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THE PALGRAVE HANDBOOK OF THE INTERNATIONAL POLITICAL ECONOMY OF ENERGY

Edited by
Thijs Van de Graaf, Benjamin K. Sovacool,
Arunabha Ghosh, Florian Kern,
and Michael T. Klare

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The Palgrave Handbook of the International Political Economy of Energy

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Part I

Introduction

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States, Markets, and Institutions: Integrating International Political Economy and Global Energy Politics

Thijs Van de Graaf, Benjamin K. Sovacool, Arunabha Ghosh, Florian Kern, and Michael T. Klare

Perhaps not since the 1970s has energy policy, technology, and security been so intensely discussed as today. Whether it is the race for energy resources in the Arctic, roller-coaster oil prices, the transition toward low carbon sources of energy, or concerns over nuclear safety, energy continues to make international headlines. Today's pressing energy challenges have opened up an incredibly vast research agenda. Sadly, political scientists and other social scientists have lagged behind their colleagues from science, engineering, and economics in addressing these issues. While some researchers directed their focus to energy matters and, especially, oil during the turbulent era of the oil shocks, the attention was short-lived. Only recently, after two decades of relative neglect, have political scientists began to rediscover energy as a major area of inquiry

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(Hughes and Lipscy 2013; Falkner 2014). Given the sheer magnitude, social pervasiveness, policy salience, and long-term nature of today's energy problems, their interest is likely to persist.

The intermittent attention to the international energy sector has important consequences for new scholars who want to venture into this domain. In contrast to the strong research traditions in international trade, security, and the environment, there is a deplorable paucity of peer-reviewed studies on the international world of energy. There is no established set of theories and concepts to which students can turn to interpret the global politics of energy. This is especially troubling given the centrality of energy policy in efforts to slow the pace of climate change. Writing in 1987, Ernest Wilson noted that, 'although no other single issue is so emblazoned on the public mind as a symbol of the age [as energy], no other issue has proven so resistant to conceptual rigor and theoretical development' (Wilson 1987, p. 126). Unfortunately, his conclusion that work on energy, especially its international dimensions, is 'largely descriptive, atheoretical, and noncumulative' (Wilson 1987, p. 128) is as valid today as it was in the late 1980s.

In searching for an analytic framework to study the changing world of energy, the field of International Political Economy (IPE) has much to offer.[1] In the simplest terms, IPE studies the relationship between politics and economics, between states and markets, at the international level. This makes it particularly apt in studying energy. It is no coincidence that the emergence of IPE as a field of study was prompted, in part, by the 1973 oil shock. Curiously, though, energy issues soon slipped off the radar of IPE scholars, leaving a theoretical and conceptual void. This is not to say IPE scholars have paid no attention to energy issues whatsoever. Yet, much of the work has been done in a fragmented fashion and has failed to spur an integrated research program. Even today, energy remains conspicuously absent from mainstream IPE textbooks.[2]

This handbook aims to bring energy into IPE again, heeding the calls that have recently been made for an 'IPE of energy' research agenda (Keating et al. 2012; Stoddard 2013; Ostrowski 2013; Hancock and Vivoda 2014). Robert Keohane (2009), one of the pioneers in the field, has identified the vola-

[1] It is often pointed out that the adjective 'international' is a misnomer for the subject matter in that it confuses 'nation' with 'state,' and fails to acknowledge the significance of private actors in world politics. Nowadays, therefore, the field is often referred to as 'global political economy' (e.g., Ravenhill 2014). We follow conventional usage in employing the abbreviation IPE.

[2] For example, Gilpin (1987), Frieden and Lake (2000), Oatley (2012), Ravenhill (2014), Cohen (2014). Some exceptions are: Gill and Law (1988), Spero and Hart (2009), Balaam and Dillman (2013), Broome (2014), Frieden et al. (2014).

tility in energy markets as one of the 'big questions' in the study of world politics that have been overlooked by the current generation of IPE scholars. Kathleen McNamara (2009, p. 82) also noted that 'energy issues … seem ripe to reorder the international political economy in ways that we as a field have not adequately analyzed.' IPE offers a powerful framework for analysis upon which scholars of energy politics can build. Energy, in turn, offers a rich but largely unexplored testing ground for insights from IPE. In the next section, we will explore the current state of energy-related social science research in order to set the scene, before turning more directly to IPE and its relation with energy issues.

1 The Rediscovery of Energy Policy and Politics by Social Scientists

Research on energy policy has long been dominated by the 'classic' paradigms of natural sciences and economics, with social scientists playing second fiddle (Sovacool 2014). This is unfortunate, for both energy research and the social sciences would benefit tremendously from closer engagement. All too often, energy research focuses exclusively on technical fixes, without due appreciation for the political decision-making and distributional consequences that are associated with energy technologies. Omitting social, political, and behavioral variables thus creates significant 'blind spots' in research on energy policy (Stern 1986). Conversely, energy constitutes one of the world's foremost public policy challenges that social scientists in general, and political scientists in particular, cannot afford to ignore.

The same reasoning applies, mutatis mutandis, to climate policy. The International Panel on Climate Change (IPCC) has barely engaged with social sciences disciplines. Just one branch of the social sciences—economics—has had a major voice in the IPCC's assessment process. Yet, as David Victor compellingly argues, social scientists can help to provide answers to questions that are key to effective climate policy, including: 'which countries will bear the costs of climate change; schemes for allocating the burden of cutting emissions; the design of international agreements; how voters respond to information about climate policy; and whether countries will go to war over climate-related stress' (Victor 2015, p. 28).[3]

[3] A recent attempt to link the science of climate change to direct physical impacts as well as systemic risks (including mass migration, state failure, and conflict) can be found in King et al. (2015).

Fortunately, energy seems to be coming back in vogue among social scientists. The revival of interest in energy matters after two decades of relative neglect is illustrated in Fig. 1.1, which shows the numbers of peer-reviewed articles on 'energy policy' or 'energy politics' since the 1960s, as indexed in the Web of Science. More precisely, it depicts the number of published articles on energy in the categories of social science (*panel 1*), political science (*panel 2*), and international relations (IR) (*panel 3*). While these panels have not been corrected for the fact that peer-reviewed publications have increased in general, they clearly illustrate that the first burst of interest in energy policy and politics occurred in the wake of the first oil shock. Yet, interest for energy issues in all three categories soon waned and during the 1990s, a period of very low oil prices, energy was mostly a fringe issue in these disciplines. Starting around 2001, and accelerating after 2008, energy issues resurfaced on the radar screen of social scientists, political scientists, and IR specialists.

After the first wave of energy research, an authoritative review essay came to the harsh conclusion that 'there is little if any sustained intellectual give-and-take in the field of international energy policy studies over the most appropriate ways to analyze the phenomenon' (Wilson 1987, p. 126). Energy is still most often analyzed from geopolitical or hard-nosed security perspectives (e.g., Moran and Russell 2009; Deni 2015). In and of itself, this need not be a problem. The role of geography (markets, raw materials, shipping lanes, ports, etc.) is certainly important to understand global energy politics. Scholars of the 'geopolitics of energy' can also fall back on a rich tradition that goes back to the pioneers in geopolitical thinking, such as Halford Mackinder, Alfred Thayer Mahan, and Nicholas J. Spykman. The problem, however, is that many political scientists and IR theorists still live in a state-centric world in which states are the primary actors and their diplomatic/military interactions are believed to be what matters most. They cannot conceive of a far more complex energy world in which states, national oil companies (NOCs), corporations, consumers/citizens, local energy cooperatives, and markets all play a pivotal role.

The dominance of geopolitical frames in public policy debates on energy has been criticized, particularly in recent years. Goldthau and Witte (2009, p. 374), for example, have lamented that 'the lopsided attention to the geopolitical dimension of energy security is based on the myopic and erroneous presumption that global energy politics is necessarily a zero-sum game in which one country's energy security is another's lack thereof.' They argue that the geopolitical frame overlooks the fact that market forces are

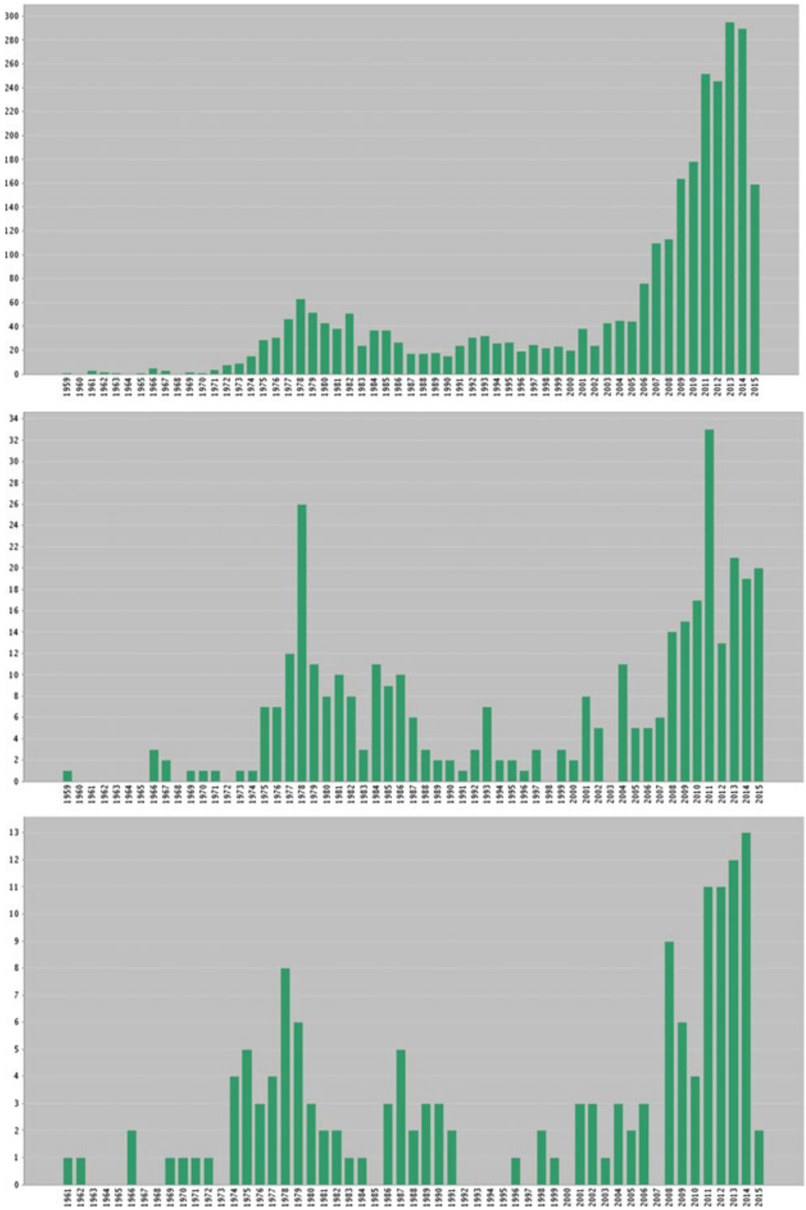

Fig. 1.1 Peer-reviewed articles on energy policy or politics since 1961

of primary importance in international energy trade. These accounts are rooted in market-liberalism and institutionalism and see energy security as the outcome of market transactions and the institutions that structure these markets. Much in contrast with the geopolitical view, the market-centric view holds that energy security is 'determined by the operation of the market, and can thus only be defined in market terms—particularly supply (physical availability) and price' (Chester 2010, p. 889).

It is thus fair to conclude that the energy literature is split in geopolitical (realist) and liberal institutionalist accounts. While the former privileges the analysis of political and security aspects of interstate energy relations, the latter gives primacy to transnational processes, markets, and institutions. Only a handful of analyses have truly engaged with the broader theoretical literature that provides the backdrop for these respective accounts. Even fewer studies have tried to merge political and economic factors in an explicit theoretical framework of international energy relations (Keating et al. 2012; Stoddard 2013).

There are four basic explanations for the under-theorization of the politics of energy in the social sciences. First, many of the acknowledged energy experts are not particularly interested in theory. Instead, their concern lies with the short- and long-run prospects for the energy market and with the question of how governments, corporations, and other actors should respond (Strange 1994). These experts, who usually have privileged access to energy data, do not write academic articles but they issue reports that are widely read. In fact, this so-called grey literature (non-peer-reviewed reports and white papers) was recently found to be the most referenced source in energy studies, accounting for over 60% of all citations in three leading energy journals from 1999 to 2013. Social science journals were barely referenced, representing less than 4.3% of total citations (Sovacool 2014).[4]

Second, there are high barriers to entry to a field that requires a dose of technical understanding. It is not easy to stay abreast of the frontiers of energy technology research across often disparate disciplines. This is especially true as the imperative of addressing climate change requires an understanding of many new or less well-known technologies, including supply and demand as

[4] It can also be noted that, within the field of IR, the main theoretic journals have published hardly anything on energy (Shaffer 2009, p. 18). Some policy-oriented journals (e.g., *Foreign Affairs*, *Foreign Policy*, *International Affairs*, *Washington Quarterly*) have, but these contributions were obviously more concerned with policy analysis and prescription than with theorizing. Still, even if these contributions do not explicitly take on theoretical issues, they are invariably underpinned by certain theoretical assumptions (Dannreuther 2013).

well as energy storage options, and their respective infrastructural requirements. Some social scientists might also be diffident to extend their research beyond what they consider as the strictly 'social.' Yet, it is misguided to think that energy policy revolves around questions of fact that are susceptible to resolution by objective, scientific research. In 1976, physicist Amory Lovins forcefully drove home the point that energy policy involves choices that are essentially political. He framed the energy debate in terms of two paths. The 'hard' path implies more centralization of energy production, including more coal and nuclear, while the 'soft' path entails more efficiency and renewables. Each path brings about different social changes and it is these changes, rather than mere technical considerations, that should guide our energy choices (Lovins 1976).

Third, the multifaceted nature of energy as a policy area makes it defy unidimensional analysis. Economists who have attempted to apply economic theory to energy markets have come home empty-handed, since these markets are often strongly influenced by political factors. Theorists in political science and IR have also been ill-adapted to the terrain, because they have been mostly area specialists (typically experts on Middle East politics) or security experts, whose methods and concepts tend to underrate the forces of the market and technological change. Sociologists and social psychologists have often focused on important micro-level dynamics of how values, attitudes, beliefs, and norms shape energy consumption patterns (Sorrell 2015) or attitudes toward energy technologies (Owens and Driffill 2008) but neglect broader economic, political, technological, or infrastructural factors influencing energy demand. The net result, as Susan Strange astutely observed, is that energy seems to constitute 'a classic case of the no man's land lying between the social sciences, an area unexplored and unoccupied by any of the major theoretical disciplines' (Strange 1994, p. 195). She called on political scientists to move beyond the artificial separation of economy and politics in the study of international energy issues.

Fourth, transdisciplinary or interdisciplinary research projects often necessary to advance integrated theory do not always mesh with academic credentialing and reward systems (Lutzenhiser and Shove 1999; Spreng 2014). Systems of promotion and tenure rely heavily on validations provided by publication in disciplinary journals (monitored by disciplinary gatekeepers, journal editors), and reviews by referees from disciplinary departments (Sovacool et al. 2015a).

Having chartered the evolution of the social science literature on energy policy and politics more generally, the next section outlines more specifically the emergence and main tenets of the field of IPE, before outlining in the subsequent section some of the key theories within IPE.

2 What is International Political Economy (IPE)?

IPE emerged as a scholarly field of study in the early 1970s in response to a string of real-world changes. One triggering event was the decision by the Nixon administration in August 1971 to devalue the dollar and to end the gold-exchange standard, which had provided the foundation of the Bretton Woods international monetary regime. Another was the first oil price shock, which erupted in October 1973 when the Arab members of the Organization of the Petroleum Exporting Countries (OPEC) unilaterally raised the posted price of crude by 70%. They also placed an embargo on oil exports to the USA and other states that had supported Israel during the Yom Kippur War. The oil boycott emboldened less developed countries, most of whom had recently gained independence, to make calls for a 'New International Economic Order' at the United Nations (UN).

The then dominant theoretical school in IR, that of classical realism, was unable to account for these events. Realists had not considered economic interactions or non-state actors to be of any significance in IR. They had depicted a world populated by sovereign states that struggle for power and survival in an anarchic environment (Morgenthau 1948). Still, in the 1970s, a set of less developed countries grouped together in OPEC was able to use its newfound 'commodity power' to cripple powerful Western states. Military force, the ultima ratio of international politics according to realists, was of limited utility to industrialized countries in resolving the most acute problems of the day—the monetary and oil crises. The period of great upheaval in the global economy paved the way for the emergence of IPE as a major framework of analysis.

It would be more accurate, however, to state that IPE *re*-emerged as a significant field of studies. The IPE scholars of the 1970s were able to draw on a rich intellectual tradition of thinking about the political economy of IR (Ravenhill 2010). In fact, the roots of the field can be traced back to the classical economists (e.g., Adam Smith, David Ricardo, and John Stuart Mill), the nineteenth-century theorists of social change (e.g., Karl Marx and Emile Durkheim), and the institutional economists, welfare economists, and anthropologists of the late nineteenth century and the first half of the twentieth century (e.g., Alfred Marshall, Arthur Cecil Pigou, John Maynard Keynes, Karl Polanyi, and Thorstein Veblen), and a few individual scholars who addressed international economic relations in the wake of the Second World War (e.g., Albert Hirschman, Jacob Viner, and Charles P. Kindleberger).

The field of IPE has since thrived and developed in many directions. Following Gilpin, IPE is often defined as encompassing the study of how government, or the 'state,' interacts with the private sector, or 'the market,' at the international level (Gilpin 1987). Frieden and Lake (2000, p. 1) define IPE as 'the study of the interplay of economics and politics in the world arena.' This common subject matter is what unites IPE scholars. On virtually everything else—theories, methods, ontology, and epistemology, there is disagreement or, put more positively, 'tolerance for eclecticism' (Ravenhill 2010, p. 542). Recognizing that there are multiple versions of the field of IPE, recent handbooks are divided in sections dealing with North American IPE, British IPE, IPE in Asia, and elsewhere (Blyth 2009; Cohen 2014) or are structured along the main theoretical approaches (e.g., Smith et al 2014) which are explained in more detail in the next section.

Despite IPE being far from a homogeneous field, several common tenets are clear (Underhill 2005). IPE is basically about Laswell's (1936) classic question of 'who gets what, when, and how' from global economic and political processes. It recognizes that economics (the pursuit of wealth) and politics (the pursuit of power) cannot be separated out (Gilpin 1987). Another premise is that there is a two-way relationship between the 'structures' of global markets and the 'agents' of political and economic interaction. States create economic structures of production and distribution, and in turn are shaped by market processes playing out within these structures. The co-constitutive relationship between states and markets cuts across the analytic distinction that is often drawn between the domestic and the international levels of analysis. A strict separation of the international and domestic into separate spheres is artificial.

When applied to the energy studies, IPE has much to offer. It can demonstrate how political structures and interactions shape energy markets and even entrench their own forms of hegemony. It can reveal the often surreptitious interests behind particular energy programs ostensibly promoted in the public good, or the fundamental dynamics at play behind particular energy technologies or policies. It can showcase the ways in which particular actions skew the world's concentration of energy wealth, the means by which actors exclude other groups from energy decision-making, and the political, contested nature of policy implementation. It can depict who benefits from a given scheme or policy, or indeed the transition to non-fossil fuels more generally, at whose expense—or put succinctly, who are the winners, and who are the losers (Sovacool et al. 2015b; Meadowcroft 2009)?

3 Main Theories in International Political Economy

The diverse approaches within IPE are usually condensed into three archetypal theoretical traditions: mercantilism/realism, liberalism, and Marxism (Woods 2014).[5] A slightly old-fashioned way to describe the field, these labels still usefully capture the main historical traditions that have structured much of the studies of and debates in IPE over the past few decades. All theories incorporate foundational assumptions about how the world works. Since these assumptions reflect values and fundamental beliefs about the nature of human beings and society, each position not only provides a description of how the world *does* work but also constitutes a normative view regarding how the world *should* work (Gilpin 1987).

The first tradition, *mercantilism* (also referred to as realism, statism, or economic nationalism), refers to the worldview of political elites in the early modern period. They took the approach that economic activity is and should be subordinate to the primary goal of building a strong state. In other words, economics is a tool of politics. Mercantilists see the world economy as an arena of competition among states to maximize their relative power. In this jungle, every state aims to maximize its wealth and independence by seeking self-sufficiency in key strategic industries and commodities, and by using trade protectionism. Applied to the field of energy, mercantilists would assume that access to or control over energy resources is a currency of power and lack of control is a sign of vulnerability. Powerful states are the key actors in this system. Stability and order will be achieved if a powerful state assumes the role of hegemon, or in other words, is willing and able to create, maintain, and enforce basic rules.

The second tradition, *liberalism*, assumes and advocates that politics and economics exist in separate spheres. Liberals emphasize the role of free markets as both efficient and morally desirable in allocating resources. Free trade is crucial as it permits countries to benefit from their comparative advantages. The optimal role of the government is to ensure the smooth and relatively unfettered functioning of markets. Economic liberals thus reject the mercantilist view that the state is the central actor. Numerous actors beyond the state can be key players, including multinational corporations (MNCs), banks, civil society groups, international organizations, and individuals. For liberals there is nothing special about energy. It is considered a commodity like any other, and energy markets are best left to themselves for the 'invisible

[5] Unless otherwise indicated, the discussion of these three theoretical traditions is largely based on Woods (2014). For a rare application of IR theories to energy, see Dannreuther (2013).

hand' of the market will bring benefits to all. One example of policies inspired by this worldview is the liberalization and privatization of electricity supply (Newbery 2005).

The third tradition, *Marxism*, argues that economics drives politics. Capitalism, with its inherent class struggle between capitalists (those who own the means of production) and the working class (those who only own their labor power), is the driving force in the world economy. The working class puts in more work than it gets back in pay, allowing the capitalist class to accumulate a surplus value. That is capitalist profit, and it is derived from labor exploitation. This pattern is replicated at the international level through the mechanism of unequal exchange, which transfers economic surplus from the periphery to the core states. Developing countries are often locked in a position as primary resource suppliers. In the Marxist tradition, states are driven by ruling-class interests and clashes between states should be seen in the context of the global class struggle. In energy markets, Marxists would argue that primary resource supplying countries receive a marginal share of the returns that multinational energy firms garner from the exploitation of resources (Nitzan and Bichler 1995).

A consensus has emerged that this 'trichotomy' no longer does justice to the wide diversity of theoretical approaches that are being pursued in contemporary IPE research (e.g., see Smith et al. 2014). In particular, there are a wide range of alternative contemporary theories that challenge the rationalist–materialist foundations of the three dominant schools. Rather than exclusively focusing on material interests and power of rationally behaving agents (governments, market participants, and classes), these alternative theories argue that the material facts of the world do not exist outside our social interpretation of them. The global political economy is thus socially constructed, which is why these theories are often referred to by the umbrella term *constructivism.* They highlight the dynamic roles played by ideas, norms, values, and identities (constructivism); gender (feminism); and economic discourses (post-structuralism) in shaping processes and outcomes in the global political economy (Broome 2014; Abdelal 2009; Smith et al. 2014).

The most significant debate taking place in the discipline of IPE today is not about any of those four theories, but about methodology and epistemology. One school, dominant in the USA, can be labeled *rationalism*. The rationalist school is essentially positivist and empiricist. It gives priority to scientific method, objective observation, and systematic testing of so-called mid-level theories. Rationalists value parsimony and take an essentially problem-solving approach. Another school, which is dominant in the UK, can be labeled *post-positivist*. This school is more interdisciplinary, evinces a deeper interest in normative issues, and is less wedded to natural scientific method. It does not shy away from grand theories and takes an explicit problem-posing approach (Dickins 2006; Cohen 2007, 2014; Blyth 2009). Table 1.1 summarizes these main theories and methods in IPE and their application to energy studies.[6]

4 Energy and International Political Economy in Context

Hydrocarbons—that is oil and natural gas coal are often said to be the lifeblood of modern society. They form what classical economists call 'basic goods' or goods that, directly or indirectly, enter into the production of every other produced commodity or service (Rühl 2010). Political scientists tend to describe nonrenewable fossil and nuclear fuels as 'strategic goods,' that is goods with a relatively high utility for which there are no readily available substitutes (Baldwin 1985). Ever since Winston Churchill converted the Royal Navy from domestic coal to imported oil in 1912, oil has become essential for warfare and thus a salient strategic issue. Energy supply is also key for domestic politics, as shortages and price hikes can lead to social upheaval. Regular access to strategic goods as oil and gas—at an affordable price—is thus critically linked to national security, economic development, and social peace. However, with many countries around the world trying to make the transition toward an economy based on renewable resources, this will not necessarily be the case in the future. Nevertheless, the availability of affordable energy will continue to be a key issue for national economies and militaries.

It is no wonder then that governments tend to exert some sway over the energy sector rather than leave it entirely into private hands. Even so, and in spite of its strategic character, the energy sector has not escaped the marked swings in the state–market pendulum that have characterized the global political economy throughout modern history. The shape and substance of energy policy has varied over time in response to price developments, changing perceptions of externalities associated with the energy sector, dwindling resource endowments, and shifting ideological preferences about the appropriate role for government in the economy (Finon 1994; McGowan 2008; Scrase et al. 2009; Goldthau 2012; Kern et al. 2014). Table 1.2 juxtaposes overall shifts in the IPE with global energy transitions and shifting energy

[6] It should be noted that, generally speaking, there is a close alignment between some of the theories and their preferred methodology. Many mercantilists and liberals adhere to a positivist epistemology and most constructivists adhere to post-positivist methods. But the alignment is not absolute. Some mercantilists also eschew positivist methods and some constructivists adhere to positivist methods (e.g., quantitative discourse analysis).

Table 1.1 Main theories and methods in International Political Economy and their application to energy

Theories	Assumptions	Application to energy
Mercantilism/realism	Politics drive economics States are key actors National interest of the state is to maximize power and autonomy International (economic) relations are zero-sum game	States hold firm grip on energy sector (e.g., via public ownership of oil companies or utilities) Energy is a strategic good, vital for national security and prosperity, and can be a source of power or vulnerability National interest revolves around secure supplies of energy as a crucial input into the economy Risk of conflict over scarce fossil fuel resources
Liberalism	Politics and economics are separated There are numerous actors who bargain in order to maximize their interests There is no single or consistent national interest; state actions and policies reflect domestic interests and bargaining International cooperation and trade is possible and beneficial for all Companies, consumers, and international organizations are as important as states	Energy is just a commodity like any other; liberalization of electricity and gas markets and private ownership of utilities seen as desirable International energy trade creates interdependence, which lowers the risk of conflict and is beneficial to all International regimes (e.g., UN Framework Convention on Climate Change) can be negotiated to avoid dangerous climate change International organizations like the International Energy Agency can be set up to deal with oil market shocks through emergency response measures
Marxism	Economics drives politics Class is key unit of analysis (Trans)national elites exploit subordinate classes States reflect interests of dominant class Global capitalist economy is stratified in core and peripheral states	Energy exporters tend to be locked into the role of resource supplier They are exploited for the advancement of capitalist classes and states Western states and multinationals have close bonds with local elites in resource-rich countries Wars in Middle East reflect need of capitalist states for access to petroleum

(*continued*)

Table 1.1 (continued)

Theories	Assumptions	Application to energy
Constructivism	Non-material factors such as beliefs, roles, ideologies, culture, knowledge, discourse, and gender shape preferences, behavior, and outcomes in IPE	Label of 'energy security' couches energy in a security frame, a process known as 'securitization' Energy security is socially constructed and energy statistics embody theoretical assumptions about what should be counted and how
Methods	**Assumptions**	**Application to energy**
Rationalism	Focuses on mid-level theories about relations within a broader structure that itself remains unquestioned Hard-science methods	Energy policies that may seem stupid or wrong may well have been 'rational' given the incentive structures and institutional constraints and opportunities faced by those making decisions
Post-positivism	Does not eschew normative concerns and grand theories Interpretive methods	Links energy systems to civilization(s) Reflects on fate of planet and humanity Discusses energy ethics and justice

governance arrangements. The present era is characterized as a state–capitalist order, even though there are competing dynamics at play. José Manuel Durão Barroso, former President of the European Commission, captured the current mood pretty well in a speech in 2014 when he said: 'The "Great Game" of geopolitics has made an unwelcome return and this is being particularly felt in the area of energy' (Barroso 2014).

While energy policy is no doubt affected by the wider political and economic context, energy policy is often ill-defined and couched in imprecise terminology. What we call 'energy policy' today usually refers to a plan of action focused on ensuring sufficient supplies of affordable fuels and electricity to satisfy market demand and, increasingly, to do so while addressing the specter of climate change. This corresponds to the IEA's definition of energy security as 'the uninterrupted availability of energy sources at an affordable price.'[7] However, such a narrow definition fails to recognize the permeable boundaries of energy policy, shaping and being shaped by fiscal policy, foreign

[7] This definition is available at: http://www.iea.org/topics/energysecurity/subtopics/whatisenergysecurity/.

Table 1.2 Key eras and shifts in International Political Economy and energy governance

Key eras	Global energy shifts	Patterns of energy governance
1840–1914: **Imperial liberalism** *Geopolitics*: British hegemony *Global South*: Imperialism and colonialism *Finance*: Gold standard and free trade	Transition from biomass (mainly wood) to coal. In 1859, Drake strikes oil in Pennsylvania. Oil essentially used for lighting purposes (where it displaces whale oil). Development of local industries for town gas (manufactured from coal)	**Birth of oil industry in the USA** (1859–1900) Law of capture spurs intense competition and rivalry in US oil industry. Rockefeller's Standard Oil effectively forms a monopoly, until its break up in 1911 by the US Supreme Court
1914–1945: **Mercantilism and war economy** *Geopolitics*: Lack of leadership *Global South*: Imperialism and colonialism *Finance*: Competitive devaluation, autarky and war	Coal still reigns but oil rises in importance due to the switch of the British Navy from domestic coal to imported oil on the eve of the First World War, the advent of the first mass-produced car (Model T Ford in 1912), and major oil discoveries in the Persian Gulf as from the late 1920s	**Neo-colonial order** (1900–1970) Fierce competition by British, French, and US companies (supported by their governments) to secure concessions in the Middle East. In 1928, 'seven sisters' form a cartel and agree not to compete on market share or price
1945–1980: **State interventionism and socialism** *Geopolitics*: US–Soviet Cold War; bipolarity *Global South*: Decolonization *Finance*: Bretton Woods until 1971, then a mix of dollarization and managed/flexible exchange rates	Oil overtakes coal in 1964. Town gas is steadily replaced by natural gas, first in the USA where better welding techniques bring a pipeline construction boom, and then in Europe where gas is discovered by the Dutch, British, and Norwegians. State-driven advent of nuclear industry, but enthusiasm is soon tempered	Seven sisters deliver oil at declining real prices, fueling post-war economic growth in OECD **OPEC revolution** (1970–1986) As oil demand rises and US production peaks in 1971, OPEC takes control of production and prices until 1986, when Saudi Arabia floods the oil market to regain market share. The rise of NOCs
1980–2008: **Liberal capitalism** *Geopolitics:* US hegemony; unipolarity *Global South*: Debt crisis, neoliberalism *Finance*: Financialization and globalization	Oil prices generally low in late 1980s–1990s. Opening up of previously closed Soviet oil and gas industry. Dash for gas in UK and elsewhere. Coal use falls in 1980s and 1990s but rebounds in 2000s. Electricity use continues to grow	**Neoliberal order** (1986–2000) Growth of spot trading and future trading ('paper barrels'), marking growing financialization of oil. Drive to liberalize and deregulate electricity and gas markets, primarily in the OECD

(*continued*)

Table 1.2 (continued)

Key eras	Global energy shifts	Patterns of energy governance
2008–: **State capitalism** *Geopolitics*: rise of BRICs; multipolarity *Global South*: Emerging markets *Finance*: Regulation, regionalism, and reform of global system	Rising demand from China and India pushes up commodity prices. Fracking revolution unlocks vast amounts of shale gas and tight oil in the USA. Nuclear energy retreats. Global drive to efficiency and low-carbon energy sources	**State–capitalist order** (2000s onwards) Rising oil prices spur new era of 'resource nationalism.' Emerging economies pursue state-led form of capitalism, often conducted via NOCs. OECD still adheres to liberal form of capitalism, but relies on a variety of public policy levers to pursue decarbonization

Sources: Modified from Cragg (2013), Dannreuther (2010, 2015), Smil (2010), and Stevens (2013)

policy, social policy, science and technology policy, climate policy, and other government concerns. Energy policy often develops informally, when governments adopt policies for a variety of considerations that are not directly related to energy (e.g., inflation, employment, regional development, poverty alleviation, and carbon emissions reduction), but which impinge upon the energy industries and energy balances, whether intentionally or accidentally (McGowan 1996).

In fact, if we take international commitments to tackle climate change seriously, analysts have argued that 'energy policy is climate policy,' since the vast majority of carbon emissions stem from energy use (Scrase et al. 2009).

When thinking of energy, most people probably think of oil, coal, natural gas, electricity—in short, something that can be metered and for which they get billed. The key detail that is overlooked here is that it is not the *energy resources and fuels* themselves that are so central to our everyday lives. Nobody just wants a barrel of oil or a cubic meter of natural gas since, by themselves, these fuels are useless. What people actually want is access to the useful *energy services* these resources yield—cooked food, illumination, heating, mobility, refrigeration, information, communication, and so on.

Access to such basic energy services is indispensable for a decent quality of life and, as such, constitutes a universal human right (Bradbrook and Gardam 2006). The lack of access to electricity or modern cooking fuels for billions of people has implications for human health, economic productivity, and gender inequalities. Yet, as a driver of the agenda of global institutions, access to energy has only emerged fairly recently (Ponzio and Ghosh 2016).

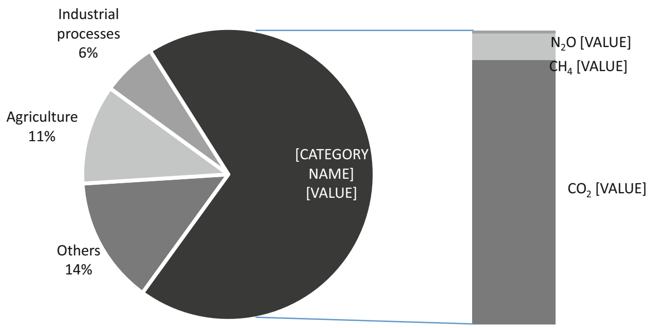

Fig. 1.2 Shares of global anthropogenic greenhouse gas emissions, 2010 (*Source*: IEA (2014, p. 7))

It was glaringly omitted from the Millennium Development Goals. Only in 2010 the UN General Assembly announced 2012 as the International Year of Sustainable Energy for All. Subsequently, at the Rio+20 Sustainable Development Conference, a process was set in motion to develop a new set of Sustainable Development Goals (SDG), adopted at the UN in September 2015, in which 'access to affordable, reliable, sustainable modern energy services for all' features prominently.

Increasingly, moreover, the problem of energy is being intertwined with the problem of climate change. Among the many human activities that produce greenhouse gases (GHGs), the energy sector represents by far the largest source of emissions, accounting for over two-thirds of all GHG emissions (see Fig. 1.2).[8] Pronounced efforts to slow the pace of global warming thus require curbs on the combustion of fossil fuels, whether through a carbon tax, cap-and-trade mechanism, or through technical solutions such as carbon, capture, and storage. By the same token, such efforts may include incentives for the development and installation of low-carbon energy alternatives such as renewables or potentially nuclear as well as incentives for increases in energy efficiency or a reduction of energy use. These were major objectives of the 21st Conference of the Parties of the UNFCCC, held in Paris in December 2015. As a result, the market environment in which local and national energy decisions are made will increasingly be skewed by the imperative of addressing climate change, affecting the global mix of future energy supplies and services.

A focus on energy services shifts attention away from resources and fuels toward the technology and infrastructures to run stuff—the buildings, lamps, motors, and electronics that bring us the energy services we value so much.

[8] The energy sector includes emissions from 'fuel combustion' (the large majority) and 'fugitive emissions,' which are intentional or unintentional releases of gases resulting from production, processes, transmission, storage, and use of fuels (e.g., methane emissions from coal mining).

This focus on energy services and the socio-technical systems which currently deliver them, how they have emerged in the past and might have to change in the future, is the focus of much recent scholarship on energy transitions (Verbong and Loorbach 2012). Sound energy policy should thus be far wider in scope than just fuel and power policy but should focus squarely on these end-use services. Since each particular piece of end-use technology requires a particular form of fuel or electricity—say, high-octane unleaded petrol/gasoline or 240-volt alternating current—changing the world's fuel mix means changing end-use technology too. Making an energy transition is, thus, not tantamount to scrapping a coal-fired power plant here and erecting a windmill there. Energy policy that concentrates entirely on the availability and cost of commercial energy carriers misses the most important part of human energy systems—the energy services and related end-use technologies (Patterson 2007).

Both the energy carriers and the end-use technologies form part of larger socio-technical systems. The notion of a 'socio-technical system' implies that a large technical system—say, the US electricity sector—is deeply embedded in the overall structure of society. It does not only consist of physical elements (e.g., electric transmission lines, turbogenerators, and coal mines) but also consist of organizations (e.g., manufacturing firms, investment banks, utilities, and regulators), legislation and laws, consumer practices, cultural expectations as well as scientific knowledge and university teaching programs. The upshot is that technological systems change in conjunction with changes in society and the economy (Hughes 1987; Geels 2004; Verbong and Loorbach 2012). Just as previous energy transitions have gone hand in hand with societal changes (Podobnik 2006; Smil 2010), future socio-technical transitions will not only involve changes in energy carriers, infrastructures, and technologies but also require or induce changes in social practices, business models, industries, institutions, and policies as well. Several scholars have argued that governments necessarily have a key role to play in shaping the direction and speed of such energy transitions (Verbong and Loorbach 2012; Meadowcroft 2009).

5 Key Debates and Research Agendas in the IPE of Energy

While the IPE of energy cannot be characterized as a coherent or unified intellectual field, there have been a number of important scholarly debates since the middle of the twentieth century about the extractive industries—most notably petroleum—and their sociopolitical impact (Ostrowski 2013;

Hancock and Vivoda 2014). At least six major themes have emerged: (1) dependency theory, oil companies, and commodity cartels; (2) the 'resource curse' effect of oil rents on state structures among the oil-rich states; (3) energy security and geopolitics; (4) international energy cooperation and institutions; (5) variants or varieties of capitalism; and (6) privatization and market liberalization. These research lines have largely been pursued in isolation from each other and, over time, have become disconnected from the wider IPE research agenda.

Dependency Theory, Oil Companies, and Commodity Cartels

The origins of research into the IPE of energy can be traced back to the 1960s, when the *dependencia* school challenged the classical economic theory of comparative advantage as developed by David Ricardo. Ricardo's theory posits that specialization in international trade works to the mutual benefit of all parties. Dependency theorists argued instead that the price of primary commodities declines relative to the price of manufactured goods, causing the terms of commodity trade to deteriorate over the long term (Prebisch–Singer hypothesis). The world economy is thus divided between a 'center' (industrial nations) and a 'periphery' (primary goods producers), with the latter locked into structural dependency. Dependency researchers, closely related to the Marxist approach in IPE, were concerned with all sorts of primary commodities and minerals, not specifically oil or energy, and focused very much on Latin America.

The rise of OPEC and the first oil shock questioned the claim that peripheral countries are locked in a never-ending cycle of dependency, and shifted attention to oil-exporting countries in the Middle East and their relations with consumer states and international oil companies (IOCs). In 1971, Raymond Vernon crafted the obsolescing bargaining theory, which showed that the governments of resource-rich states were not in an inherently weak bargaining position vis-à-vis large foreign-owned firms (Vernon 1971). A number of scholars have since studied the cyclical shifts in bargaining power between host governments and IOCs, and the phenomenon of 'resource nationalism' (Wilson 1987; Morse 1999; Mommer 2000; Stevens 2008; Vivoda 2009; Bremmer and Johnston 2009; Wilson 2011).

A related strand has focused on the conduct of IOCs, particularly the Seven Sisters oil regime (Penrose 1968; Sampson 1975; Turner 1978; Moran 1987). The unique role of IOCs and NOCs is a distinctive feature of the realm of global energy politics. As many have noted, giant IOCs like ExxonMobil often have more political–economic clout than the nations they operate in—something that is beautifully exposed in Steve Coll's (2012) book *Private Empire*. A leaked e-mail recently revealed that Exxon knew about the dangers of climate change since at least 1981 but it kept funding climate deniers for 27 more years (Goldenberg 2015; see also Oreskes and Conway 2010). Likewise, NOCs of both energy-exporting and emerging economies play a unique role as both economic enterprises and political instruments (Marcel 2006; Baker Institute 2007; Losman 2010; Victor et al. 2011; Tordo 2011). The fact that they also serve noncommercial purposes for their governments has raised concerns, such as over China's strategy of purchasing 'equity oil' outside of global markets—a strategy that it has now largely forsaken (Downs 2004; Jiang and Sinton 2011; Leung 2011).

The oil crisis of 1973 also stimulated research on commodity cartels and the conditions under which producer associations might overcome collective action problems (e.g., Mikdashi 1974; Krasner 1974; Bergsten 1974). OPEC, in particular, has continued to attract scholarly attention and has given way to a vast body of literature (e.g., Skeet 1988; Claes 2001; Amuzegar 2001; Colgan 2014). Scholars have also discussed whether and to what extent oil can be used as a weapon, either by oil exporters (Paarlberg 1978; Licklider 1988; Kelanic 2012; Hughes and Long 2015) or by major oil importers (Van de Graaf 2013a). The same questions have later been posed about natural gas (Goldthau 2008; Stegen 2011; Shaffer 2013) and electricity exports (Lilliestam and Ellenbeck 2011). Research into the link between energy and coercive power has also been extended to energy transit and pipelines (Jentleson 1986; Victor et al. 2006; Stulberg 2012; Kandiyoti 2012; Kropatcheva 2014).

The 'Resource Curse' of Oil Exporters

Another major body of work has focused on the effects of oil rents on the state structures in the Middle East. This work was initially centered on the concept of a 'rentier state': a state that relies heavily on income from the export of natural resources, especially oil and gas (Mahdavy 1970; Beblawi and Luciani 1987; Anderson 1987). This revenue is not generated by productive operations in the national economy but by the natural endowments of the country. The reliance on external, non-tax revenues gives these states a large degree of autonomy vis-à-vis their citizenry, a fact that has far-reaching repercussions, including incoherent economic policies, the lack of political freedom, the entrenchment of crony capitalists and military elites, and the decline of agriculture and industry through a process known as the 'Dutch disease' (Gelb 1988; Schwarz 2008; Morrison 2009; Ostrowski 2013).

In the 1990s, this debate continued under the heading of the 'resource curse,' a term introduced by Richard Auty (1993). The resource curse thesis—sometimes also referred to as the 'paradox of plenty' (Karl 1997)—holds that abundance of natural resources is correlated with poor economic performance (Sachs and Warner 1995), low levels of democracy (Ross 2001), and civil war (Collier and Hoeffler 2004). The resource curse literature is probably the most sophisticated branch of the wider IPE of energy literature. The different dimensions of the phenomenon continue to be intensely studied (e.g., Smith 2007; Ross 1999, 2012) and hotly debated, such as in the recent exchange between Haber and Menaldo (2011) and Andersen and Ross (2014) on the link between oil and authoritarianism. New ideas are continuously emerging. Colgan (2013), for example, recently found that revolutionary petrostates have a dramatically higher propensity to engage in interstate wars than comparable non-petrostates. The extent to which rentier states are starting to actively promote energy transitions toward renewable energy and higher energy efficiency, and the constraints they are facing in doing so, is also an emerging topic in this field (Reiche 2010).

Energy Security and Geopolitics

A third major strand in the literature has focused on the politics and policies of major energy importers. The comparative state responses to the oil price shocks of the 1970s was an obvious point of focus (Kohl 1983; Ikenberry 1986). More recently, some scholars have extended the focus beyond the oil shocks of the 1970s (McGowan 2011; Chakarova 2012; Cheon and Urpelainen 2014; Hughes 2014; Duffield 2015) and to other types of energy shocks, such as the nuclear accident in Fukushima in 2011 (Ramana 2013) or the Russian–Ukrainian gas crises in 2006, 2009, and 2014 (e.g., Stern 2006). Domestic energy policies that bear significant international consequences have also been studied, such as Ikenberry's (1988) classic study of the decision to decontrol oil prices by the Carter administration. There is also a large but mostly fragmented literature about the comparative politics and policies of energy across different countries.

The interplay between energy and foreign policies of major consumer countries has also received considerable attention. By far most studies have focused on the USA, whose hegemony is allegedly closely connected to the international oil industry (Bromley 1991; Klare 2004; Stokes and Raphael

2010), the role of the dollar therein (Shipley 2007), and increasingly also the shale gas revolution (Dunn and McClelland 2013). An enormous literature exists about the link between US energy interests and its foreign policy (e.g., Bull-Berg 1987; Randall 2005; Gholz and Press 2010; Mahdi 2012; Kalicki and Goldwyn 2013), including the alleged link between oil and US participation in wars (Jhaveri 2004; Price-Smith 2015). Scholars are now increasingly turning their attention to China's domestic and international energy policies (Kong 2010; Andrews-Speed and Dannreuther 2011; Taylor 2014). A much smaller literature exists on the energy diplomacy of other major powers and blocs, such as the European Union (Goldthau and Sitter 2015).

With the rise of emerging economies, the locus of energy diplomacy is also shifting but remains understudied. Energy security for middle powers, dependent on growing imports of energy resources, extends beyond mere supply. It is equally concerned about aggressive (sometimes mercantilist) competition for securing ownership of oil and gas fields or coal and uranium mines, the volatility of prices, sudden physical disruptions and regional instability in sea lanes of communication, questions about efficient and cost-effective storage (within and outside one's borders), and the constraints imposed by limited remaining global carbon space (Steven and Ghosh 2014; Bery, Ghosh and Mathur 2016). The debate about 'unburnable carbon' (McGlade and Ekins 2015) introduces a whole new geopolitical dimension to energy policy debates as it raises the question of how to determine which fossil fuels are to remain in the ground (Van de Graaf and Verbruggen 2015). Another set of drivers, which requires more cross-country studies, is affecting the push for renewable energy, with the imperatives of 'green jobs,' the attractions of foreign investment and new opportunities for manufacturing and exports impacting how countries develop green industrial policies and relate to global markets for clean energy technologies (Ghosh 2015).

International Regimes and Institutions

Yet another area where a more or less coherent body of work has emerged concerns international energy cooperation and institutions. Early work focused on the International Energy Agency (IEA), which was established at the behest of US Secretary of State Henry Kissinger in 1974 as the response of major consumer countries to the first oil shock. There were studies of how the agency came about and how it functions, focusing particularly on its multilateral oil stock regime (Walton 1976; Toner 1987; Horwich and Weimer 1988; Kapstein 1990). Most famously, Robert Keohane employed the IEA as a case study in his seminal work *After Hegemony* (1984). After Keohane's study, curiously, oil and energy were hardly discussed anymore through the framework of international regimes (Leaver 1990).

During the 1990s, the newly created Energy Charter Treaty (ECT) captured some attention (e.g., Wälde 1996; Aalto 2016) but it is really from around 2009 to 2010 that research on international energy cooperation took off in earnest. Under the rubric of 'global energy governance,' a host of scholars have examined how the energy sector is governed internationally, by whom, and with what consequences (Florini and Sovacool 2009; Goldthau and Witte 2010; Lesage et al. 2010; Van de Graaf 2013b). A wide range of multilateral energy forums are still studied individually, but a growing range of scholars has begun to characterize the global energy architecture as a 'regime complex,' consisting of an array of overlapping and parallel regimes and institutions (Ghosh 2011; Colgan et al. 2012). This is in addition to the global climate change regime under the UN Framework Convention on Climate Change (UNFCCC) which has very significant implications for the further development of energy systems around the world (Keohane and Victor 2011). There is also attention to transnational governance arrangements, such as the Extractive Industries Transparency Initiative (e.g., Haufler 2010), and to the role of norms, such as corporate social responsibility (Watts 2005) and transparency (Gillies 2010).

Variants and Varieties of Capitalism

An additional brand of IPE scholarship has been termed 'variants of capitalism' or 'varieties of capitalism.' These works attempt to categorize or explain how different countries embrace (or reject) market forces related to energy production and use, resource management, industrial relations, and other activities. Some countries promote liberal market policies, others prefer to centralize or coordinate actions (Hall and Soskice 2001).

Spencer et al. (2005) argue that national political institutional structures for energy innovation, for instance, can differ organizationally and socially. They suggest that such institutions can fall into four quadrants: social corporatist; state corporatist; liberal pluralist; and state nation. Figure 1.3 provides an overview of this framework. They note that Denmark is a typical example of a social corporatist country and that the USA is a typical example of liberal pluralist nation. In social corporatist nations (Denmark), the role of the state is to facilitate and not to dictate, whereas in the liberal pluralist nations (the USA), the state is relatively weak and has thus a smaller role in

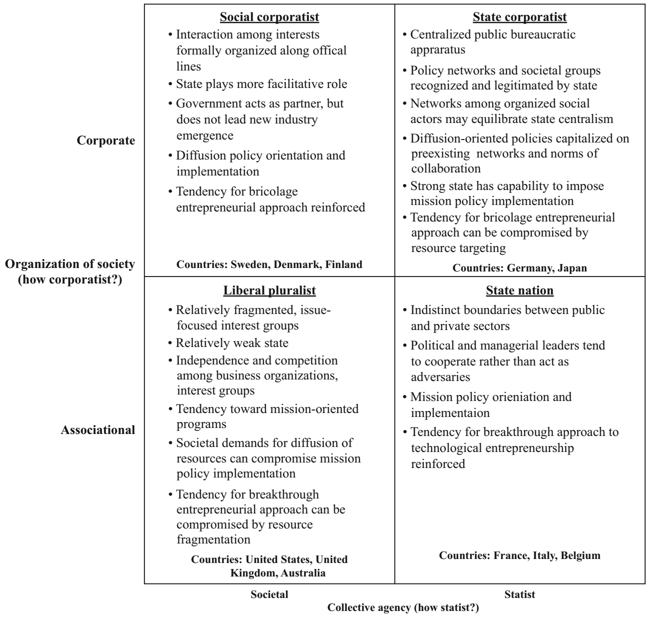

Fig. 1.3 National political institutional structures (*Source*: Spencer et al. (2005))

technical development. Whitley (2000) also explored the institutional structure for innovation in capitalist countries and found that the USA was more corporatist, fragmented, and even destructive. The result of this is that many energy and technology firms that could not compete went bankrupt. The European environment, by contrast, was more cooperative, publicly supported, and populated by smaller and medium-size enterprises. However, such taxonomies have also been found to be misguided when confronted with empirical evidence in the area of energy technology innovation (e.g., see MacNeil 2013).

Another strand of this literature emphasizes the nationalization of energy assets or the renegotiation of contracts (see also the 'resource nationalism' discussion above), essentially showcasing how some states strongly regulate and monitor energy activity, whereas others let market entrants roam and operate more freely (Bebbington and Bury 2013). A corollary discussion here looks at the impact of rising powers in reshaping domestic politics—especially in Africa and Latin America—where countries such as Brazil or China have embarked on an 'oil safari' (Taylor 2006) but also started placing pressure on how regional energy governance institutions are formed or operate (Hancock 2015; Giner-Reichl 2015; Fulquet and Pelfini 2015).

Privatization and Market Liberalization

This final strand of IPE focuses broadly on how states manage energy development, or how they promote certain types of markets (Vogel 1996; Weiss 1998). More specifically, much of this research has investigated different models of electricity or utility restructuring. In the last 40 years, telecommunications, electricity, gas, railway, water, and sewerage utilities have undergone immense ideational and structural shifts. Utilities in countries across the world have experimented with new ownership models and abandoned the convention that infrastructure services should be the exclusive domain of the state. The introduction of private sector participation and competitive forces is in fact not a novelty, but a return to before Second World War when many of these utilities were privately held. The role of private sector (owned or managed) utilities, governed by national regulatory agencies, has been further shaped in recent years by cross-border regulation. Electricity is neither treated as a commodity under the General Agreement on Tariffs and Trade nor listed as a service under the General Agreement on Trade in Services, and thus gets no guaranteed protection for cross-border supply under WTO rules (Ghosh 2011). But the ECT does demand of member governments to facilitate the building of new transmission lines to permit cross-border trade. The European Commission also convenes dialogues between national regulators, transmission system operators, gas and electricity traders, and network users and consumers (Wälde and Gunst 2002).

The basic principles of privatization in the Chilean and British cases included that the customer's needs should drive electricity supply; competition would reduce tariffs in line with ratepayers' interests; natural monopolies should be accompanied by regulation; the maintenance of security and safety; customers would have new 'rights'; industry employees would be free to manage their commercial affairs without government involvement (Cory and Lewis 1997). Whereas the electricity supply industry reform process created sectoral segments (e.g., generation, transmission) whose ownership and operations were clearly either privatized or state-owned, privatization in water sectors around the world assumed a more nuanced character. Privatization, more frequently described as 'private sector participation,' assumed a range of formats along a spectrum of completely privatized to fully state-owned.

Dubash (2011) examines how alternating phases of state control and 'grafting the market' in India's energy governance have been shaped by global trends and its domestic political economy. Victor and Heller offer the most concise version of the 'standard textbook model' as unbundling, privatization, creation of a regulatory institution, and creation of markets, their version is an appraisal of events instead of an exposition of the ideal model like those proposed by other scholars (Victor and Heller 2007). Bacon and Besant-Jones (2001) argue that a 'full-scale reform program' entails six components: (1) the commercialization of enterprises which requires they pay taxes and market-based interest rates and enjoy increased autonomy; (2) the introduction of competition to improve various performance indicators with the recognition that competition is generally not viable in the transmission, distribution, and system control segments; (3) unbundling the incumbent enterprises to foster a competitive environment and prevent discrimination; (4) privatizing unbundled generators and distributors to different owners; (5) developing market regulation to be implemented by an agency insulated from the influence of other stakeholders; and (6) the divestiture of state-owned generation and transmission assets.

6 Approach of This Volume

This handbook combines two lenses to study energy resources and markets: 'political economy' (where the market meets the state) and 'political ecology' (where political economy meets the environment). By doing so, the handbook proceeds from the assumption that all politics is inevitably ecological (i.e., political choices affect the biophysical world) and that ecology is inherently political (i.e., the biophysical reality shapes distributional conflict and political outcomes). Combining those two lenses requires a thorough understanding not only of the changing natural resource base itself and the human response to it, but also the broader changes in society that shape and are shaped by this human–environment interaction. Such an approach sets the handbook apart from apolitical studies of environmental and resource management.

Our handbook also offers a critique of much of the existing literature on (international) political economy, where energy and environmental resources are still often treated as fringe issues or purely exogenous factors. We argue that energy and environmental resources should occupy a more central place in the field of IPE. To adopt an IPE lens means as much as to focus on the interrelationship between public and private power in allocating scarce resources at the domestic and international levels. These scarce resources not only comprise material things such as capital or fossil fuels, or things like pollution rights, but also immaterial goals such as status, prestige, power, and influence—the scarce character of which follows from the fact that these are relational and hence relative attributes. The interplay between ideas, interest groups, economic classes, MNCs, multilateral and regional institutions, transnational networks, and global markets is at the heart of the political economy—the who-gets-what-and-why—of the world energy system.

As the literature review in the previous section reveals, much of the existing scholarship of the IPE of energy has focused on a single energy source: petroleum. This is understandable given that oil has been the world's most important source of energy since the mid-1960s. Oil was also the first energy source to be traded internationally in large quantities, reflecting the fact that oil reserves are more geographically concentrated than coal reserves. Yet, clearly, as the energy mix undergoes significant changes, other energy sources and technologies also warrant attention from IPE scholars, as they too raise important questions about the pursuit of wealth and power in a global perspective. Moreover, the field of IPE continues to evolve, and interesting links and synergies can be established with other traditions of research, including global governance, transition studies, security studies, and ethics.

Thus, rather than merely replicating the six branches of existing IPE of energy research, we see the need to deepen and augment mainstream IPE discussions so that they reorient themselves around:

1. Energy actors and institutions;
2. Energy trade, finance, and investment;
3. Energy transitions;
4. Energy conflict and the resource curse;
5. Energy justice and political ecology.

The handbook consists of these five parts. Some of these themes have received a great deal of attention in the literature (e.g., the resource curse), others much less (e.g., energy justice). But practically none of these topics is routinely taken up in general IPE discussions, nor have they been brought together before under an IPE framework. In line with our overarching concept (combining political economy with political ecology), each section will seek to unravel how political forces shape energy policies and transformations, which in turn shape political conflicts and coevolve with societal practices.[9]

The first part focuses on how diverse international and transnational *actors and institutions* attempt, with varying degrees of success, to govern energy—that is, to develop rules and norms that aim to influence behavior and outcomes in the energy sector. This part builds on a strong tradition of studying

[9] The basic idea of this handbook was to present a broad range or review of complex topics, meaning that the editors do not necessarily agree with all positions, arguments, and perspectives raised throughout the book. We saw our role more as facilitators than as gatekeepers.

international energy regimes and institutions, as outlined above. An introductory chapter (Chap. 2) sets the scene by sketching the fragmented nature of energy governance at the national and international levels. The rest of the section focuses on four institutions. OPEC (Chap. 3) selects itself as one of the oldest international energy institutions that has spawned a very large literature on whether or not it can act as a powerful cartel on the global oil market. The Extractive Industries Transparency Initiative (Chap. 4) is a much more recent institution. As a multi-stakeholder initiative that brings together governments, companies, and civil society actors, it provides an excellent case study to gauge the roles and motivations of different types of actors in global energy governance. The UN (Chap. 5) and the World Trade Organization (WTO, Chap. 6) are two institutions that have not received much attention in the literature, yet they arouse interest due to their (near-)universal membership, broad mandates, and recent activism with regard to energy (think about the adoption of the SDGs in the UN or the flurry of energy trade disputes in the case of the WTO).

The chapter on the WTO forms a bridge toward the second part of this handbook, which analyzes the political economy of some of the key *trade, finance, and investment* issues in the global energy sector. Being one of the most capital-intensive sectors in the world economy, hosting some of the world's most valuable companies, and accounting for enormous cross-border flows of money, technology, and commodities, the energy sector is key to the global trade, investment, and finance systems. This section thus connects to core areas of IPE scholarship—trade, investment, finance—but it does so from an energy angle, and therein lies its novelty. Most of these issues have received only scant attention in IPE circles. This is certainly the case for the growing number of green energy trade conflicts (Chap. 7), which are of course a rather recent phenomenon. Energy investment (Chap. 8) and oil and gas pricing regimes (Chap. 9) are more long-standing issues, yet these areas are subject to notable shifts (such as the roles expected to be played by mega-regional trade and investment agreements), which warrant further scrutiny. The final two chapters deal with how climate policies have created new markets in the form of carbon-trading schemes (Chap. 10) and are putting pressure on energy subsidy regimes that have traditionally been geared toward supporting fossil fuels and (in some countries) nuclear (Chap. 11).

The third part turns to the topic of energy *transitions*, analyzing international trends and comparing different national experiences with advancing particular energy transition pathways, fuels, and technologies. While these topics could be linked to the varieties of capitalism literature or the literature on privatization and liberalization, as outlined above, the introductory chapter to this section argues that there is much to be gained from combining an IPE perspective with the field of energy transition studies (Chap. 12). Subsequent chapters examine the obstacles and drivers in the diffusion of different energy technologies. Chapter 13 argues that carbon capture and storage (CCS) technologies have advanced the most in fossil-fuel rich countries where there is a strong commonality of interest between the public and private sector as investing in CCS is crucial for maintaining the oil rents in a carbon-constrained world. Chapter 14 looks at changes in the electricity industry in four European countries and finds that energy transitions are slowed down in countries with less inclusive policy styles. Chapter 15 argues that nuclear power is facing a variety of political, social, and economic obstacles that hamper its global diffusion, despite several nuclear energy industries being keen on trying to obtain international orders beyond their 'home' markets. Chapter 16 examines the potential for biofuels to substitute oil as a transport fuel and also hints at a number of political economy factors that influence policy developments and effects (e.g., dominance of MNCs in downstream production, uncertain job effects across countries, impact on food prices).

The fourth part examines *conflict and the resource curse*. This part ties back to two major streams of literature, discussed above: the 'resource curse' of oil exporters, and energy security and geopolitics. The introductory chapter (Chap. 17) paves the way by tracing the historical militarization of energy and examining whether the recent claims of energy abundance break this pattern. All chapters in this section point out that there are limits to the much-hyped securitization of energy. While military force is often brandished by states in asserting their claims over contested oil-producing areas, they only initiate full-scale combat when the survival of the state (or the regime) appears to be at stake (Chap. 18). Gazprom's so-called gas weapon, in turn, is at best a double-edged sword, which may in the very end herald its own demise, as it focuses efforts in Europe to create a genuine internal energy market and look for alternatives to Russian gas (Chap. 19). There are also strict limits to the value of enacting energy sanctions against major producers (Chap. 20). Finally, this section also reviews the large body of literature that has developed around the notion of the 'resource curse.' Chapter 21 identifies four waves of scholarship on this matter and argues that there is an emerging consensus of evidence of a conditional resource curse—with some scholars recently pointing out that under specific conditions resources can indeed be a blessing rather than a curse.

The fifth part, finally, turns to questions of energy *justice and political ecology*. After a discussion of the meaning of these concepts (Chap. 22), this section features five different theoretical concepts or lenses that offer a novel way of evaluating and assessing how just energy systems really are. Chapter 23 sees the application of a political ecology lens to Nigeria to reveal how provision pacts and systems of ressentiment continue to create a domestic petroleum economy there marked by tension, subjugation, and violence. Chapter 24 emphasizes the role of dispossession and the tyranny of market forces in worsening the social and environmental consequences of global energy production and use, with a special emphasis on chronic threats such as degraded human health from cookstoves or catastrophic risks such as major accidents and meltdowns. We see the concept of Global Production Networks introduced in Chap. 25, used to describe how global commodity chains function and shape energy decisions, and enclosure and exclusion introduced in Chap. 26, used to describe how market forces or elite actors can enclose upon previously public resources to transform them into productive, private assets and then exclude others from access. Chapters 27 and 28 focus intently on energy justice where we see notions such as distributive equity, procedural justice, justice as recognition, and progressive capitalism introduced and evaluated.

7 Conclusions and Implications

Overall, the contributions to this handbook speak to a range of important themes within IPE but also offer scope for critical reflection on what an IPE lens misses and provide insights into what energy themes may offer the study of IPE. Here we highlight a few of the broader lessons emanating from this handbook about what energy offers IPE and how IPE can inform energy studies.

The handbook illustrates that the energy sector exhibits the same dialectical relationship between public and private actors that characterizes the wider field of IPE, albeit with some unique features. Many of the world's biggest corporations are active in the energy, mining and utility sectors, so the research strand in IPE that focuses on the role of corporations cannot afford to ignore the energy business. At the same time, many, if not most, contributions to this volume acknowledge the crucial tensions that arise when (national) governments, while crafting energy planning and policy, must engage and, at times, compete with private sector actors and the rise of other stakeholders from civil society and academia. Many actors—governments, corporations, community groups, nongovernmental organizations, even consumers—often operate in a polycentric tandem. Focusing on only two scales and actors, the state and the government, several contributions to this volume highlight how state and corporate elites can collude in terms of ideas (e.g., embrace of carbon markets, see Chap. 10), or interests (e.g., promotion of national nuclear industry, see Chap. 15). An extreme case is Gazprom, Russia's state-owned gas company, which essentially serves as a foreign policy arm of the Kremlin (see Chap. 19). While civil society can play a role, its authority seems to be limited in the current IPE of energy.

The volume also speaks to the agent–structure debate in IPE. Several chapters touch upon the debate of how (fossil) resource endowments impact political constituencies and outcomes, and vice versa. An obvious case in point is the resource curse, the idea that large resource endowments are bad for economic development and good governance (Chap. 21). Large fossil-fuel producers such as Saudi Arabia, the USA, Canada, and Brazil typically have a strong fossil fuel industry with access to policy-makers and considerable political and financial resources, which explains why these countries pursue the controversial technique of CCS, which could enable the continued use of fossil fuel reserves even in a climate-constrained world (Chap. 13). Choices made in the past as well as today about energy technologies and infrastructures create path dependencies and carbon lock-in, thereby limiting the agency of future generations. Critical scholars would argue that the twin challenges of energy security and climate change have the potential to reshape the deeper structures of how the world economy works, and even call into question the capitalist mode of production and accumulation.

Another long-standing IPE debate this handbook touches on is about how national and international political and economic processes interact. The field of energy seems a particularly good case to study such interactions across political levels as energy developments can rarely be understood by looking at national or international processes on their own. There is a continuous interaction between national or subnational (interest-group dominated) politics (e.g., lobbying for biofuels subsidies) and the international economy, trade flows, and commodity prices (e.g., global market developments for liquid transport fuels; impact of biofuel subsidies on global food prices) (cf. Chap. 16). Compared to other traditional areas of IPE, energy is characterized by a remarkable weakness of global institutions. There is no global energy institution comparable to, for example, the WTO for trade or the IMF for finance. Global institution-building in this area is hampered by the dispersion of national interests and power across sectors and value chains, and by the complexity and multidimensionality of energy issues. One notable international energy organization is OPEC. While most experiments with commodity cartels in the 1970s floundered, OPEC survived, yet its ability to steer oil markets is limited at best (see Chap. 3).

Perhaps most importantly, the handbook serves as a potent reminder that energy systems are inherently political and economic as much as they are technical or technological. Speaking to one of Susan Strange's favorite questions, 'cui bono?,' energy systems clearly create winners and losers (cf. Chaps. 22, 24, 25, and 26). Energy devices and systems can have their own type of political economy (cf. Chap. 23); their trajectory can be shaped exogenously by external political and economic forces; and they themselves can influence endogenous or internal political and economic trends. Energy systems can also be framed and utilized in different ways to accomplish different—often competing—political goals. For their designers they may represent the pinnacle of human engineering and technical achievement; for displaced communities and disgruntled workers, they may represent blatant symbols of corruption and environmental blight.

These conclusions represent only the beginning of a long list of issues that could be addressed in a genuine IPE of energy research agenda. Energy as an issue area is characterized by a high degree of issue linkages and complexity. Energy systems reach vertically from individual households all the way up to the global policy level, and are horizontally linked to almost all major issues in IPE, including international security, trade, money, sovereign debt, tax and welfare, global poverty and development, and labor relations. Moreover, energy policy—at both national and international levels—is often instrumentalized to achieve other purposes. The upshot is that an IPE of energy research agenda should not just lead to the inclusion of 'energy chapters' in canonical IPE textbooks, but to more attention to energy matters across the board.

Ultimately, IPE analytical concepts and theories can contribute to our understanding of the political underpinnings and implications of energy systems, and energy systems can contribute to a clearer comprehension of political science methods, theories, and case studies. To study the IPE of energy is not a trivial or peripheral matter—it cuts to the heart about both describing and explaining what types of energy systems society has at the moment and why, and prescribing what better systems ought to look like tomorrow, and how we can get there.

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Part II

Energy Actors and Institutions

Primary editor: Thijs Van de Graaf

2

Actors, Institutions and Frames in Global Energy Politics

Thijs Van de Graaf and Fariborz Zelli

If one ought to describe the global political economy—the 'who gets what when and how'—of energy in a single word, 'fragmentation' would be an appropriate term. The pursuit of wealth and power in energy is driven by a hugely diverse set of actors and institutions, operating across different political scales, geographical spaces, energy sources and market segments. Interests, power, values and perceptions in global energy are equally splintered. They are also constantly in motion, molded by global shifts in technology, politics, the environment and the economy. This fragmentation makes the analysis of global energy politics difficult but all the more interesting. The goal of this chapter is to lay out the different types of actors, institutions and frames that are active or valid in global energy politics, and to look in particular at the fragmented institutional architecture of global energy governance.

The chapter proceeds in the following fashion. First, it provides a deconstruction of the global energy challenge, arguing that the world does not face a singular energy problem but in fact multiple energy-related challenges. Which energy problem merits attention depends very much on the worldviews and values that one subscribes to. Second, the chapter argues that effective governance is needed to overcome these challenges and it lays bare

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the fragmented nature of energy governance at the national, regional and global levels. Third, the chapter zooms into some of the relations between elements in this fragmented governance landscape, identifying the most prominent gaps, overlaps and interactions in global energy governance. Finally, a brief overview is given of the remaining chapters in this section of the Handbook.

1 Deconstructing the Energy Challenge

Unsustainable Energy Trends

Economic growth and prosperity in modern society are unthinkable without the reliable provision of sufficient and affordable units of energy and, thus, some degree of energy security. The energy sector is also key to effective climate change mitigation as it is responsible for no less than two-thirds of global greenhouse gas emissions (IEA 2015). Addressing the twin challenges of climate change and energy security is of critical importance but world energy trends are heading in the wrong direction.

To assess the world's energy trends, there is probably no better place to start than the *World Energy Outlook* (WEO). The WEO is the flagship publication of the International Energy Agency (IEA), issued each year in November. With hundreds of pages of analysis and charts, the report's projections are widely seen as the 'bible' of the international energy industry. The report projects how energy demand, supply, prices and technologies will evolve in the ensuing 25 years under business-as-usual and some alternative scenarios. Energy geeks revel in the wealth of data that the outlook contains, but governments and the media also pay a close eye to the policy messages that the IEA conveys through its report. Those messages have become more grim in recent years.

In its baseline scenario, the IEA projects that energy demand will be 37% higher in 2040 than in 2012, putting us on track for a long-term average global temperature increase of 3.6°C above levels that prevailed at the start of the industrial revolution (IEA 2014).[1] Almost all of the growth in energy demand comes from non-OECD countries, shifting the center of gravity of energy markets decisively away from the Americas

[1] The IEA's baseline scenario is the so-called New Policies Scenario, which takes account of new policy commitments and plans (even if the plans to implement these have yet to be announced).

and Europe. Fossil fuels (oil, coal and gas) remain the dominant energy sources, though their share in the overall energy mix falls from 80% to 74%. The IEA estimates that a cumulative investment of 37 trillion US dollars (in year-2011 dollars) is required to expand the world's energy-supply infrastructure to meet expected market demand over the next 25 years (IEA 2012, p. 73).

Often overlooked in mainstream accounts of global energy trends is the issue of energy poverty—probably because it is more a constant than a trend. About 1 billion people (i.e., about 15% of the global population) currently have no access to electricity in their homes, and are thus deprived of the useful energy services that electricity delivers, including modern lighting and refrigeration services. An even higher number of people, 2.9 billion, rely on solid biomass fuels—such as wood, agricultural residues and dung—to cook their food or heat their homes (REN21 2015, p. 103). This has dire consequences for health—the World Health Organization (2014) estimates that approximately 4.3 million people die prematurely, every year, as a result of fumes from household air pollution. This makes it the greatest health risk in the world after high blood pressure, tobacco and alcohol (Lim et al. 2012). Dependence on such solid fuels is also detrimental for more productive activities such as farming and education since those people, most often women and children, spend many hours gathering such fuels (Subramanian 2014). Wood gathering can also lead to deforestation, severely damaging local and global ecosystems (Birol 2007).

These sobering statistics and trends led the IEA to conclude that 'the world's energy system is at a crossroads. Current global trends in energy supply and consumption are patently unsustainable—environmentally, economically and socially. But that can—and must—be altered; *there is still time to change the road we're on*. It is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the two central energy challenges facing us today: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply. What is needed is nothing short of an energy revolution' (IEA 2008, p. 37). Yet, in practice, many types of energy revolutions are advocated. At best, this reflects disagreement about what the global energy challenge really is. At worst, it reflects rhetorical strategies to cloak private interests in a discourse of the public good. This leads us to discuss the importance of framing in energy policy.

Energy Frames, Values and Worldviews

While the energy statistics of the IEA remain largely undisputed, views diverge on what constitutes the key energy problem of today and the most appropriate way to solve it. As frame theorists like Schön and Rein (1994) argue, we do not just make decisions based on hard, cold facts, but also on values, worldviews, paradigms and principled beliefs. Benjamin Sovacool and Marilyn Brown (2015) identify no less than eight different cognitive or epistemic 'frames' with regard to energy. A popular frame among physicists and engineers is that of 'technological optimism,' which states that we can fix practically any energy problem with technological innovation. Economists subscribing to the frame of 'free market libertarianism' share this optimism but place their faith in free and open markets as the harbinger of public and private goods. These worldviews are contested by more pessimistic notions that stress the detrimental effects of energy on the environment (the 'environmental preservationist' frame), social communities ('justice' or 'philanthropist' frame), labor relations ('neo-Marxist' frame) or national security ('national security' frame). The 'conscientious consumer' frame, finally, holds that it is individual behavior or consumer demand that must be changed to ensure better energy outcomes.

These energy frames bear close resemblance to four major worldviews of the global political economy of the environment, as identified by Jennifer Clapp and Peter Dauvergne (2005). One worldview is that of 'market liberals,' who see globalization and economic growth as positive forces that will improve environmental conditions. They also place great faith in the ability of modern science and technology to help societies slip out of any environmental binds that may occur. Another view is that of 'institutionalists,' who see a lack of global cooperation as a key source of environmental degradation and emphasize the need for stronger global institutions to harness globalization. Third, there is the view of 'bioenvironmentalists,' who warn that the earth's carrying capacity is (about to get) overstretched unless we pose limits to economic and population growth. Finally, 'social greens' see social and environmental problems as inseparable. Global capitalism feeds exploitation of social groups (workers, women, indigenous peoples, the poor) and of the environment, and should be rejected.

The existence of different energy frames and worldviews is a reminder that there is no such thing as 'the' global energy challenge; instead, there are many different energy problems and the prioritization and trade-offs involved reflect different worldviews and values. Energy is merely a prism through which broader issues refract. This helps to understand why 'energy security' is such a contested concept, with one account identifying no less than 45 distinct definitions of the concept (Sovacool 2010). Some observers have even concluded that 'energy security is like a Rorschach inkblot test—you can see whatever you want to see in it.'[2] Focusing on the underlying values and frames of energy security directs attention to the strategic value of this multitude of definitions: actors advance very different notions of energy security to justify their actions and policies on 'energy security' grounds (Sovacool and Mukherjee 2011).

Frames and Goals of Global Energy Policy

Building on these conceptualizations, we differentiate at least four overarching frames for the field of global energy policy. Each of these frames is marked by one interconnected dimension or prioritized component with regard to energy security. These dimensions are 'availability,' relating to the relative independence and diversification of energy fuels and services; 'affordability,' which does not just mean low prices for energy consumers but also stable prices to increase planning and investment security; 'sustainability,' referring to both the protection of the natural environment and preventing the full depletion of non-renewable energy sources by making a timely swift to renewable energy sources; and 'social acceptability,' which implies respect for human rights and dignity in relation to both individuals and social groups.

Table 2.1 juxtaposes these different frames, worldviews and values on the international political economy (IPE) of energy. It highlights for each type of frame in the left column, depicted here as frame agents, different basic perspectives with regard to global energy security—namely, the dominant worldviews that are at the core of each frame, the key energy problem perceived, the referent object for energy security and the underlying values of the approach. Although this table provides a useful heuristic to make sense of the importance of framing in relation to any discussion about the global energy challenge, it necessarily represents an oversimplification of reality. There can be considerable variation in views within each of the four categories. Moreover, both these views and their interrelation are subject to remarkable swings over time. The notion of energy security has clearly broadened. Whereas in the 1970s and 1980s, energy security meant stable supply of cheap oil under threats of embargoes and price manipulation by exporters, contemporary

[2] Participant at the International Workshop on Energy Security Concepts and Indicators for Asia, Lee Kuan Yew School of Public Policy, November 14–16, 2009, Singapore, quoted in Sovacool and Mukherjee (2011).

Table 2.1 Frames and worldviews on the international political economy of energy

Frame agents	Dominant worldviews	Prioritized component of energy security	Energy security for whom?	Underlying values and goals
Market liberalists	Technological optimism, free market libertarianism	Economic affordability	Economy	Welfare, freedom
Neo-mercantilists	Defense of national security	Geopolitical availability	State	Political independence and territorial integrity
Environmentalists	Environmental preservationism, conscientious consumption	Environmental sustainability	Earth	Respect for nature
Social greens	Justice, neo-Marxism	Social acceptability	Society	Equity, justice

views of energy security encompass a much wider range of issues beyond oil supplies. In addition, the understanding has grown that energy is entangled with other global issues such as development and climate change (Cherp and Jewell 2014).

To be clear, the above four frames, which are based on Clapp and Dauvergne (2005), are but one possibility to distinguish and assign core energy-related worldviews, agents and goals. In an overlapping, but slightly different approach, the goals of global energy policy are routinely presented as a 'policy trilemma,' as they revolve around the question of how to meet the three demands of securing energy supply, protecting the global climate and (specifically for developing countries) reducing energy poverty (Cherp and Jewell 2011; Gunningham 2012). The World Energy Council (WEC), a United Nations (UN)-accredited global energy forum, sees the energy trilemma as balancing between the competing needs of energy security, energy equity (comprising both accessibility and affordability) and environmental sustainability (see Fig. 2.1). The WEC has developed an Energy Trilemma Index that captures and aggregates the energy performances of almost 130 countries on a yearly basis.[3]

[3] See: https://www.worldenergy.org/data/trilemma-index/ (last accessed: October 27, 2015).

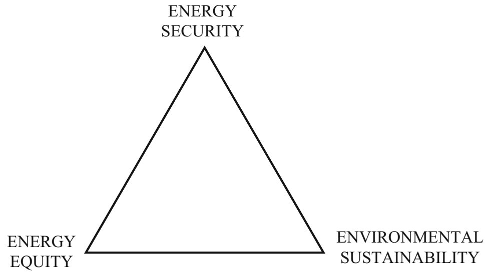

Fig. 2.1 Balancing the 'energy trilemma' (*Source*: World Energy Council)

The basic idea of such a trilemma is that it is often difficult to achieve all three goals simultaneously (e.g., Froggatt and Levi 2009; Ürge-Vorsatz and Herrero 2012). For example, off-grid diesel generators have long been the preferred solution for bringing electricity to rural regions in the developing world, yet they bring further harm to our warming climate. Nuclear energy emits less CO_2 than coal- and gas-fired power plants, but it entails huge security risks, and it presents no solution to rural energy poverty if not accompanied by costly grid extensions. To be sure, synergies and co-benefits can certainly be reaped—for example, decarbonization policies can lead to improved air quality, thereby reducing energy-related health impacts worldwide, and they can lead to lower import dependencies, thereby bolstering energy security for countries and regions (McCollum et al. 2013). Yet, a comprehensive overview by Sovacool and Saunders (2014) suggests that there are more conflicts than synergies involved. 'Energy security,' in their view

> can never be truly optimized… Energy security only works by prioritizing some dimensions more than others. Put another way, successfully reducing oil dependence is totally different from a strategy for affordability or sustainability; as such, energy security planning is about managing tradeoffs and risks, it can never truly eliminate them. Therefore, it will never be sufficient to provide policymakers a "laundry list" of policy prescriptions for achieving energy security when this list ignores qualitative differences between technologies and energy security goals. … Energy analysts and policymakers should plan for energy security failure; they should expect that whatever energy gains they accomplish will only come at the expense of losses at some other part of the energy security spectrum. (Sovacool and Saunders 2014, p. 649)

However, the energy trilemma is a specific rhetorical device that is prone to criticism itself. For one thing, different versions of the trilemma exist that stress or collapse certain factors while neglecting others. The central goals of

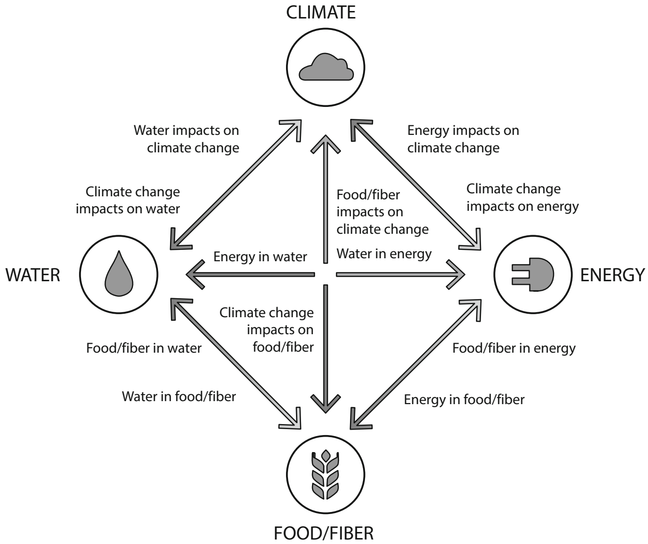

Fig. 2.2 The water–energy–food–climate nexus (*Source*: World Business Council for Sustainable Development)

the energy policy of the European Union (EU) are spelled out in the Lisbon Treaty (Article 194) as security of supply, competitiveness and sustainability. Compared to the WEC's energy trilemma, no mention is made of energy poverty in its global dimensions. The WEC's conceptualization can also be criticized for lumping together affordability and accessibility under the same heading of 'energy equity,' although they are two different things and may involve trade-offs among themselves (cf. the perspectives of market liberalists and social greens in Table 2.1).

Moreover, there is increasing recognition that energy systems are inextricably linked to food and water systems, all of which affect and are affected by climate change, constituting a global resource 'nexus' (Bazilian et al. 2011). Such a nexus approach, as depicted in Fig. 2.2, introduces many more dimensions into the equation and therefore also involves a multiplication of the dilemmas and trade-offs involved. Compared to the energy trilemma, it is more complex and may therefore be less attractive as a policy planning instrument. Yet, crucially, it underlines the importance to go beyond a silo approach and attempt to devise energy policies holistically, taking into account multiple dimensions and related trade-offs.

2 The Fragmented Landscape of Energy Governance

Despite the manifold meanings and framings of the term energy security, there is a large consensus that the energy sector needs some form of 'governance.' The concept of governance became widely used in development policy circles in the 1980s and, from there, also spread among social scientists more generally. The term is now part of the established lexicon of multiple disciplines, including political science, law, public administration, economics, sociology, geography and history (Rhodes 1996). The emergence and rapid spread of the term is linked to processes of neoliberalism and globalization, which denotes the global shift from the 1970s onward to financial deregulation, trade liberalization and the consolidation of global production networks (Scholte 2005). These shifts are said to have eroded the capacity of traditional modes of state-based regulation to steer society, both domestically and internationally (Strange 1996).

Although the 'retreat of the state' is probably overstated in many narratives of globalization, there is plentiful evidence that non-state actors have come to play a more important role in issues of public policy. Where governance was once assumed to be synonymous with the activities of government, today it is understood to also encompass the activities of local and international non-governmental organizations (NGOs) and activist groups and the decisions crafted in corporate boardrooms and at global conferences. The key difference between 'government' and 'governance' is of course that the former exercises formal authority, backed by strong enforcement mechanisms, whereas the latter refers to activities backed by shared goals that may or may not rely on formal authority and coercive power (Rosenau and Czempiel 1992).

National Energy Governance

Despite all the buzz about energy sector deregulation, liberalization and privatization, the role of government in shaping the energy sector remains crucial. The policy and regulatory frameworks established at national levels still largely steer energy investment and consumption decisions. A useful way to grasp the challenges associated with national governance is offered by political geographer Michael Bradshaw (2014), who has examined how the energy dilemmas identified above play out in different regions and countries. In the high-energy societies of the *developed world*, there is a growing tension between the climate-change imperative of decarbonization and the affordability dimension of energy security. For the *emerging economies*, the imperative to secure sufficient energy to continue to fuel economic growth often takes precedence over concerns about emissions. In the *developing world*, finally, issues of energy access take clear priority over the promotion of clean energy. Throughout these different country categories runs the cleavage of energy exporters versus importers, each of which faces a distinct set of dilemmas.[4] In terms of the four frames above, these country strategies reflect a dominance of neo-mercantilist and market-liberalist frames—with obvious tensions between them—while environmentalist and social green frames are less influential.

As mentioned in the introductory chapter, there are different styles of national energy governance. *State corporatist* countries (e.g., Germany, Japan and Korea) combine a highly centralized public bureaucracy apparatus with policy networks that include societal groups recognized and legitimized by the state. *Social-corporatist* countries (e.g., Nordic countries) also exhibit interaction among interests formally organized by the state, yet the state itself plays a less peremptory role. In *liberal-pluralist* countries (e.g., the USA, UK and Australia), the state plays a minimalist role, leaving ample space for private interest groups to influence policies. A final category of countries, the *state nations* (e.g., France, Italy and Belgium), encompass a strong state with close associations to business (Spencer et al. 2005). These categories only capture variation among capitalist, developed countries. More styles exist when non-capitalist, developing countries are taken into consideration.

These cross-national differences in governance styles can be juxtaposed with differences in how energy governance is organized institutionally and what types of policy instruments are favored. In terms of institutions, there are huge differences across countries. For example, control over India's energy policy and planning has long been spread over five fuel-based ministries: coal, power, petroleum and natural gas, new and renewable energy, and atomic energy (Dubash 2011). China, by contrast, does not even have an energy ministry tasked with coordinating government policy in this sphere (Kong 2011). Under Margaret Thatcher's conservative government in the 1980s, Britain also abolished its energy ministry, applying the same set of competition and liberalization rules to energy as to any other sector, yet the government nevertheless remained heavily involved in the regulation of the sector (Buchan 2002; Helm 2002). The EU Commission did not have an energy directorate until recently—energy had been conjoined with transport. Since

[4] Bradshaw also discusses a fourth category of countries, post-socialist transition states, but concludes that while they share a similar past, their future paths will diverge and these countries will either become developed, emerging or developing.

2010, it has a directorate general (DG) for energy, but also for climate action (which was previously included in the remit of the DG environment).

In terms of favored policy instruments—for example, whether the state resorts to taxes, subsidies or regulations—choices appear to be influenced by the distributional effects of policies on important energy-related industries, public sentiment and the institutional capacity of governments (Hughes and Urpelainen 2015). The *political* effects of a given policy instrument were deemed the most important. As Hughes and Urpelainen (2015, p. 61) explain: 'feed-in-tariffs, for example, are effective both because they increase the share of renewable energy in the electricity generation mix *and* because they increase the political influence of industries that support the retention and expansion of energy-related climate policies.'

Although political preferences matter a great deal in explaining national energy trajectories and policies, state preferences in the IPE of energy are of course also shaped by more structural factors. Geography matters a great deal, as countries have strongly varying degrees of resource endowment. The extractive industries (e.g., coal, oil, gas, uranium) differ much from those of manufacturing or services because the energy resources are either there or not there. Unlike factories, they cannot be created elsewhere (Mitchell and Mitchell 2015, p. 18). Like geography, climate matters too. Colder regions (e.g., UK or Denmark compared to Spain or Portugal) usually have higher heating loads—that is, the energy required to maintain interior temperatures in buildings at comfortable levels. This largely accounts for higher per capita energy consumption.

Multilateral Energy Governance

At present, the energy sector is still primarily addressed at the national level of government. Due to the increasing globalization of energy markets and externalities, however, there is an increasing number of energy issues that require collective action at the regional or global levels. Some energy-related challenges such as global warming or nuclear proliferation are global public 'bads' that require international cooperation to avoid the dilemmas of collective action, such as free-riding, the prisoner's dilemma or the tragedy of the commons (Hardin 1968: in Olson 1965; Ostrom 1990). Others, such as the urgent need to research and diffuse breakthrough energy technologies as widely as possible require the production of global public goods such as knowledge, finance and standards (Barrett 2007). Even for seemingly pure local issues, such as electricity deprivation in the Global South or corruption in the upstream oil sector, which are actually quite ubiquitous, benefits could be reaped from international cooperative action, complementary to regional and domestic action. For example, the dissemination of information, best practices, technology and capital are functions, relevant to energy that states often delegate to international organizations (Van de Graaf 2013b). The political and economic sensitivities associated with the energy sector have made nation states reluctant to cede control over energy policy to global bodies or through international agreements. The result is what McGowan (2009) has called a 'paradox of sovereignty,' whereby states have less control over energy policy but remain largely unwilling to act jointly.

The dispersion of state interests and power is one of the major reasons why the energy sector has not given way to a coherent international regime. There is no single, overarching global institution for governing energy. Instead, energy is governed by a Byzantine architecture of parallel, nested and overlapping institutions, forming what Raustiala and Victor (2004) have called a 'regime complex' (see also Colgan et al. 2012; Van de Graaf 2013b). It consists of a host of intergovernmental organizations, including the Organization of Petroleum-Exporting Countries (OPEC), established in 1960 and now assembling 12 oil-exporting countries that collectively account for 40% of the world's oil supply.[5] There is also the Paris-based IEA, created in the wake of the first oil shock at the initiative of the American Secretary of State Henry Kissinger. While formerly antagonistic, OPEC and the IEA are now on speaking terms and even stage joint press conferences and informally coordinate in times of oil crises. The rapprochement between both organizations has given way to the establishment of a new international organization, the International Energy Forum (IEF), a biannual gathering of energy ministers that is supported since 2001 by small secretariat in Riyadh, Saudi Arabia.

Other intergovernmental energy organizations include the International Atomic Energy Agency (IAEA), created in 1957 with a mandate to promote the peaceful and safe use of nuclear energy; the Energy Charter Treaty (ECT), which emerged in the early 1990s—the heyday of post–Cold War euphoria—as a means to create a secure investment climate for developing the energy sector, and particularly the natural gas sector, in the Former Soviet Union; the Gas-Exporting Countries Forum (GECF), which tries to emulate the OPEC model in the gas sector, so far to little avail; the International Partnership for Energy Efficiency Cooperation (IPEEC), housed at the IEA's headquarters

[5] In September 2015, former member Indonesia submitted an official request to OPEC to reactivate its membership. See OPEC press release, http://www.opec.org/opec_web/en/press_room/3146.htm, last accessed October 19, 2015.

Table 2.2 Selected intergovernmental energy organizations

	Mission	Year of inception	Member states	Seat of the secretariat
International Atomic Energy Agency (IAEA)	Promote nuclear safety and security	1957	165	Vienna
Organization of Petroleum-Exporting Countries (OPEC)	Raise oil rents for producers	1960	12	Vienna
International Energy Agency (IEA)	Energy security for consumers	1973	29	Paris
Energy Charter Treaty (ECT)	Govern Eurasian gas markets	1994	46	Brussels
International Energy Forum (IEF)	Global producer–consumer dialogue	2001	76	Riyadh
Gas-Exporting Countries Forum (GECF)	Raise gas rents for producers	2001	12	Doha
International Partnership for Energy Efficiency Cooperation (IPEEC)	Promote energy efficiency globally	2009	16	Paris
International Renewable Energy Agency (IRENA)	Promote renewable energy	2009	143	Masdar

since 2009 but with a global membership; and the International Renewable Energy Agency (IRENA), set up in 2009 by a number of member states of the IEA—notably Germany, Denmark and Spain—who were dissatisfied with what they saw as the IEA's lack of enthusiasm for renewable energy (Van de Graaf 2013a).

The principal energy-specific intergovernmental organizations are listed in Table 2.2. However, this table offers an incomplete picture of the global energy architecture. To begin with, it omits the international organizations that were not primarily created to govern the energy sector, but whose activities nevertheless impinge on energy outcomes. Examples include the World Bank and other multilateral development banks, whose loans impact on energy infrastructure development in the Global South (Martinot 2001; Tirpak and Adams 2008; Nakhooda 2011; Kim and Urpelainen 2013); government clubs like the G8 and G20, which have turned to the energy sector from time to time in their attempt to manage the global economy (Lesage et al. 2009; Van de Graaf and Westphal 2011); the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) with their support for public–private energy networks, energy efficiency and renewable energy projects; and various international environmental regimes that impact on the energy sector—for example, the United Nations Framework Convention on Climate Change (UNFCCC) or the international regime that controls oil pollution at sea (Mitchell 1994).

There are also a host of regional institutions that are relevant to the energy sector, including the EU, the North Atlantic Free Trade Agreement (NAFTA) (Selivanova 2011), the Center for Renewable Energy and Energy Efficiency of the Economic Community Of West African States (ECOWAS) (Hancock 2015) and the Organización Latinoamericana de Energía (OLADE).

Coming back to the two main framings of world energy politics introduced above: in terms of the trilemma of energy goals, Table 2.2 shows a clear dominance of securing energy supply among the missions of key intergovernmental energy organizations. The two other main goals, mitigating climate change and enhancing energy equity, rather play the role of side products or are addressed by organizations with a non-energy-focused mandate, like the UNFCCC, UNDP, UNEP or the World Bank. In the same vein, these other organizations also show a stronger influence of environmentalist and social green frames, while the energy institutions listed above largely reflect a market-liberalist view.

Transnational Energy Governance

Table 2.2 also fails to acknowledge the growing role played by non-state actors, such as business, civil society and science organizations in global energy governance. Alongside the growth of civil society organizations domestically, the number of international NGOs has increased consistently since the Second World War, and most notably since the 1990s. In 2014, a total of 4186 NGOs were registered as groups with consultative status with the UN Economic and Social Council (ECOSOC).[6] A lot of them focus on energy, climate or sustainable development. Business actors have always played a crucial role in the international energy sector, as is illustrated by the pivotal role that the international oil majors played in governing the petroleum market before the 'OPEC revolution' of the 1970s.

These non-state actors sometimes participate in intergovernmental processes. For example, oil companies with business operations in IEA member countries are directly involved in the IEA's oil emergency mechanisms (Badger 1988; Van de Graaf and Lesage 2009). Both civil society and business groups

[6] List available from: http://csonet.org, last accessed September 22, 2015.

attend international climate negotiations and try to influence the intergovernmental processes. Apart from participating in interstate negotiations, non-state actors have also created transnational networks around global policy objectives. While such networks may involve governmental actors, their defining characteristic is independence from state approval or support. Where transnational networks assume a more institutionalized form and begin to set broader norms and rules, they become transnational governance networks in their own right (Falkner 2011). Such networks make up a central steering mechanism in contemporary global governance, including in the energy sphere.

Such transnational governance regimes come in various forms. Some are structured as 'public–private partnerships,' bringing together business actors, societal groups and governmental actors in joint efforts to address specific public policy problems. At the UN level, partnerships have been endorsed through the establishment of the Global Compact, a voluntary partnership between corporations and the UN, as well as through the so-called type-2 out comes concluded by governments at the UN World Summit on Sustainable Development (WSSD) in Johannesburg in 2002 that institutionalizes public–private partnerships in issue areas ranging from biodiversity to energy. Out of the 340 partnerships that were registered with the UN Commission on Sustainable Development (UNCSD) in early 2012, 46 have a primary focus on energy issues (Pattberg et al. 2012).

The Renewable Energy and Energy Efficiency Partnership (REEEP) is a prime example of the larger universe of public–private partnerships devised and established around the 2002 summit. As an open-ended initiative to facilitate multi-stakeholder cooperation in the renewable energy, climate change and sustainable development sector, REEEP is a cooperative platform for more than 3500 members and 250 registered partners, among them over 40 governmental actors (both national and subnational), including all of the G7 states, and several international organizations.

Another instance of transnational governance are 'private regimes,' which involve non-state actors willing to commit to self-regulatory norms, standards and certification schemes in a given issue area. The Global Sustainable Electricity Partnership, an association of electricity companies, promotes sustainable energy projects and capacity building (Abbott 2012; Green 2013). These instances of transnational energy governance are mostly voluntary in nature and tend to rely on disclosure. The Extractive Industries Transparency Initiative (EITI), which is discussed in Chap. 4, aims to tackle corruption in the upstream oil and gas sectors by facilitating voluntary reporting on payments made by major firms.

In addition, a number of transnational networks have emerged that only indirectly aim at the reduction of greenhouse gas emissions, but rather focus on creating the necessary information and transparency for societal actors to assess corporate responses to climate change and thereby induce lasting behavioral change, for example, the Carbon Disclosure Project. Often these schemes are supported by institutional investors that have begun to include sustainability in their investments decision. These benchmarking processes create a global competition among business actors to address climate change as a serious limitation to their profit-making activities. The emerging information-based governance schemes effectively institutionalize new norms at the transnational level, for example, the norm to disclose corporate carbon emissions, in addition to the country-based reporting of the UNFCCC (Florini and Saleem 2011).

Given the enormous diversity in such transnational governance networks, it need not come as a surprise that there is equally much divergence in the effectiveness of such networks. Research by Heleen de Coninck et al. (2008) has concluded that international technology-oriented agreements to address climate change can be effective, especially if they set standards and mandates for specific sectors, not for specific technologies. Another analysis concurs that the internal structures and institutional design enhance the effectiveness of transnational energy partnerships, although the involvement of powerful actors (industrialized countries and major corporations) may further enhance effectiveness. These causal connections notwithstanding, Szulecki et al. (2011) also found that, so far, the majority of private–public energy partnerships have not been fulfilling the high expectations placed on their effectiveness.

In terms of dominant frames, most of the transnational energy initiatives seek to marry energy security concerns with environmental sustainability, that is, mitigating climate change. In the same vein, they combine market-liberalist and environmentalist framings, pursuing the vision of a green economy, thus—and unlike major intergovernmental energy organizations—reflecting the focus of different UN institutions that have facilitated the creation of many transnational initiatives.

3 Gaps, Overlaps and Interactions in Global Energy Governance

An emerging strand of literature has come to address the institutional patchwork of global energy governance, describing it as 'chaotic, incoherent, fragmented, incomplete, illogical or inefficient' (Cherp et al. 2011, p. 76). Yet, a more systematic, concept-driven approach to interinstitutional relations on energy is largely missing—but with a few exceptions (Bradshaw 2014; Cherp et al. 2011; Colgan et al. 2012; Florini and Sovacool 2011; Zelli et al. 2013). In the following, we characterize the interactions between the different institutions by assessing the gaps, synergies and tensions they reflect with regard to the three major goals of the aforementioned energy trilemma: securing energy supply, reducing energy poverty and mitigating climate change.

With respect to dominant frames and gaps, we already made a series of observations in the previous section:

- national energy politics in the industrialized world is marked by a partly conflictive, partly synergistic dynamic between environmental sustainability/climate change mitigation and securing energy supply;
- domestic energy politics in emerging economies is dominated by energy security concerns;
- national energy governance in low- and middle-income developing countries, by contrast, exhibits a clear dominance of energy access and the related poverty reduction goal;
- the major intergovernmental energy institutions focus on questions of securing energy supply;
- the two goals of energy equity and environmental sustainability, by contrast, play a stronger role in energy-related international institutions with a broader or different mandate, such as the World Bank or the UNFCCC;
- finally, most transnational energy governance initiatives seek to combine mitigation and energy security goals.

These insights suggest that energy equity enjoys the least institutional backup among the three major energy goals, being mostly promoted by governments of poorer countries and international development institutions. We can therefore expect that most institutional interactions in global energy governance reflect synergies and tensions between the goals of environmental sustainability, that is, climate change mitigation and securing energy supply. Our following look at some of the key institutional overlaps confirms this expectation, however with some notable exceptions.

When it comes to interactions involving major energy organizations and UN agencies, there is a certain trend toward synergy between mitigation and energy security. Even the relationship between the IEA and the UNFCCC has changed from strong tensions, due to the IEA's original bias toward fossil and nuclear industries, to one of mutual learning. After its telling absence in the early stages of climate negotiations, the IEA has eventually come to feed its expertise on energy technologies into climate summits. Likewise, the agency has broadened its climate-related work since 2005, albeit primarily incentivized by the G8 summit in Gleneagles (Van de Graaf and Lesage 2009). Nonetheless, there is still a conflictive side to this interaction. After all, the climate regime architecture was designed to profoundly restructure energy choices around the world through its restrictions on carbon emissions and concomitant price increase for traditional energy carriers. Some of the European countries that advocate this role for the climate regime consequently pushed for the creation of IRENA as renewables counterpart to the IEA (Van de Graaf 2013a).

Unlike the IEA, OPEC has kept a consistently strenuous relationship with the UNFCCC process—and hence the goal of mitigating climate change—until present. While the ideational clash over values and knowledge has slightly eased (OPEC delegates at least no longer question climate change per se), the issue of adverse impacts of climate policies or response measures is at the core of an ongoing conflict. 'In essence, OPEC's strategy towards climate policies centers on two main goals: compensation and assistance' (Goldthau and Witte 2011). As it becomes increasingly clear that a large share of all fossil fuels, including crude oil reserves, needs to stay in the ground to avoid average global warming to exceed 2°C (McGlade and Ekins 2014), OPEC's options are gradually limited. Faced with the risk that oil deposits become 'stranded assets,' OPEC's only real option is to diversify its economy away from oil (Van de Graaf and Verbruggen 2015).

Interactions between club or public–private energy arrangements and UN institutions over energy issues are characterized by both synergistic and conflictive features. There are supportive overlaps wherever club arrangements have provided their members with additional incentives and awareness to advance their low-carbon development paths. The G8+5 with the Gleneagles Process and G20 are cases in point here. Summit declarations in Heiligendamm 2007, L'Aquila 2009 or Brisbane 2014 endorsed the UNFCCC process and included soft commitments for phasing out inefficient fossil energy subsidies (Zelli 2011; Van de Graaf and Westphal 2011; Zelli et al. 2013). But also the third major energy goal of equity was highlighted in these G20 declarations: stressing the importance of improved energy access for the global poor, the G20 and other clubs offer at least rhetorical synergies with similar objectives of UNDP and the World Bank.

On the other hand, observers cautioned against disruptive effects of various government clubs: their non-binding approaches may undermine the climate negotiations' drive toward hard law development on energy efficiency and the mitigation goal in general (Vihma 2009), and their lack of inclusiveness leaves behind the energy concerns of the majority of developing countries—and particularly the poorer countries, thus rather paying lip service to the goal of energy access than pursuing it as a key priority. This indirect goal conflict is also evident for some of the public–private technology partnerships that evolved in the early 2000s, such as the now defunct Asia Pacific Partnership on Clean Development and Climate (Karlsson-Vinkhuyzen and van Asselt 2009).

While government clubs have ambivalent overlaps with other institutions on the goals of environmental sustainability and energy equity, transnational initiatives engage in largely synergistic interactions on all three energy goals. When it comes to mitigation and energy access, information-based governance schemes not only institutionalize new norms like carbon disclosure but also induce energy-related behavioral changes of private actors toward these goals (Florini and Saleem 2011). Still, many critical voices remain as to potential disruptive effects of 'climate capitalism,' especially a preference for low-hanging fruits paired with an aversion for potentially risky investments for renewables in poorer developing countries (Paterson and Newell 2010).

We so far looked at overlaps between energy-focused institutions, intergovernmental or transnational, on the one side, and energy-related institutions like UNFCCC, UNDP or the World Bank on the other side. This perspective provided various examples of the expected dominance of energy security concerns and their synergies or tensions with the mitigation goal, with the objective of energy access still playing a secondary role.

In a final step, we briefly want to look at interactions among energy-related UN institutions, which, as we characterized them above, rather promote the goals of environmental sustainability and energy equity. One might assume a largely synergistic picture here, but this expectation is not always met. Although sustainable development is one of the UNFCCC's core principles (Article 3.4), ideational tensions between development (or rather: energy consumption) and sustainability objectives frequently emerged in climate negotiations—most prominently in the ongoing deadlock over burden sharing for limiting greenhouse gas emissions (Dubash and Florini 2011). These tensions somehow resurfaced as turf wars between the UNFCCC and its UN sister agencies over the imprint of climate change on the energy and development agendas. Climate issues were largely subsumed under the 'energy' heading at the 2002 WSSD, and the UNFCCC secretariat at best played a modest role in the preparations for the Rio+20 summit in 2012.

But aside from these rivalries, UNEP, UNDP and UNFCCC created considerable ideational synergy as norm entrepreneurs for renewable energies, energy efficiency and reducing energy poverty since the late 1990s. Further convergence on these matters is reflected in the vibrant cross-institutional rhetoric of a 'green economy,' notwithstanding the lack of concrete strategies to tackle underlying drivers of energy poverty (Bruggink 2012).

Likewise, the World Bank's Climate Investment Funds significantly enhanced incentives and opportunities for developing countries to limit their greenhouse gas emissions, thus creating a synergistic relationship with the international climate regime. But there are also conflictive aspects to this interaction, as the Bank largely goes for the commercially most attractive projects that do not show a particular pro-poor focus (Michaelowa and Michaelowa 2011). The donor-oriented voting structure further adds to this bias in the Bank's low-carbon project portfolio. The new Green Climate Fund is expected to avoid such prioritization—and be more in line with energy choices promoted by the UNFCCC, but this will ultimately depend on its final governance structure and allocation criteria. In the same vein, for pursuing a pro-poor energy agenda more comprehensively, adaptation to climate change needs to be factored more strongly into the nexus between sustainability and energy equity across these institutions.

In sum, we find considerable variation at the global level for the overlaps between energy-focused organizations, both intergovernmental and nongovernmental, and energy-related UN institutions. This is no surprise given the different actor constellations, objectives and logics that mark these institutions—and the relatively feeble ties among them. The institutional complexity hence very much reflects the material complexity—with dominance patterns, synergies and conflicts—between the three key goals of energy security, environmental sustainability and energy equity.

4 Preview of the Section

The remainder of this section on energy institutions examines some of the key institutions and actors in the global political economy of energy. In Chap. 3, Bassam Fattouh and Anupama Sen take on the oldest and probably most studied international energy club: the OPEC. This chapter traces the origins and evolution of OPEC since its inception in 1960. Next, it identifies three broad views of OPEC behavior and the cartel's ability to influence world oil prices. After carefully weighing the empirical evidence in support of each model, Fattouh and Sen conclude that OPEC's pricing power is not constant, and tends to vary over time. They then shift their attention to the sharp drop in oil prices in the latter half of 2014, an event on which there has been little or no published academic literature thus far, but which holds important lessons on the role of Saudi Arabia as the 'swing producer' in the wake of US shale and tight oil revolution. The chapter concludes that although OPEC holds a strong belief that oil will continue to play a role in the world's energy mix, there is a clear recognition that in the face of climate change policies, economic diversification remains the only viable long-term response.

In Chap. 4, James Van Alstine and Nathan Andrews study the EITI. The EITI is a relatively recent multi-stakeholder initiative, promoted and upheld by non-state actors such as corporations and civil society, that aims to bring more transparency and good governance to the extractive sector. It does so by setting a voluntary global standard. Van Alstine and Andrews discuss the roots, strengths and weaknesses of the EITI. The chapter concludes that transparency is a necessary but not sufficient condition for addressing the multifaceted challenges that resource-rich countries face. Yet, the EITI focus on revenue transparency represents an important entry point from which to discuss related matters such as reporting on fiscal and legal terms, contracts and licenses.

In Chap. 5, Sylvia Karlsson-Vinkhuyzen discusses the energy activities within the world's foremost multilateral organization, the UN. While energy issues were long overlooked within the UN, recently some interesting policy initiatives have been launched, including the adoption in September 2015 of the Sustainable Development Goals (SDGs). Karlsson-Vinkhuyzen traces the history of norm development and institutionalization around energy issues in the UN system. She finds that the UN has remained a rather weak player on both accounts and illustrates some of these weaknesses by using the negotiations over the SDGs as a case study.

In Chap. 6, Tim Meyer discusses the role of the World Trade Organization (WTO) in global energy governance. Given the importance of energy in world trade, it is remarkable how energy issues have been kept off the agenda of multilateral trade negotiations in the past. Meyer explains this reluctance to engage with energy by the fact that many major fossil fuel-producing states were outside of multilateral trade negotiations. He then presents an overview of WTO rules and how they relate to the energy sector, noting that the WTO's dispute settlement mechanism has become an active tool for regulating government support of the renewable energy sector while active WTO regulation of the fossil fuel sector remains limited. Meyer explains this discrepancy in terms of the larger number of states aspiring to be 'producers' of renewable energy and the large growth of the renewable energy sector.

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3

The Past, Present, and Future Role of OPEC

Bassam Fattouh and Anupama Sen

1 Introduction

The sharp fall in oil prices during the latter half of 2014 after a four-year period of relatively stable and high prices has once again brought to the forefront the role of the Organization of the Petroleum Exporting Countries (OPEC) in the international oil market. There is an abundance of literature that has attempted to explain OPEC's behaviour and its role in oil markets, with little or no consensus over a single model that could both explain past behaviour and help anticipate future developments. The recent price fall (2014–15) raised a new set of fundamental questions. Has there been a structural shift in OPEC's oil policy? If so, what are the implications of this shift in policy on the short- and long-run dynamics of the oil market? And, will OPEC continue to be relevant in the 'new oil order'?[1]

This chapter aims to address these questions and begins in Sect. 2 by discussing the history and evolution of OPEC, classified into various historical

[1] In 2015, Goldman Sachs published a report titled 'The New Oil Order: Making Sense of an Industry's Transformation', where it sees the oil market 'moving into an environment that reinforces commodity prices to be lower not higher'. Available at: http://www.goldmansachs.com/our-thinking/outlook/the-new-oil-order/#overview.

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episodes that have shaped OPEC's behaviour. Section 3 covers the role of OPEC in the latest price fall and the implications for the oil market of leaving it to the price mechanism to rebalance the market. Section 4 reviews the literature on OPEC models and concludes that there is no single explanatory model to explain its behaviour. OPEC's behaviour and pricing power cannot be generalized—it is dynamic and context specific and is influenced by market conditions, the nature of the shock, the internal dynamics within OPEC, its interactions with non-OPEC producers, and the strategic objectives of its key member, Saudi Arabia. Section 5 then takes a forward view, by looking at some of the long-term policy issues that are likely to influence the future role of OPEC, the most important being OPEC's ability to maintain internal cohesion and its strategy to deal with the climate change challenge. Section 5 concludes.

2 Historical Evolution of OPEC

The Formation and Early Objectives of OPEC

The origins of OPEC can be traced back to the 1950s and 1960s, during which the structure of the oil industry remained largely a remnant of the old-world order where a group of international oil companies (IOCs),[2] known as the Seven Sisters, dominated the international oil industry outside the USA, Canada, the USSR, and China, through to the late 1960s. These multinationals controlled the rate of supply of crude oil going into the market through vertical integration and joint ownership of companies that operated in various countries. Vertical integration and horizontal linkages enabled them to control the bulk of oil exports and prevented large amounts of crude oil from accumulating in the hands of sellers, providing support for oil prices (Penrose 1968). Host governments did not participate in the production or pricing of crude oil and acted only as competing sellers of oil concessions, receiving in return income through royalties and income taxes. The industry structure at the time implied that oil trading was restricted to inter-company exchanges, with the multinationals using transfer pricing to minimize their world-wide tax liabilities. Companies used a 'posted price' to calculate the stream

[2] The terms 'IOCs', 'companies', and 'multinationals' are used to refer to the dominant group of IOCs in their various forms (these forms changed through industry mergers and acquisitions over the years). The original 'Seven Sisters' comprised Anglo-Persian Oil Company (now BP), Gulf Oil, Standard Oil of California (SoCal), Texaco (now Chevron), Royal Dutch Shell, Standard Oil of New Jersey (Esso/Exxon), and Standard Oil Company of New York (now ExxonMobil).

of income accruing to host governments. As a fiscal parameter, the posted price did not reflect market fundamentals. As some oil companies had more crude than they could process within their vertically integrated operations, and others had to purchase oil for their downstream operations, transactions occurred between the multinationals through long-term contracts for which prices were undisclosed.

By the late 1950s, however, the dominance of the vertically integrated companies was challenged by the arrival of smaller independent oil companies who were able to invest in upstream assets and obtain access to crude oil outside of the Seven Sisters' control—Venezuela, Libya, Iran, and Saudi Arabia were countries that granted independents limited access to their oil reserves. At the same time, US producers began protesting at the loss of their domestic market share to cheaper foreign imports and demanding greater protection (Fattouh and van der Linde 2011).[3] In 1959, the USA imposed mandatory import controls, which led to a surplus of oil on the international oil markets and greater competition for market share. Under competitive pressures from independent oil producers, the IOCs decided to cut the posted price in 1959 and 1960 resulting in lower income to host governments. The formation of OPEC by the governments of five oil-producing developing countries (Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela) in September 1960 was in part an attempt to prevent declines in the 'posted price' of oil (Skeet 1988).[4] During most of the 1960s, OPEC functioned as a trade union negotiating with the IOCs to prevent the income of its member countries from falling.

OPEC's Unilateral Pricing Power: 1971 and 1973

From 1965 to 1973, annual global oil demand grew by an average of around 2.75 million barrels/day (mb/d) (BP 2015). Most of this growth in demand was met by OPEC, which increased its share of world oil production to over 50%, strengthening the bargaining power of host governments relative to the companies operating within their jurisdictions. Consequently, the oil pricing system and the supply management of the IOCs were increasingly questioned in the capitals of the producing countries, which were concerned about the

[3] The structure of the US oil industry was different from the rest of the world, helped by the subsoil ownership structure, the maturity of the sector, and antitrust legislation. Many smaller companies were involved in all parts of the value chain (Fattouh and van der Linde 2011).

[4] The official objective of OPEC was 'to coordinate and unify the petroleum policies of its Member Countries and ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers and a fair return on capital for those investing in the petroleum industry' (Fattouh and Mahadeva 2013).

stability of their revenues and wanted to gain greater control of the strategic oil sector. In September 1970, the Libyan government reached an agreement with the independent oil company Occidental, wherein the latter agreed to pay income taxes based on a 30% increase in the posted price, as well as to make retroactive tax payments dating back to 1965. Soon after, all other oil companies in Libya submitted to these terms (the 'Tripoli agreements'), leading to other Middle Eastern oil-producing countries demanding the same terms and invoking most favoured nation clauses in their contracts. Negotiations conducted in Tehran (the 'Tehran Agreement') resulted in a collective decision to raise the posted price and increase the tax rate (Fattouh 2005).[5]

In September 1973, amidst tight market conditions, OPEC reopened negotiations with the IOCs on revisiting the Tehran Agreement and seeking large increases in the posted price. While the IOCs were negotiating for minimal price increases, OPEC was seeking reparations for past real oil price slippage (Sampson 1975). Negotiations thus proved to be difficult, and were further compounded by the breaking out of hostilities between Egypt, Syria, Jordan, and Israel in October 1973. Consequently, on 16 October 1973, the six Gulf members of OPEC unilaterally announced an immediate increase in the posted price from $3.65 to $5.119 per barrel. Further, on 17 October, members of the Organization of Arab Petroleum Exporting Countries (OAPEC), less Iraq, announced production cuts of 5% per month until the 'evacuation of Israeli forces from Arab territory occupied during the June 1967 war' (Skeet 1988). In December 1973, OPEC raised the posted price further to $11.651 per barrel. The year 1973 therefore marked a shift in OPEC's influence—prior to that date, it had only acted as a trade union negotiating to prevent price decreases, but after 1973, OPEC assumed the unilateral power to set the oil price.

Accompanying these price increases was a gradual change in the ownership structure of the oil industry—OPEC members had been seeking equity participation in the IOCs since the 1960s, but had been resisted in their attempts. In the OPEC conference of July 1971, OPEC succeeded in negotiating an agreement with IOCs to allow OPEC members 25% equity participation, reaching 51% by 1983. Over the following decade, some OPEC members chose to pull out of the agreement and carry out nationalizations at their own pace. This consequently led to changes in the structure of the oil value chain and to the organization of producer and consumer countries into blocs, which held wider implications for international political and eco-

[5] By the end of 1971, six other members had joined OPEC: Qatar, Indonesia, Libya, the United Arab Emirates, Algeria, and Nigeria.

nomic relations (Fattouh and van der Linde 2011; Koopman et al. 1989). In a landmark speech in December in 1973, US Secretary of State Henry Kissinger proposed that the USA, Europe, and Japan create an energy group to solve what he coined the 'energy problem' (Kissinger 1973). This proposal resulted ultimately in the foundation of the International Energy Agency (IEA) in November 1974.

The 1979 Price Shock, the 1986 Counter-Shock, and the Emergence of the Market

During the years 1975–78, OPEC countries consolidated their control over production, prices, and investment in the oil sector. However, they remained dependent on IOCs to lift and market the crude oil and initially sold low volumes through their national oil companies (NOCs) to firms other than the old concessionaires. The IOCs retained both their upstream and their downstream assets, but their positions were more imbalanced and they did not have enough crude to meet downstream requirements. This prompted IOCs to gain access to and to develop reserves outside OPEC and new sources of supply started to reach the market. At the same time, the appearance of new players (such as independents, Japanese and Wall Street refiners, state oil companies, trading houses, and oil traders) allowed NOCs in the OPEC countries to switch away from their main term contract customers—primarily, the IOCs. This was precipitated by the 1979 crisis when spot prices rose above OPEC's official selling prices. The IOCs, which had purchased crude on term contracts from OPEC countries, reaped the high margins by selling onward into the market. This was unacceptable for OPEC member countries, which resorted increasingly to selling directly to third parties.

The emergence of new players on both the demand and the supply side led to the creation of a market beyond OPEC control, and IOCs and new oil suppliers began to undercut OPEC prices, increasing their market share. The increase in oil supply from new provinces such as the North Sea and Mexico, the pursuit of oil substitution with other fuels such as coal and natural gas in the power sector, the decline in US demand following the Volcker shock, and uncompetitive OPEC prices all combined to lower demand for OPEC's oil. In an attempt to stem the price decline, OPEC had no choice but to cut production. OPEC's market share of world oil production fell from 58% in 1975 to 35% in 1985 (see Fig. 3.1).

Under the pressure from falling oil prices, disagreements within OPEC began to surface. Saudi Arabia, OPEC's biggest producer, lost market share

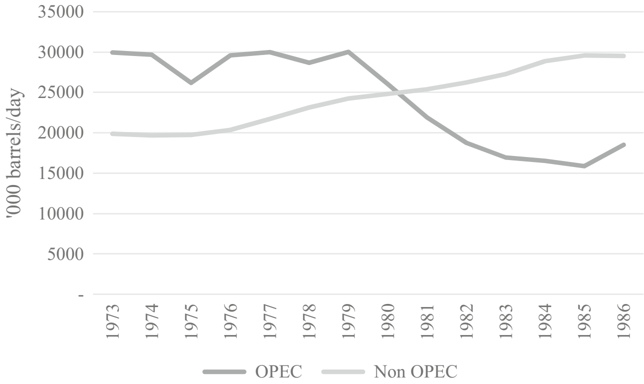

Fig. 3.1 OPEC and non-OPEC oil production, 1973–86 (*Source*: BP Statistical Review of World Energy, 2015)

with every price increase and hence opposed them. Other OPEC members pushed for large price increases—while at the same time putting additional oil in the market in an attempt to boost revenues. OPEC's introduction of a formal quota system in 1982 to share the burden of the cut proved to be ineffective and most OPEC members were producing above quotas. Lower production and low prices proved costly for Saudi Arabia, which had been losing market share with every increase in the marker price. Between 1980 and 1985, Saudi Arabia cut oil output from 10.2 to 3.6 mb/d, but without much success in reversing the price decline. It was becoming clear for Saudi Arabia that it could not control volume and prices at the same time. To recover its market share, Saudi Arabia had to abandon its control of prices.

Saudi Arabia abandoned the administered pricing system in 1985 and adopted the formula-based pricing, where the marker was derived from the market rather than being administered by OPEC. This period consequently laid the ground for the development of the current structure of oil markets, with physical, forward, futures, options, and other derivatives' markets flourishing and with oil benchmarks namely Brent, West Texas Intermediate, and Dubai playing a key role in the new international pricing system.[6] The move towards market-based pricing opened a new history in the chapter of the oil market, which saw OPEC lose control of the administered pricing system and its price-setting power.

[6] See Fattouh (2005, 2011) for a comprehensive analysis of the operation of modern oil and financial markets.

The Gulf War and the Asian Financial Crisis

Although oil demand began to grow in the second half of the 1980s, oil substitution policies and higher-efficiency measures implemented by OECD governments prevented a quick return to previous oil demand trends, while demand in electricity generation was structurally lost (Fattouh and van der Linde 2011). Iraq's invasion of Kuwait on 2 August 1990 constituted one of the biggest supply shocks in the history of the oil market where 4.5 mb/d of oil was taken out of the market as a result (Fattouh and van der Linde 2011). This provided temporary support to the oil price, but the high level of spare capacity and OPEC's decision at its Ministerial Committee meeting in Vienna on 29 August 1990 to increase its production to fill the supply gap helped moderate the rise in the oil price.

Overall, the 1990s proved to be a gloomy decade for the oil market (Fattouh and van der Linde 2011). Despite the exit of Iraq from the oil market for most of the decade due to UN sanctions, plus US sanctions on Libya and Iran, the market fundamentals remained weak. Venezuela's ambitious investment programme to increase productive capacity and raise production above its quota did not bode well for oil prices. This prompted Saudi Arabia in October 1997 to increase its production to 300,000 barrels above its old quota to maintain its market share (Fattouh and van der Linde 2011). Consequently, other OPEC members pushed for an official increase in their quotas at the 103rd Meeting of the OPEC Conference in Jakarta held from 26 November to 1 December 1997, raising production from 25 to 27.5 mb/d. However, this led to an oversupply, which coincided with the Asian financial crisis and a fall in Asian demand, causing a collapse in the oil price to below \$10 per barrel in 1998. During this period, *all* oil-producing countries felt economically and politically vulnerable and began exploring ways to cooperate on output cuts—deemed the only way to reverse the decline in the oil price. After a series of negotiations in March 1998,[7] OPEC (excluding Iraq) and non-OPEC (Mexico and Norway) producers agreed to collectively implement a total output cut of 1.725 mb/d of which OPEC countries cut 1.325 mb/d. OPEC implemented a further round of output cuts in June 1998, taking the total reduction in its output to 2.6 mb/d.

[7] See Lajous (2015) for details of these negotiations.

The 2008 and 2011 Price Cycles

The first half of the 2000s saw a strong rebound in Asian demand, and the acceleration of consumption in the non-OECD. Demand growth in non-OECD countries rose by 10.5 mb/d from 2000 to 2009, whereas OECD oil demand dropped by 2.1 mb/d. Demand was driven by the Asia-Pacific region, as well as growing oil demand in the Middle East and Latin America. Non-OPEC supply was slow to respond, and instead, OPEC countries met most of the increase in demand. Tighter spare capacity along with a number of supply shocks triggered yet another ascent in the oil price reaching a record high of $147 per barrel in July 2008. But the US sub-prime crisis and ensuing global economic recession hit the oil market in the second half of 2008 and led to a sharp drop in the oil price. Following the fall in the oil price, OPEC decided to implement a large output cut—totalling 4.2 mb/d between September and December—which eventually helped prices recover. This episode showed the effectiveness of OPEC in dealing with a *temporary* shock affecting the oil market, in this case manifested by the temporary decline in global oil demand due to the financial crisis.

The oil price recovered in 2009–10; Brent prices rose from a very low base of $33.73 on 21 December 2008 to almost $78 on 31 December 2009. It then oscillated within a narrow price band—from $60 to $70—between July and September 2009, and $70–$90 during the rest of 2009 and most of 2010. Prices continued rising into 2011, soon breaching $100 per barrel. In June 2011, an acrimonious OPEC meeting failed to produce an agreement to increase oil production. In December 2011, OPEC ministers agreed to increase the output ceiling to 30 mb/d, but without allocating any individual quotas to member countries.

While many supply centres within non-OPEC continued to disappoint, the non-OPEC poor supply performance was counteracted by the sharp increase in US output driven by high oil prices and technological innovation (hydraulic fracturing) which allowed the exploitation of shale oil and gas reserves on a large scale. The received wisdom, only a decade ago, painted the picture of a US economy becoming increasingly reliant on oil imports, especially from the Middle East. Quite the opposite has happened: Overall, US oil imports have been declining and now Canada, not the Middle East, is by far the most important foreign supplier of oil to the USA. These developments on the supply side have reversed two decades of secular decline in US liquid production. Total US liquid production increased from around 7.3 mb/d in 2007 to above 11 mb/d in 2013 and 12.7 mb/d in 2014, constituting one of the key areas of liquid supply growth in the world. In 2013 and 2014, the USA added 1.2 and 1.6 mb/d of liquid production, respectively.

Between 2011 and 2013, US oil supply growth was almost completely offset by supply losses in other parts of the world and as a result, there has been no drastic shift in the global supply curve. The US shock and the 'counter shock' go a long way in explaining why oil prices continued to oscillate within a relatively narrow range for a prolonged period, despite wide macroeconomic uncertainty and a rapidly deteriorating geopolitical situation in many parts of the world. The Middle East and North Africa (MENA) has been central to this outcome in two very different respects (El-Katiri et al. 2014). First, the region has been the main source of the counter supply shock. Geopolitical outages in MENA—particularly from Iran, Libya, Iraq, Syria, and Yemen—have resulted in large losses from the market for a prolonged period of time. Between 2011 and 2013, it is estimated that more than 1600 mb of oil were lost due to outages arising from countries affected by the Arab Spring and due sanctions linked to Iran's nuclear programme (El-Katiri et al. 2014). These supply losses matched the supply gains from the USA. Second, the extent of these losses has meant that the growth in US tight oil production has not itself been sufficient to balance the market; OPEC Gulf Cooperation Council producers therefore had to ramp up production to fill the gap. This has not just been an increase in absolute terms. Problems affecting other OPEC members have led to the Gulf States' share of total OPEC production rising above 50% since the beginning of the uprisings resulting from the Arab Spring—exceeding 55% in September 2013.

3 The 2014–15 Oil Price Cycle and the Role of Saudi Arabia

The combination of a slower oil demand growth, the robust performance of US shale, and the easing of disruptions, all contributed to the recent sharp fall in the oil price. As oil prices began to fall in June 2014, expectations that Saudi Arabia would come to 'rescue' and 'balance' the market by adjusting its output and putting a floor under the oil price shaped market expectations and provided some support for the oil price (Fattouh and Sen 2015). Although oil prices continued to fall from their peak in June 2014, the initial decline was moderate with the Brent price continuing to trade at $100/barrel at the beginning of September 2014. OPEC's decision, spearheaded by Saudi Arabia, not to cut output in its November meeting and instead to leave it to the market to find the new equilibrium price resulted in the revision of market expectations and affected sentiment, causing a sharp decline in the oil price. Between 26 November 2014 (the day before the OPEC meeting) and mid-January 2015, the Brent price fell by more than $30 per barrel. The concern for Saudi Arabia was that any cut in its production would have been offset by an increase in production from within and outside OPEC, with a limited impact on prices (Fattouh and Sen 2015; Fattouh et al. 2015).[8] Both OPEC and large non-OPEC producers such as Russia indicated that they were unwilling to share the burden of production cuts. Internal factors also played a role in the decision 'to leave it to the market' (Fattouh and Sen 2015). Saudi Arabia is in a relatively better financial position than many other oil exporters to withstand lower prices at least for the short term. During the boom years, the kingdom had accumulated large foreign assets of more than $600 billion as of August 2015, while its debt was quite small and its capacity to borrow large (Fattouh and Sen 2015).

OPEC's response to the 2014–15 price fall holds two key implications for the oil market. First, it represents *the loss of an important feedback mechanism* on the downside. Cuts by OPEC (and unintended supply disruptions) still constitute the quickest and most effective mechanism that directly feeds to oil market balances. If there is no quick mechanism to balance an oversupplied market, the market can only balance through demand and supply adjustments to changes in oil prices. Given the low short-run price elasticity of supply and demand, the adjustment is not immediate and supply continues to exceed demand, causing inventories to build up and putting downward pressure on oil prices. The high degree of uncertainty and the different market expectations about the timing and magnitude of supply and demand adjustments to low prices can also induce volatility with oil prices becoming more prone to sharp swings if the market overestimates the size of the oversupply and/or if there are concerns that the available on-land and floating storage facilities are not big enough to absorb all the extra crude coming into the market (Fattouh and Sen 2015).

The decision to 'leave it to the market' also has long-term implications for the investment environment (Fattouh and Sen 2015). The fact that prices could, in the future, fluctuate widely implies that the perception of risk in investing in oil projects has changed. In addition to a high oil price, the stability of price within a narrow range between 2011 and mid-2014 and the

[8] Given the uncertainty about the elasticity of the US shale supply curve, Fattouh et al. (2015) show in a simple game that it is better off for Saudi Arabia to assume that the US supply curve is elastic and not to cut output. But as Saudi Arabia learns more about this new source of supply, its policy could adapt accordingly.

implicit expectation that OPEC would put a floor on the oil price (and in effect guarantee the rate of return on investment in new energy projects) encouraged investment and the entry of new sources of supply into the market. Increased volatility, together with the perception that prices could fluctuate within a wide range, can cause investors (including national and international companies) to reassess the risks in new energy projects, discouraging overall investment and increasing the value of the option to wait (Dixit and Pindyck 1994).

4 Models of OPEC's Behaviour

The role that OPEC played in the market over the years prompted a large theoretical and empirical literature aimed at modelling OPEC's behaviour, primarily exploring the extent of OPEC's pricing power. There are three broad views (Fattouh and Mahadeva 2013). The first view holds that, despite OPEC's presence over more than 50 years, it has had little effect on the oil price and oil market dynamics (Colgan 2014)—rather, the oil price is seen to be determined in a globally competitive market. At the other end of the spectrum, there is a view that OPEC has been successful in cartelizing the oil market and using its power to raise the oil price above competitive levels by restricting output. And third, there is the view that OPEC pricing power is not constant and tends to fluctuate, depending on interactions between OPEC members and on oil market conditions. In other words, the power to collude is not constant (Geroski et al. 1987). These divergent views about OPEC have resulted in a wide range of OPEC models.

Early 'textbook' studies have modelled OPEC as a classic example of an international cartel. In the classical monopolist model, given the highly inelastic oil demand in the short term, OPEC can set the oil price well above the marginal cost (Fattouh and Mahadeva 2013). However, this characterization of OPEC as a classical monopolist in a static framework and the treatment of oil as a standard commodity are subject to many limitations. Given that oil is as an exhaustible resource, it commands a resource rent (also known as scarcity rent) and therefore an oil price above the marginal cost of extraction is not necessarily evidence of pricing power. The literature on exhaustibility of resources also introduced a dynamic context to oil market models by showing that oil production and consumption in one period affect future periods. For instance, Hotelling (1931) showed that in a competitive market, the optimum extraction path is such that the price of a non-renewable resource will rise over time at the rate of risk-free investment in the economy, as only then will the gains from delayed extraction equal the opportunity cost of extracting the resource now and investing the proceeds at the safe return. Models based on this literature suggest that the price path of a rationalist monopolist will be higher than the competitive price path as the monopolist takes advantage of the relatively lower price elasticity in the earlier periods to restrict output and charge a higher price, allowing the monopolist (in this case, OPEC) to achieve large enough gains to offset the costs associated with cartelization (Pindyck 1978).

Other early studies have argued that OPEC can restrict output even in competitive models, but for reasons other than collusive behaviour (Fattouh and Mahadeva 2013). For instance, production cuts and the consequent rise in the oil price in the 1970s have been attributed to the transfer of property rights from IOCs to producing governments that tend to have lower discount rates (Mead 1979; Johany 1980).[9] MacAvoy (1982) attributes price increases to supply disruptions caused by political events. Other studies emphasize that oil production decisions are made with reference to investment requirements and budgetary needs, which in turn depend on the absorptive capacity of domestic economies and imperfections in international markets (Fattouh and Mahadeva 2013).

A limitation of these early models is the treatment of OPEC as a single actor, whereas OPEC consists of a group of countries with different oil reserve bases and divergent political, social, and economic systems (Fattouh and Mahadeva 2013). Accordingly, some models split OPEC members into subgroups on the basis of their time preference and endowment. Eckbo (1976) splits OPEC into three groups: hard core, the price pushers, and the expansionist fringe. He finds that countries with low discount rates and high reserve bases will choose a lower price path than the 'price pushers'. Hnyilicza and Pindyck (1976) divide OPEC into savers (countries with low discount rates) and spenders (countries with high discount rates) and analyse the interaction between these two groups by using the theory of cooperative games. A cooperative solution for this game is feasible if the net incremental gains from cooperation are set in proportion to the losses made in the case of non-cooperation. Hnyilicza and Pindyck (1976) find that, for an optimal outcome, OPEC members should not produce simultaneously: Spenders would produce first, whereas savers would initially keep their reserves underground. However, given the dynamics of OPEC's functioning, these outcomes are not politically feasible.

[9] The property rights theory postulates that faced with the threat of nationalization, the oil majors increased their production levels in order to maximize the present value of their profit stream, which implies a very high implicit discount rate. In contrast, governments have a longer time horizon in developing the reserve base and hence would slow down the growth of oil extraction.

While these early studies provided some interesting insights on the interaction between OPEC members, some controversial points remained—one key issue being that of output sharing within OPEC. After all, according to these models, the outcome of a cooperative game will depend on the decision of how to share output, which in turn depends on the bargaining power of individual members. Statements such as '[OPEC members] will have a lot to argue about' (Hnyilicza and Pindyck 1976) are not very useful in this context.

Empirical Evidence

The empirical evidence has thus far failed to provide a consensus explanation among the varied models attempting to explain OPEC's behaviour. Empirical models can be divided broadly into two groups: pricing models and output models. One view, for instance, sees no clear evidence for OPEC having any pricing power. If OPEC exercises market power, then this should be reflected in a significant deviation between the oil price and the marginal cost. On the basis of this observation, one can identify a wide range of behaviour that ranges from non-cooperative behaviour, to Cournot competition in the presence of a competitive fringe, to Cournot competition without a fringe, to cooperative cartel in the presence of a competitive fringe, to an efficient cartel without a fringe (Almoguera et al. 2011). Each of these models entails a different relation between price and marginal cost; however, the power of empirical tests to distinguish between these various models is inherently weak (Smith 2005). Furthermore, in these models, it is not clear whether to attribute the difference between the price and the marginal cost to scarcity rent or to monopoly profits.

Output models, in contrast, examine the production behaviour of OPEC's individual members. Griffin (1985) uses a simple regression that links the production of an individual country to the oil price and to other members' production. A significant relationship between an individual country's output and that of OPEC would indicate market-sharing behaviour and hence evidence that the market is cartelized. Griffin finds support only for partial market sharing, concluding that 'OPEC is a looser cartel'. Smith (2005) focuses on whether an individual member's output offsets or compensates for production changes in other members. He argues that in a Cournot oligopoly model, when faced with an idiosyncratic shock that causes the output of one individual member to decline, the other members will compensate by increasing production. In contrast, in competitive markets, there is no interdependence in the production of various producers. Smith (2005) identifies a spectrum of market models ranging from a cartel to perfect competition and finds that traditional explanations of OPEC behaviour do not hold. Instead, he describes OPEC as a cartel, but one that is weighed down by the cost of establishing consensus.

Another complication is that OPEC pricing power varies over time, depending on market conditions and on producers' behaviour. The most plausible models are therefore those that allow for a change in conduct. For instance, Geroski et al. (1987) argue that collusion is rarely perfect, and some producers may change their behaviour in response to rivals' previous actions. Their empirical results show that varying-behaviour models tend to outperform constant-conduct models. Almoguera et al. (2011) find many switches between collusive and non-cooperative behaviour in the period 1975–2004, indicating that the ability to collude is not static. These empirical results indicate that changes in oil prices can be explained not only in terms of shifts in oil market balances but also by changes in the conduct of market players. This conclusion is particularly relevant for Saudi Arabia—OPEC's most prominent member.

Saudi Arabia as OPEC's Dominant Producer

Another strand of models has tended to focus on the role of Saudi Arabia within OPEC, owing to its unique position in the Organization. Saudi Arabia holds the largest oil reserve base, it accounts for a large share of global production, it is the only country that maintains adequate spare capacity, and it restricts foreign investment in upstream oil (Fattouh and Mahadeva 2013). Given these features, many studies have modelled Saudi Arabia as the dominant producer and the remaining producers (both OPEC and non-OPEC) as the competitive fringe (Mabro, 1991). As a dominant leader, Saudi Arabia sets its output in anticipation of the reaction of the fringe and maximizes its profits on the basis of the residual demand (Belu Mănescu and Nuño 2015).

Empirical evidence has not been very supportive of the dominant producer model. Smith (2005) finds no evidence in support of a dominant producer and concludes that if Saudi Arabia 'has assumed the role of Stackelberg leader, dominant firm, or swing producer, it must not have been pursued with enough vigor and continuity, either before or after the quota system was adopted, to have left a discernible pattern in the data'. Mabro (1998), who has been a strong proponent of the dominant producer model, acknowledges that against all expectations, from 1992 to the first half of 1997, Saudi Arabia has performed the role of a fixed volume supplier that does not vary output according to changes in oil demand. Griffin and Nielson (1994) find evidence that, rather than acting as a dominant producer, Saudi Arabia opted for a tit-for-tat strategy that punishes members for producing above their quotas and rewards them for compliance. Proponents of this view point to two episodes: (a) when Saudi Arabia in 1985 boosted its supply in an attempt to increase its market share and (b) when Saudi Arabia in 1998 responded to Venezuela's increase in production and rapid capacity expansion by increasing its own output. In both cases, Saudi Arabia played the role of the discipliner by increasing its production and punishing cheaters to maintain the cohesiveness of OPEC (Fattouh and Mahadeva 2013).

5 Longer-Term Challenges for OPEC

The Fundamental Trade-Off and the Internal Cohesion of OPEC

While OPEC member countries differ fundamentally in terms of their political and socio-economic structures, their level of economic development, and the size of their reserve base, a common feature that unites them is their lack of economic diversification and hence their high dependence on oil revenues. This implies that revenue maximization will always feature high in OPEC output policy. But the size of the revenues is a function of prices and volumes, which are highly interdependent. Pushing supplies beyond what is demanded by the market will result in accumulation of stocks and prices falling. Given that demand is highly inelastic in the short run, the decline in the oil price will not necessarily stimulate demand or at least not enough to absorb the entire surplus. Given that the supply curve is also inelastic in the short term, production will not fall promptly. Therefore, OPEC's attempt to increase supply in a falling market will result in accumulation of stocks and weaker prices and potentially lower revenues, as the increase in volume of production does not compensate for the decline in the oil price (Mabro 1998). This represents a fundamental trade-off (revenues vs market share) facing OPEC.

All oil-exporting countries are aware of the fact that in the face of a fall in the oil price caused by ex ante excess supplies, cooperation on cutting output is the most effective way to reverse the price decline and clear the excess supplies. The disagreement usually arises over which of the producers should shoulder the burden of the cut. The OPEC quota system has not been effective in resolving this fundamental issue. Many within OPEC would like to leave it to Saudi Arabia to shoulder most of the burden of the cut, while Saudi Arabia has made it very clear since 1986 that it is not willing to cut output unilaterally or assume the role of the swing producer, and any production cut should be shared with other producers, including from non-OPEC.

Within OPEC, the quota system remains the only mechanism to regulate output levels. But this mechanism rarely works, especially when the market is oversupplied (i.e. when the quotas are mostly needed to balance the market). Even if there is an agreement between members on the volume of the cut that is required to support prices, assigning quotas for individual countries has proven to be difficult over the years. Previous efforts to designing a system of allocating quotas that is 'equitable to all members' and based on formulae that incorporate 'objective' criteria (such as the size of the reserves, the production capacity, historical production share, domestic oil consumption, production costs, dependency on oil exports, the size of the population, and external debt) did not work. But even if there is an agreement on such formulae to allocate individual quotas, OPEC does not have the formal monitoring mechanisms in place, and hence, violations are usually not detected instantly, and even if they are, OPEC does not have the formal enforcement mechanisms to punish member countries or to force them to abide by the agreed quotas (Kohl 2002; Libecap and Smith 2004). These problems become more acute when the required cuts are large, as small OPEC members usually find it difficult to reduce their production on a pro rata basis (Gately 1989) and hence are always dissatisfied with their allocated quotas.

Lack of effective monitoring and enforcement mechanisms have raised doubts as to whether OPEC can collude to restrict output. But insights from game theory suggest that even in the absence of such formal disciplinary mechanism, collusion could still work if implicit threats force members to abide by the agreed quotas. Stigler (1964) argues that price wars are often a signal of the collapse of collusion. In Porter (1983a, b) and Green and Porter (1984), on the other hand, price wars represent the equilibrium outcome of a dynamic non-cooperative game. Price wars can be the solution to the problems of imperfect information and imperfect enforcement mechanisms that plague OPEC. This mechanism to force collusion however implies sharp adjustment in revenues from time to time, as prices may have to fall to very low levels to induce other producers to agree to act collectively. This is complicated by the fact that there are large differences in the revenue needs, the financial reserves, and production costs among OPEC members. In short, if the quota system is ineffective in regulating production and 'price wars' are the only means to achieve discipline within OPEC, then the impact of shocks on the oil market are amplified, as in addition to changes in fundamentals, the behaviour of players (and market perception of these players' behaviour) can also affect market outcomes.

The time horizon over which a country is trying to maximize its revenues also complicates the revenue maximization-volume trade-off and the ability of OPEC to reach agreements on output cuts. For oil exporters with a small reserve base, the more revenues that could be obtained, the better off that exporter is. But given Saudi Arabia's massive oil reserves, its focus is not only confined to maximizing short-term revenues; securing long-term demand for its oil is a key consideration. Given its dominant position within OPEC, Saudi Arabia has been able to impose its longer-term objectives within the Organization, even if it is in odds with other producers. In addition to being the biggest oil exporter within the group and the only player with capacity to adjust its output in both directions, it is in a better financial position relative to other players to pursue longer-term objectives. The recent increase in Iraq's output capacity and the potential increase in Iran's productive capacity post sanctions may change this dynamic within OPEC, but this will take time, and even then, may require that Iran and Iraq combine their policies to achieve a joint objective. Thus, for the foreseeable future, Saudi Arabia and its long-term view of oil market dynamics will remain the major influence within OPEC.

Climate Change

Climate change mitigation measures—primarily those targeted at reducing global dependence on fossil fuels—pose a long-term challenge, given OPEC's high dependence on oil revenues.[10] This threatens OPEC member countries' ability to collect revenues, which have kept and will continue to keep their economies running for as long as few alternative industries have been developed. A related issue is that of 'unburnable carbon'[11]—it has been estimated that if the probability of warming by 2 degrees or more is to be kept below 50%, approximately 60–80% of booked fossil fuels are 'unburnable' (Collier and Venables 2014). Given the large reserve base of key OPEC member countries, climate change policies can have direct impact on these countries' ability to monetize these reserves.

[10] While OPEC should be preparing for a future where the share of oil in energy mix will continue to fall, the risk of secular decline in demand due to climate change policies does not seem imminent from OPEC's point of view. For instance, OPEC's 2014 World Oil Outlook suggests that globally, oil demand will increase by just over 21 mb/d from 2013 to 2040 driven by non-OECD. The BP Energy Outlook to 2035 forecasts that shale oil production will level off in the share of world oil production post-2020, which will be replaced by growth in OPEC output. In such a world, the challenge facing OPEC would be how to increase production to meet the expected increase in oil demand.

[11] Or 'stranded assets', from the point of view of the owners of fossil fuel reserves.

In reaction to climate mitigation measures, some OPEC member countries such as Saudi Arabia have declared that they will seek 'compensation' for the adverse impacts of mandatory climate change mitigation measures on their export revenues (Van de Graaf and Verbruggen 2015). OPEC has been insisting that all parties should adhere to the principle of 'common but differentiated responsibilities' and that any agreement 'should be comprehensive with regard to mitigation, adaptation, financial resources, technology transfer and capacity-building', particularly it should involve some form of assistance to OPEC member countries to adapt 'by diversifying their economies, strengthening their resilience, and enhancing increased investment and technology transfer'.[12]

Beyond calls for 'compensation' and 'assistance', many studies have focused on the potential strategic response of OPEC, faced with what could possibly be a structural decline in oil demand (Van de Graaf and Verbruggen 2015; Dullieux et al. 2011; Wirl and Dockner 1995). For instance, in response to an imposition of a carbon tax aimed at reducing oil demand, OPEC can decide to increase the oil price and capture the rent itself (Wirl and Dockner 1995). High oil prices, however, increase the pace of demand reduction and could encourage supply growth in other parts of the world. In fact, many believe that OPEC's ability to influence market outcomes in face of structural shocks such as the advent of US shale has become rather limited (Dale 2015).

Alternatively, OPEC could accelerate its investment pace and increase its output to put downward pressure on the oil price in order to induce a rebound in global demand and drive out 'more expensive' non-OPEC supply. From an emissions mitigation viewpoint, this scenario is termed the 'green paradox' as owners of carbon resources would pre-empt future policies by accelerating the production of fossil energy while they can, inducing higher consumption and higher emissions (Sinn 2012). However, some studies using simulations analysis suggest that such a strategy would have limited effectiveness in terms of increasing OPEC revenues; the severe climate target is more important in determining future oil demand than OPEC production strategies and thus the increase in oil demand will not compensate for the lower oil price and hence OPEC oil revenues will fall in such a scenario.[13]

[12] 'OPEC Statement to the United Nations Climate Change Conference (COP19)', Delivered by OPEC Secretary General, HE Abdalla Salem El-Badri, at the UN Climate Change Conference (COP19/CMP9), Warsaw, Poland, 22 November 2013, http://www.opec.org/opec_web/en/2670.htm.

[13] See Ghanem et al. (1999) and Loulou et al. (2008). For instance, Loulou et al. conclude that 'OPEC would derive no advantage in flooding the oil market in the Climate scenario, since its own net revenues would decrease in such an event. In other words, the severe climate target is more important in determining oil demand than OPEC's policies, and thus decreasing oil prices does not induce a sufficient demand rebound to overcome the lower price'.

Given the limited effectiveness of these investment and output policy options, OPEC members recognize that diversifying their economies and income sources constitute the main challenge as well as priority in the long term. Diversification efforts however have not been very successful and in most OPEC member countries oil revenues still constitute the bulk of their government and export receipts (Amuzegar 2011).

6 Conclusion

Over its 50-plus-year history, OPEC's role has continued to evolve, reflecting changes in the broader political scene and in oil market conditions, and its own remarkable longevity. The formation of OPEC in 1960 was an attempt by member countries to prevent the decline in the posted price and thus for most of the 1960s, OPEC acted as a trade union whose main objective was to prevent the income of its member countries from declining. In 1973, and for the first time in its history, OPEC assumed a unilateral role in setting the oil price. Under severe market pressures, however, it was forced to abandon its price-setting power. Against many expectations, the price war in the mid-1980s did not result in the demise of OPEC, but rather highlighted the importance of strategic interaction between OPEC members and between OPEC and non-OPEC producers. Between 1986 and 1998, OPEC assumed various roles but mainly that of a spare capacity manager and swing producer filling the gap caused by supply disruptions. In the 1990s, weak demand growth and large spare capacity diminished OPEC's capacity to collude and in 1998, OPEC had to re-establish its cohesiveness through another price war. Between 2000 and 2008, OPEC acted as a residual supplier, adjusting its output at market-determined prices. From 2008 onwards, Saudi Arabia has increasingly played the role of a signaller to market participants. In the latest price fall, OPEC decided to leave it to the pricing mechanism to rebalance the market.

The evolution of OPEC's behaviour indicates that its conduct and market power is not constant. This chapter emphasizes the importance of relying on dynamic models that allow for changes in OPEC's conduct depending on market conditions, the interactions with other players, and the nature of the shock hitting the oil market. Attempts to fit OPEC into one category have failed in the past and will most likely do in the future. This also explains the failure of empirical studies to reach more concrete conclusions: While some empirical models may fit the data quite well in specific periods, they fail miserably in other periods. It also warns against premature declarations that OPEC is defunct. As Mabro (1986) notes, '[OPEC members' ability to] compromise to reach agreement should not be underestimated. It is founded on the belief that all members, including the largest producers, would be worse off without OPEC'. While OPEC faces new longer-term challenges, this is likely to herald yet another era in its evolution and its role in the global energy governance.

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4

Corporations, Civil Society, and Disclosure: A Case Study of the Extractive Industries Transparency Initiative

James Van Alstine and Nathan Andrews

Although the commodities super-cycle may be over, the global boom in natural resource extraction since the early 2000s has driven foreign direct investment (FDI) into some of the world's poorest economies, providing huge opportunities for development, but also the risk of failure due to corruption and mismanagement of revenues. According to the 2013 Africa Progress Report, for example, tax avoidance and opaque natural resource deals cost Africa over US $38 billion annually, which is slightly higher than the flow of development assistance to the region (Africa Progress Panel 2013a). Kofi Annan, head of the Africa Progress Panel, has called for greater transparency as a way for African countries to manage their resource wealth for positive transformation rather than squandering it (Annan 2013). Transparency in resource governance has been rising up in the political agenda over the past decade.

This chapter explores the emergence of the 'governance by disclosure' norm and the trend toward public–private partnerships within the extractive sector through the lens of the Extractive Industries Transparency Initiative (EITI). The EITI is a global standard that promotes revenue transparency and accountability. Although the multi-stakeholder initiative is criticized for

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failing to achieve pro-poor societal change or even greater accountability in resource governance, it is widely recognized that revenue transparency is a first step in a long and difficult process. We begin by positioning the EITI within the field of global governance, and then discuss how the initiative has emerged and evolved, followed by an assessment of its strengths and weaknesses.

1 Governance by Disclosure and the Rise of Public–Private Partnerships

Over the last three decades, non-state actors have become increasingly important in processes of governing the international political economy (Biermann and Pattberg 2008; Falkner 2003). Private actors have played important roles in ordering transnational economic relations since the nineteenth century but their role has expanded alongside the acceleration of the processes of economic globalization in the late twentieth century (cf. Falkner 2003, p. 73). The rise of industry and nongovernmental organizations (NGOs) in global governance is linked to the retreat of the state, growth in global civil society, and shifts in authority and ideology. Critics suggest that the increase in non-state actors in global governance may relocate authority away from the state and serve to promote global self-regulation and the international liberal paradigm (Falkner 2003). However, in the governance of the extractive industries, there is a curious tension between state and non-state actors, given that the state remains the primary actor controlling access to and governance of natural resources. Yet international and non-state actors exert significant influence over host government policy directly as well as indirectly through the multiple layers of international rules, norms, and standards being applied in host country contexts (Garcia-Johnson 2000; Singh and Bourgouin 2013).

The EITI is a well-established multi-stakeholder initiative that exemplifies the challenges and practicalities of so-called collective governance (Rich and Moberg 2015). The EITI brings together extractive industry companies, civil society representatives, and government officials in a voluntary public–private partnership to help governments of resource-rich nations govern more effectively (Aaronson 2011). The growth of public–private partnerships in global governance is well documented, particularly within the field of global environmental governance and sustainable development (Backstrand 2006). Proponents call for these new forms of voluntary partnership networks to address governance, implementation, and participation deficits (ibid.). Others question the ability of public–private partnerships to increase the effectiveness and legitimacy of global governance noting the wide-ranging form and functions of these multi-stakeholder initiatives (Borzel and Risse 2005).

The EITI represents a 'transparency turn' within the field of global governance that has emerged since the early 1990s (Rhodes 1996). 'Governance by disclosure' is favored by the international community as a 'light touch' way of correcting failures of conventional forms of government regulation in the face of emerging risks and public service flaws (Florini 1998; Fung et al. 2007). Disclosure-based governance is a global norm that is well documented within the fields of state-led international environmental regimes (Gupta 2010; Mason 2010), private and market-based forms of governance (Auld and Gulbrandsen 2010), and targeted national transparency policies (Florini 2010; Fung et al. 2007). Yet transparency challenges the traditional norms of corporate privacy and state sovereignty, which limits the extent to which disclosure-based governance leads to substantive change (Gupta and Mason 2014; Haufler 2010).

The extent to which information disclosure informs, empowers, and improves has come under increasing scrutiny (Gupta 2010; Mason 2010; Van Alstine 2014). The critique of governance by disclosure includes three key areas (Gupta and Mason 2014). First, observations of 'drowning in disclosure' have highlighted the need to find the balance between quality and quantity of information provision (Fung et al. 2007). Second, the dynamics between the powerful and powerless, that is, access to and control over information, is central to this debate (Mol 2010). Third, although the procedural aspects of governance by disclosure may inform and empower in some instances, there is limited evidence of how transparency substantially improves, for example, environmental quality and performance (Gupta 2010; Mol 2010).

Before exploring the strengths and weaknesses of the EITI, particularly as a new form of disclosure-based governance, we discuss how it has emerged and evolved.

2 Background and Evolution of the EITI

The EITI emerged from the confluence of four trends dating back to the 1990s and early 2000s (see e.g. Benner et al. 2010; Wilson and Van Alstine 2014). First, the link between natural resource wealth and weak development outcomes came under increasing scrutiny. The 'resource curse' was identified and its causes and consequences began to be interrogated (see Auty 1993;

Humphreys et al. 2007; Ross 1999; Sachs and Warner 2001; Chap. 21 of this volume). Second, academics and policy makers reframed the resource curse as a 'governance issue' and a political–institutional challenge, as opposed to a quasi-automatic phenomenon that poor resource-rich countries were destined to follow (Mehlum et al. 2006; Robinson et al. 2006). Third, the international community began to question the traditional practices of the extractive industries, as campaigns emerged on issues such as corruption, human rights offenses, and environmental degradation. Fourth, the legitimacy of multinational corporations came under intense scrutiny in the 1990s as high-profile campaigns highlighted issues such as child labor in Nike's Asian factories to Royal Dutch Shell's alleged human rights offenses in Nigeria. Pressure mounted for industry to become more transparent and accountable in its international operations and to more clearly define its contributions to sustainable development.

A key event in setting the agenda for the emergence of the EITI was the 1999 Global Witness report, *A Crude Awakening*, which highlighted the role of the oil and banking industries in the plundering of state assets in Angola's 40-year civil war (Global Witness 1999). The report called for oil companies in Angola to 'publish what you pay' (PWYP 2011). Gillies (2010) argues that the reputational concerns of influential international players—Western governments, international financial institutions, and multinational oil companies—have strongly influenced the emergence of transparency as a norm in the oil and gas sector, which was notoriously opaque until the end of the 1990s.

The mining sector also came under increased scrutiny. In the run up to the World Summit on Sustainable Development in Johannesburg, nine major mining companies initiated a two-year independent project between 2000 and 2002 to assess the contribution of the minerals sector to sustainable development, known as the Mining Minerals and Sustainable Development Project (MMSD 2002). Although substantive change did not emerge from this multi-stakeholder initiative, it marked the beginning of an ongoing dialogue on the extractive industry's contribution to sustainable development and greater transparency in information production and dissemination throughout the extractive industries project cycle (Bebbington et al. 2008; MMSD 2002; Buxton 2012).

Another key initiative was the Extractive Industries Review of the World Bank Group, which was initiated in 2001 after NGO pressure (World Bank 2003). The Review sought to evaluate whether extractive industry projects could be compatible with the World Bank Group's goals of sustainable development and poverty reduction. Revenue transparency in fact emerged in the Review 'as one of the few issues that everyone could agree on' (van Oranje and Parham 2009, p. 39). Finally, the PWYP coalition formally launched in 2002, has evolved into a global network of over 800 NGO members, and has campaigned continuously over the last decade for voluntary and mandatory transparency and good governance within the extractive sector (PWYP 2015).

In the wake of growing momentum for transparency in the extractive sector and in the spirit of public–private partnership, the idea of the EITI was outlined in a speech intended to be delivered by then UK Prime Minister Tony Blair at the World Summit on Sustainable Development in 2002 (Rich and Moberg 2015). The UK Government sought to strike a compromise between the PWYP coalition, which wanted mandatory company reporting, and the companies, which resisted this demand, through an initiative that would provide equal transparency from governments and companies (ibid). The EITI Principles were agreed upon by a diverse group of countries, companies, and civil society stakeholders at its first conference in 2003 hosted by the UK (EITI 2015a). The Principles agree to increase transparency over payments and revenues in the extractive sector and forms the cornerstone of the EITI today (ibid). Since its first conference in 2003, a set of rules and procedures have been refined to 'give effect' to the EITI Principles (Short 2014). The initiative is governed by a board, a secretariat, and a members' conference run every two years to appoint the Board (EITI 2015b). The EITI has evolved into a global initiative involving 48 implementing countries (31 compliant and 17 candidate countries as of September 2015). Since 2013, Norway is compliant and the UK and USA have become candidates, with France, Germany, Mexico, and the Netherlands among others preparing to begin implementation (Rich and Moberg 2015). Thus, the EITI may no longer be an initiative only advocated by Western countries for developing countries with governance challenges to implement. As Rich and Moberg (2015) highlight, by 2015 EITI has become a true 'global standard.'

A distinguishing feature of the EITI is that it is a voluntary government-led process. Countries seek to become compliant with the EITI Rules and procedures through a validation process. To be admitted as an EITI Candidate country, respective governments must meet four sign-up requirements, which include a public statement of intention, a commitment to work with civil society and companies, and the establishment of a multi-stakeholder group (MSG) to oversee implementation. After being admitted to the initiative, the first EITI report is required to be published within 18 months, and annually thereafter. Validation starts after the first report is published and must commence within two and a half years. A country may hold EITI Candidate status for no more than five years, but may be suspended or delisted if it does not make meaningful progress during that time. If, according to the EITI Board, a country has met all of the requirements then it will be recognized as EITI Compliant. However, countries that are Compliant must still complete validation every three years, and may be reviewed by the EITI Board if deemed to have fallen below the required standard (EITI 2015a).

Up until 2013, the EITI focused narrowly on seeking voluntary publication and verification of company payments and government revenues, and subsequently was criticized for having become a 'tick box' exercise, focused on transparency but not on accountability (Short 2014). However, the EITI is transitioning from the EITI Rules, which were agreed upon in 2011, to the EITI Standard, which was adopted in May 2013. Among other things, the new Standard enables the MSGs to set their own objectives to make EITI more relevant to the local context, sets a variety of new disclosure requirements, requires machine-readable data which should make information more useable and accessible, and includes a Civil Society Protocol that reaffirms and supports civil society participation (EITI 2015a). Future EITI country reports must also provide significant contextual information on the extractive sector. The 2013 EITI Standard is particularly important for countries that have not gone beyond the bare minimum reporting requirements.

The 2015 EITI Progress Report analyzed the first 29 reports published under the 2013 Standard and noted 'a step change towards wider and deeper disclosure'; however, the Natural Resource Governance Institute (NRGI), a nonprofit organization headquartered in New York, cautioned that more needs to done for EITI implementation to lead to actual reform, and outlined a number of recommendations to improve the quality of implementation and the content of the new reports (EITI 2015c; NRGI 2015). While the EITI has evolved into a relatively advanced and high-profile global standard, its strengths and weaknesses are widely debated.

3 Benefits of the EITI

One of the primary benefits of the EITI is to eradicate corruption and rent seeking, as corruption (generally known as the misappropriation of public office for private gain) is considered to be one of the symptoms of the 'resource curse' (Kolstad and Wiig 2009; Caspary 2012; Corrigan 2014; see also Chap. 21 of this volume). The understanding is that improved transparency in the transactions that occur between governments and extractive companies should preclude illicit or hidden activities since the governance system becomes open to and accessible by a variety of stakeholders (Ölcer 2009). Transparency, in essence, is deemed to have a combination of political, economic, and social benefits (Frynas 2010). The EITI as of April 2015 reported of US $1.6 trillion in terms of government revenues from oil, gas, and mining sectors that have been disclosed, with 39 out of the 48 implementing countries having published revenues (EITI 2015d). Prior to the establishment of the EITI, such transparency could not have been considered a norm in the global extractive industry (Haufler 2010; Van Alstine 2014; Short 2014).

Another acclaimed benefit of the EITI is the improvement of investment and general access to capital. Not many investors will put money into a country that is perceived to be corrupt. And yet since corruption could be so ingrained into a society's fabric, taking steps toward the implementation of the EITI is presented as a positive indication that hitherto corrupt countries at least have intentions to reform their extractive sectors, being that the initiative is voluntary (Ölcer 2009). This endeavor could increase their overall rating on international transparency indexes and result in more incoming flows of capital through both proactive investments and support from multilateral donor institutions most of whom require disclosure of payments. It can even reduce the cost of borrowing (Gillies and Heuty 2011). General stability is something both investors and donors prefer, and thus, adopting EITI has the potential to curb the collusion and other illicit practices that could result in coups and rapid regime changes in many countries of the global South (Eigen 2006). Consequently, FDI in other non-extractive sectors may appreciate thereby boosting overall economic development (Al Faruque 2006).

The EITI is also expected to help build public capacity. One of the reasons corruption occurs and often goes untamed is the fact that many citizens in resource-rich countries are unaware of government revenues from the extractive sector. Lack of access to such information has resulted in the inability of citizens to monitor and question government activities, and it is expected that the EITI implementation is a step toward capacity building by making information about revenues readily available to the general public (Al Faruque 2006; Ölcer 2009). At the very least publishing EITI reports, for example, has boosted public knowledge about extractive industries and become a viable basis for the much-needed improvement in that sector (Sovacool and Andrews 2015).

The initiative is also touted to empower civil society through the collective governance model (Rich and Moberg 2015). The EITI involves about 400 NGOs that work as part of a bigger coalition of governments and international organizations such as World Bank, International Monetary Fund, and the International Council on Mining and Metals (EITI 2015d). One of its requirements as discussed above is the establishment of an MSG to continually review the impact and outcomes of EITI implementation in specific countries and to act on lessons learned. The creation of the MSG is meant to facilitate proper community dialogue and ensure active participation of citizens since the group is expected to represent the interests of the people. The establishment of this group reflects the growing connection between social movements and civil society and the corporate sector and it also shows growth in public–private partnerships (de Bakker et al. 2013). But more importantly, it is now commonplace that failure to include these advocacy groups in disclosure mechanisms could lead to perceptions of malfeasance which can create divisions and fuel social tensions resulting in conflict (Sovacool and Andrews 2015). Many advocates therefore insist that the EITI mechanisms have given primacy to increased citizen participation and even resulted in the creation of new civic associations in specific local contexts (Goldwyn 2008; Gillies and Heuty 2011).

Lastly, another promise of the EITI is that it benefits companies by providing some sort of a level playing ground that enhances their engagement with community leaders and civil society. It is already mentioned that opaque business practices reinforce corruption (Eigen 2014). But the competitive nature of business often increases the impulse of companies to engage in illicit or backdoor activities in order to meet the demands of the market and ensure overall profitability. The EITI is expected to help companies avoid these back dealings or 'race to the bottom' by establishing transparency through disclosure of payments as a norm instead of corruption and bribery (Eigen 2006). At the time of writing this chapter, over 90 major extractive companies that collectively manage over US $19 trillion have been listed as EITI supporters (EITI 2015d). Disclosure overall makes corporations more open to the public and empowers them as formidable stakeholders who act as 'surrogate regulators' (Hess 2012). It is also said to boost companies' reputation, which in the end makes them attractive to young and talented recruits who are concerned about social (justice) issues more broadly (Eigen 2006).

4 EITI's Limited Mandate

Despite the many benefits proponents have outlined, the EITI has a number of limitations that need to be discussed and addressed in order for the initiative to become the global standard its adherents expect it to be. One of the limitations relates to disclosure and access to information (ATI), both of which are ironically crucial to maintaining membership in the initiative. The EITI is spearheaded under the metaphor that sunlight is the best disinfectant (Sovacool and Andrews 2015). This implies that by disclosing payments, the extractive sectors of member countries could become less opaque and in fact open to the general public. Yet, this is not the case in many countries that have become part of the initiative. Despite efforts to set up MSGs that include a number of representatives that cut across the plurality of stakeholders in the extractive sectors of African countries, for instance, the laws that govern the sectors are not up to the task of proper disclosure (see Calland and Diallo 2013). A legal review of upstream and downstream petroleum laws and advanced petroleum bills in Ethiopia, Ghana, Liberia, Uganda, and Zimbabwe shows that information provisions in these laws have many limitations especially since many African countries are yet to pass a comprehensive ATI law (Veit and Excell 2015).

To be sure, the Review also found that some petroleum laws in these countries have confidentiality clauses that criminalizes and sanctions the disclosure of confidential information, making it difficult to expect any particular petroleum law to make provisions for the plethora of issues needed to ensure effective governance of information and public ATI (Veit and Excell 2015). Additionally, although these laws require governments to make one or more types of information available to the public, 'no law calls for all or even most types of petroleum information generated and collected by government to be disclosed' (Veit and Excell 2015, p. 74). Being that these countries noted above, except Uganda and Zimbabwe, are EITI countries with Ghana and Liberia receiving compliant status in 2010 and 2009, respectively, one would expect a better regulatory regime that makes disclosure of information to the public pivotal. For example, confidentiality clauses in Liberia's petroleum law and the Ghana National Petroleum Act leave a lot unsaid regarding how confidentiality is determined, who may have access to such information, and how long a particular kind of information could be held as confidential (Veit and Excell 2015).

Second, the EITI's transparency–accountability or transparency–good governance linkages are flawed. The initiative in Nigeria is particularly fraught with the real challenge of making a meaningful connection between transparency and accountability in the face of endemic corruption in its oil and gas sector (Idemudia 2013). This example provides an indication that 'EITI disclosures can alter incentives without altering behavior' (Gillies and Heuty 2011, p. 37). And it is some of these examples that make one question the underlying assumption that transparency gives birth to accountability (Fox 2007). For example, an earlier study of the initiative found that public endorsement of the initiative does not improve corruption perception levels in countries that have joined and in some cases EITI countries seem to be worse off than non-EITI countries (Ölcer 2009). Gillies and Heuty (2011) attribute the lack of causality to two main factors: first, the methodological challenges prevent the accurate observation and measurement of transparency (in terms of information disclosure) in particular relation to development outcomes. Second, many transparency initiatives are externally driven and thus affect the intent and character of implementation. These two factors are in addition to the narrow manner in which transparency is defined—a definition that fails to capture other larger sources of public revenue and properly monitor illicit financial flows that benefit a small fraction of the population (Shaxson 2008; Le Billon 2011). To be sure, the 2013 EITI Standard seeks to address some of these critiques by making EITI reports more understandable, accurate, and relevant in implementing countries.

Nevertheless, a recent study of EITI in Azerbaijan and Liberia suggests that it is difficult to attribute governance improvements to the EITI. Using six governance metrics based on datasets from the Worldwide Governance Indicators, the authors argue that transparency per se is not enough to reduce corruption since several governance indicators at least in the case of these two forerunners plummeted since they gained compliant status in 2009 (Sovacool and Andrews 2015). Other research has also shown that in order for transparency to result in improved governance, several obstacles need to be avoided including collective action dilemmas, political resistance by frontline staff and officials and the slippage induced by long chains of implementation and accountability (Kosack and Fung 2014). It does not appear these obstacles are absent in EITI countries for one to make a stronger correlation between the instrument's disclosure mechanisms and viable governance improvements. Although several companies have embraced the initiative, actual implementation of disclosure could pose a number of challenges regarding how to capture and collate relevant information, the proper reporting and management of payments, and the legal and political implications of public disclosure (Hughes and Pendred 2014). In short, the challenge of how to harness transparency to stimulate accountability remains (Short 2014). Even beyond the specific focus on the EITI, existing research has shown that the hypothesized causal relationship between transparency and reduced corruption or good governance cannot be taken as a given. In a cross-country study of 111 countries, Lindstedt and Naurin (2010, p. 316) argue that transparency in itself is not sufficient because 'making information available will not prevent corruption if the conditions for publicity and accountability are weak.' This evidence suggests that transparency initiatives such as the EITI will require other reforms to ensure that people have access to requisite information and that violators of existing mechanisms are properly sanctioned.

Furthermore, although the EITI is recognized as an innovative form of collective governance, it fails to ensure enduring partnerships between companies, governments, and civil society or the general public that results in active participation and overall empowerment of the citizenry. As already highlighted, the MSG arrangement is one of the requirements of the EITI standard that is meant to ensure that civil society has some oversight responsibility when it comes to revenue disclosures. But this arrangement does not go without question in many implementing countries. In the case of two EITI trailblazers (i.e. Azerbaijan and Liberia), the active involvement of civil society in MSG activities is questionable to say the least (Sovacool and Andrews 2015). Particularly in Azerbaijan, the President recently promulgated a number of constitutional amendments that inhibits the freedom of civil society groups in the country (see NGO Coalition on ITEI 2013). This evidence reinforces the argument raised by Aaronson (2011) that the 'partnership' expected out of the EITI's MSG mechanisms has tremendous limitations that result in the marginalization of people who are expected to be at the stakeholder table. In the case of Madagascar, for instance, there is a delicate power relationship between stakeholders that inhibits the 'good governance' goal of the initiative to come to fruition (Smith et al. 2012). In some instances, there is even the absence of a viable local civil society to fully participate in the EITI process (Van Alstine 2014). Thus, although the EITI teaches us how many stakeholders (i.e. governments, corporations, civil society, and international institutions) can come together to jointly address a particular issue, it also reveals the multiple constraints embedded in such an activity.

Another limit of the EITI is its voluntary nature. The compliance/governance by disclosure character that the EITI symbolizes makes it a 'soft law' (Fasterling 2012). It is 'soft' in the sense that despite the powerful language and actors that embody the initiative, there is no surety that its members will take it seriously. Voluntarism is possibly the most weakening aspect of the initiative because it basically 'limits the potential scope of the club of countries, whereas the discretionary side to the initiative limits the utility of the disclosure requirements' (Topal and Toledano 2013, p. 277). It simply allows discretion and does not necessarily force many corporations who wish to evade taxes and governments who do not want to shine the light on their resource revenues to join (Otusanya 2011). Although the EITI website as of June 2015 lists several stakeholders including over 90 extractive companies, a number of civil society groups and 48 implementing countries, there is still a great deal of resource-rich countries and extractive companies that are not part of the initiative yet. Another interesting fact is that most of the countries (predominantly Western) listed on the website as 'stakeholders' are neither candidate nor compliant EITI countries. The case of Canada is particularly noteworthy since it is considered to be a leader in the global extractive industry (see Deneault and Sacher 2012). Even the USA only became a candidate country as of 19 March 2014 with validation expected to occur within three years, but it remains uncertain how successfully the MSG can meet the established EITI standards (Fineberg 2014). This evidence goes to support an existing contention that civil society-centered international 'soft' regulation, in general, often fails to live up to its professed expectation (Wells 2007). Thus, a voluntary disclosure mechanism that hinges on NGO participation might not be as promising as advocates want us to believe.

5 Summary: The Winners and Losers of the EITI

Based on the discussion so far around the benefits and limits of the EITI, it is worthwhile to briefly assess the 'winners' and 'losers' of the initiative if one believes that such global endeavors often do not present a win–win outcome for all of its beneficiaries. We have already highlighted that the EITI is originally designed to be beneficial to a variety of stakeholders including governments, extractive companies, civil society, and the general public. But the EITI presents an inherent paradox when one takes into consideration evidence that some of the most corrupt countries may join the initiative. As noted above, the MSG processes and activities that each country undertakes have improved accountability to some extent particularly in terms of shining the light on payments and how they are reported. Yet, this same MSG arrangement is seen to be unable to effectively stand as a mechanism to curb corruption. Søreide and Truex (2013) argue that the idea on the surface can be appealing since it presents a viable forum or space for debate and the recognition of different voices. Their position is that working with different donor-supported groups such as government agencies, the private sector, and civil society may have counterintuitive and detrimental effects on good governance reforms due to the varying incentives that drive these actors to the decision-making table. The internal factors include the incentive to hold information that highlights weak sector performance of a government, the incentive for corporations to both hide damaging information and emphasize social responsibility, and the incentive on the part of civil society to release information to improve transparency (Søreide and Truex 2013). The collusion of these incentives in addition to external constraints and the balance of interests could result in counterintuitive effects such as 'an undermining of civil society, the possible covering-up of collusion between the private sector and government agencies, and that aid itself may drive the initiative more than a motivation to solve sector challenges' (Søreide and Truex 2013, p. 217). This evaluation implies that depending on whom the balance favors in the end, all participants in MSG processes cannot be deemed to be 'winners.'

The other side of the paradox is the fact that some very corrupt countries join the initiative. Of course, one can be quick to question why such countries wish to shed light on themselves. Beyond the quest to actually reform their internal dynamics, research suggests that they join the EITI in order to improve their international reputation and therefore secure more foreign aid (David-Barrett and Okamura 2013). Being that perceptions of improved transparency boosts the flow of FDI and general access to international capital and as a government-led initiative, the EITI could be an alibi for opportunistic countries that may not have a genuine interest in good governance reform. There is no doubt this kind of reputational management is crucial since many donor organizations such as the International Monetary Fund, the World Bank, and the European Union (EU), among others, are strong supporters of the initiative. The assessment below by Sovacool and Andrews (2015, p. 190) reflects how joining the EITI may be perceived to represent a strategic decision by some participating countries:

> For Azerbaijan, many years of autocratic rule and poor performance on the Corruption Perception Index meant that it needed to showcase itself as a country making conscious steps towards transparency in its extractives sector. For Liberia, fourteen years of civil war and the quest of President Sirleaf to prove to the world that it could recover from years of dictatorship, human rights abuses, corruption, and possibly a low rating on the Human Development Index in 2007 led to the frantic adoption the EITI.

The brief discussion in this section of the chapter further solidifies our previous account of the EITI's limited mandate. To be sure, corporations and governments can be considered 'winners' so far since the constraints that civil society face as part of the MSG process are well captured, not to speak of the involvement of the general public who are purported beneficiaries of resource rents (Aaronson 2011; Smith et al. 2012; Van Alstine 2014; Andrews 2016). This position, of course, illuminates the challenges of civil society in the international political economy of energy. However, it does not absolutely reveal their powerlessness since at least there is now a forum provided by the EITI for such voices to be heard. Additionally, it is expected that the new Civil Society Protocol that was developed in conjunction with the EITI Rules adopted in May 2013 could properly situate civil society groups as formidable actors and watchdogs for the ideals of transparency and accountability. But we wait to see the difference this new provision makes in practical terms.

6 Conclusion

Despite the global reach of the EITI, the discussion above does highlight the fact that there are serious challenges that dog the initiative. Transparency itself is insufficient to address the multifaceted problems resource-rich countries face and therefore one can be doubtful of the transformative potential of the EITI if it remains a technocratic and 'tick box' process (Kolstad and Wiig 2009; Van Alstine 2014; Sovacool and Andrews 2015; Andrews 2016). Yet, the fact that there are many forces that have rallied around the principles underlying the EITI suggests an incremental shift in natural resource management. As EITI advocates at the 2015 NRGI conference noted, revenue transparency was an 'entry point' into a conflicting conversation between companies, governments, and civil society.[1] By building up trust around a table, consensus can be built on issues beyond revenue, which is exactly what the 2013 EITI Standard intended. The fact that reporting on fiscal and legal terms as well as contracts, licenses, and beneficial ownership are now happening in some of the EITI implementing countries demonstrates how the initiative continues to evolve. As EITI supporters stressed at the 2015 NRGI conference, 'at least those conversations are now happening in 48 countries.'

We can, in fact, agree that despite its inherent weaknesses, 'the EITI has successfully embedded itself in other institutions which further reinforce its aims' (Haufler 2010, p. 68). The EITI is not the only initiative that seeks to promote greater transparency and accountability in the extractive sector. The effect of EITI needs to be evaluated more fully in the context of other initiatives operating globally and at the national level in resource-rich countries. It is worth noting, however, that EITI is distinct from the others in the specific rules and enforcing mechanisms that it employs. The normative space for transparency and good governance in extractive sectors has been influenced by, inter alia: the PWYP coalition; the NRGI; the International

[1] See: http://www.resourcegovernance.org/news/2015-natural-resource-governance-institute-conference-25-and-26-june-university-oxford.

Monetary Fund Guide on Resource Revenue Transparency; the International Finance Corporation Social and Environmental Performance Standards; the Equator Principles; the International Council on Mining and Metals Principles for Sustainable Mining; and the UN conventions on human rights and corruption.

As a consequence of converging campaigns and narratives, transparency in resource governance has risen up the global agenda. The 2013 European Union Accounting and Transparency directives require European oil, gas, mining, and forestry companies to disclose project level payments to governments in addition to country level payments. The EU directives follow the US Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010, in which the extractive industries disclosure provision (Section 1504) requires all US-listed companies to disclose payments to governments when reporting annually to the US Securities and Exchange Commission. Additionally, the 2013 Africa Progress Report focused in particular on transparency in Africa's oil, gas, and mining sectors, raising the profile of transparency prior to the 2013 G8 summit, which had transparency as one of its key themes (Africa Progress Panel 2013b). Also, the Africa Mining Vision, adopted by African Heads of State and Government in February 2009, and the Africa Progress Panel, which is led by Kofi Annan have brought a great deal of serious consideration of the importance of using transparency to improve the prospects of sub-Saharan African countries to make the most of their resource potential.

The EITI represents a powerful norm in the international political economy of energy. Transparency and accountability within the extractive sectors has risen up the international agenda over the last decade. Although questions remain whether EITI processes are a 'triumph of form over results, with real power remaining in the hands of government and corporate elites' (Haufler 2010, p. 57), it can be argued that the EITI and organizations such as PWYP and NRGI have played a crucial role in building the capabilities of civil society (Rich and Moberg 2015). In fact, in undemocratic countries the EITI MSG might be the only political space that exists for civil society to exert pressure on governments to reform (ibid). Nonetheless, one thing to be learned from the exploration in this chapter is that, although the quest to avert the 'resource curse' (see Chap. 21 in this volume) and ensure sustainable development is laudable, it is uncertain if the EITI alone can help resource-rich countries to undertake this endeavor (Hilson and Maconachie 2010). As participants emphasized at the 2015 NRGI conference, 'transparency is necessary but not sufficient.'

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5

The UN, Energy and the Sustainable Development Goals

Sylvia I. Karlsson-Vinkhuyzen

1 Introduction

The very humble presence of energy in the United Nations (UN) during the organization's first seven decades can be linked to states not considering it justified that the UN exerts authority on this topic, in other words global energy governance has not been considered legitimate (Karlsson-Vinkhuyzen 2015). However, the UN and particularly its General Assembly (UNGA) became the arena for developing countries, including newly independent ones, to push for the principle of national sovereignty of natural resources, including energy, securing their right to develop its resources without interference from foreign actors (Schrijver 1997). This followed the same vein of looking at energy, and particularly its extraction, ownership and access as being part of 'high politics' where the primary concern is national security within state borders rather than international collaboration. The linkages between energy and national security were already strong at the time when the UN was formed (1945) with some developed countries just then becoming dependent on energy imports from other countries, particularly fossil fuels (Podobnik 2002). Countries had in fresh memory what importance the role of access to fossil fuels had had in both World Wars and could thus foresee the role it would have for their future security. The oil crises with nationalizing of oil and gas resources in many

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developing countries in the 1970s tied the links between energy and security even further and made 'western foreign affairs offices … treat disruptions of energy supplies as a national security issue to be counteracted by military strategy' (Peters 2004). But these western countries then also saw the need for international collaboration and set up the International Energy Agency under the Organisation for Economic Co-operation and Development (OECD) (Van de Graaf and Lesage 2009).

The story of energy in the UN is told in this chapter along the two processes of norm development and institutionalization.[1] The development of specific norms—understood as standards of appropriate behaviour (Finnemore and Sikkink 1998)—is one of the major activities of the UN. Various bodies within the organization provide the arena for negotiations of declarations, action programmes, recommendations and other 'soft law' instruments in addition to the 'hard law' instruments such as treaties that outline desired behaviour of states (and occasionally other actors).[2] How and to what degree international norms influence state behaviour is both highly debated and difficult to establish. Most of them have no enforcement mechanisms with material sanctions. Nonetheless, they can still exert influence through norm diffusion and management approaches (Chayes and Chayes 1995; Raustiala 2000). Such influence can take different routes, directly on states but also via various international organizations (IOs). Particularly for donor dependent developing countries the way that bilateral and multilateral donor organizations take guidance from these norms can influence the direction of their activities on the ground. Another indication that even soft norms 'matter' is the very careful attention that states give to their negotiation and the many disagreements and conflicts that need to be overcome to reach agreement. As we shall see this has also been the case for that very meagre scope of soft norms that have been negotiated within the UN explicitly for energy.

The UN is the most universal organization that the international community of states has created. Its central organs, programmes and specialized agencies—and sometimes the Bretton Woods institutions are included here—constitute the UN System—an institutionalized arena

[1] This means that the chapter does not aim to provide a review of the operational activities of the agencies of the UN System. Readers interested in a good overview of these can consult the publications of UN-Energy, see http://www.un-energy.org/publications.

[2] The scope of international or global norms discussed here follows the perspective of legalization where international formal norms take various forms along the continuum from soft law that score low on the criteria of obligation, precision and delegation to hard law that score high on the same criteria (Abbott and Snidal 2000).

for cooperation among states (and increasingly between states and non-state actors).[3] And while 'all efforts of international cooperation take place within an institutional context of some kind' (Keohane 1988), many parts of the UN System manifest the strongest form of institutionalized collaboration; an IO based on a charter or treaty and equipped with a secretariat and funding to take action in a specific field. But there are also many more ad hoc and 'light' degrees of institutionalization, for example, in the form of time-bound committees, inter-agency task forces and the like. Some issues have been highly institutionalized throughout UN's history with dedicated bodies—such as international peace and security, the maintaining of which was the primary rationale for establishing the UN and that remains the mandate of the Security Council; development (United Nations Development Programme [UNDP], Bretton Woods institutions); and health (World Health Organization [WHO]). Others have been institutionalized over time such as environment (the United Nations Environment Programme founded established in 1972). Energy, as we shall see, has a relatively long history of institutionalization in the UN but in very light and often ad hoc modes.

The chapter proceeds as follows. The next section paints an overview of the development of norms related to energy in the arenas of the UN—weak as it has been. The subsequent section describes the few efforts made to institutionalize collaboration on energy within the UN System. Both of these sections cover the history up to and including the first decade of the twenty-first century and the final substantive section takes the story through negotiating the future including the Rio+20 conference in 2012 and the adoption of the Sustainable Development Goal (SDG) on energy in 2015. To conclude, a brief discussion is presented on the challenges of legitimizing global governance on energy in the UN System.

2 Norm Development

The member states of the UN have not used this universal multilateral arena to negotiate a treaty that directly addresses energy. From humble beginnings of discussing energy in scientific and expert conferences in the 1940s and 1960s—although discussions on permanent sovereignty were very active in 1950s and 1960s—some normative language explicitly on

[3] 'Institutional' refers here to a structure or process linked to an organization departing from the usage of, for example, Young (1999) who reserves the concept for rules and norms only.

energy emerged in the form of UNGA resolutions, intergovernmental conference outcome documents, Commission on Sustainable Development (CSD) decision documents and have addressed different dimensions of energy, and more explicitly so from the 1980s and onwards.[4] The developments of norms around energy in the broader arena of the UN System can be followed along at least four major topics: sovereignty over natural resources, economic development (national), environmental protection (including climate change) and human/social development.[5] The process of norm development along each of these trajectories will be discussed separately below notwithstanding the linkages among them—linkages that are increasingly manifested over time and which will be discussed in the final section on negotiating the future.

Energy for the Nations

The process of decolonization that started with the end of the Second World War brought the issue of ownership of energy and other natural resources of people under colonial rule and newly independent states to the fore (Schrijver 1997). Over the next decades, the permanent sovereignty over natural resources emerged as a new principle of international economic law, and although the birth of this principle was contentious, the speed of its emergence came from the fact that UNGA was used as the arena for lawmaking (Schrijver 1997). The increasing number of developing countries that became both independent from their colonial powers and members of the UN at the same time gave them a majority in the UNGA. A number of issues were linked to the call for the new principle including views on scarcity of natural resources, deteriorating trade terms for developing countries, protection of foreign investment and nationalization of resource extraction companies (Schrijver 1997). The nationalization of the British-owned Anglo-Persian Oil Company by the government of Iran in 1952 evoked a first clash between developed and developing countries over the topic and the UNGA became the arena for debate and a first resolution with Latin American countries playing a prominent initiator role (Schrijver 1997). In the following years, a number of resolutions cemented the principle, and from the 1960s onward, there was more focus

[4] For a more detailed discussion on the history of norm development in the UN, see Karlsson-Vinkhuyzen (2010).

[5] The themes linked to the use of nuclear energy is excluded in this chapter both in terms of norm development and institutionalization that did occur early through founding of the IAEA in 1957, primarily due to its linkages to peace and security through the risk of nuclear proliferation (Braithwaite and Drahos 2000).

on how to implement it and indeed how to link resource use to the development of countries. The oil crisis in 1974 led Algeria to initiate a special session of the UNGA only devoted to the issues of raw materials and developments leading to the adoption of a Declaration and Action Programme on the Establishment of a New International Economic Order—and permanent sovereignty was seen as a key element of this new order (Schrijver 1997).

Energy for the Economy

The first UN intergovernmental conference dedicated exclusively to the subject of energy took place in Nairobi in 1981. It was called for by two UNGA resolutions and addressed 'new and renewable sources of energy'.[6] Many developing countries without access to their own fossil fuels suffered during the oil crises of the 1970s and were looking for energy sources that were cheaper than expensive fossil fuels and the wood based energy that was being exhausted (Schechter 2005). The conference discussed various common renewable energy sources as well as oil shales and tar sands. All these energy sources were considered possible means to enable a transition from (conventional) oil and gas (Mak and Soltau 2005). The Arab–Israeli conflict was looming in the background and made for considerable tension during the conference. However, also other topics led to conflicts, primarily a World Bank proposal to drastically increase the government lending for energy investments through a special body (Schechter 2005). President Carter had backed the proposal but the incoming Reagan administration did not want to support loans to governments (Schechter 2005). The follow-up of the Nairobi conference through various committees in the UN (see below) continued to be focused on the countries' energy needs as a prerequisite for economic development and this theme was also prominent in the discussions on energy in the CSD (see next section for elaboration on the CSD) in 2001 and 2006–2007.[7] Particularly in the 2006–2007 CSD meetings, the context for developing countries was similar to that in 1981. Oil prices had hit record levels, but this time, due to what some claim to be the first demand-driven price shock. Many developing countries expressed considerable eagerness to get access to renewable energy during the meeting, and for those developing

[6] Resolutions 33/148 and 34/190. Its first origins can however be traced to the Sixth Special Session of UN General Assembly's Declaration and Program of Action for the New International Economic Order (Schechter 2005).

[7] The analysis of the energy discussions at the CSD meetings is taken from Karlsson-Vinkhuyzen (2010) and empirical documents referred to there.

countries that are also vulnerable to climate change impacts there was now a double motivation to move away from fossil fuels. The ability to have security of an affordable supply of modern energy was framed by many as energy security, and strong concern for this was expressed at the CSD not only by developing countries but also by the European Union (EU) and China. However, the concept was heavily opposed by oil-exporting countries who argued that it should be considered also from the energy exporters' perspective in terms of security of demand.

(Some) Energy Is Bad for the Environment!

The resolution of the 1981 conference on renewable energy invited governments to consider the close relationship between energy and the environment, specifically with reference to soil, water and forest policies but otherwise it has been the series of UN conferences on environment, environment and development and sustainable development that over time has devoted more attention to this relationship (Schechter 2005). The 1972 UN Conference on the Human Environment (UNHCE) in Stockholm was the first of a series of environment related conferences called for by the UNGA. The outcome of the Stockholm Conference included only a marginal reference to energy but two decades later in the 1992 UN Conference on Environment and Development (UNCED) in Rio de Janeiro, the link between energy and environment was stronger, particularly in relation to climate change. Actions such as improving efficiency, reducing demand and making cleaner technology were proposed in the outcome document Agenda 21 (Najam and Cleveland 2003). Yet, it had no dedicated chapter to energy nor did it result in a meaningful programme of action on energy within the UN. The 19th special session of the UNGA in 1997 reviewed the implementation of Agenda 21, and in this session governments suggested that energy was one of the most important issues to be addressed in a comprehensive manner by the CSD. The CSD was the functional high-level commission under UN's Economic and Social Council (ECOSOC) that had been created in 1993 with the mandate to, inter alia, monitor the implementation of the outcomes of the Rio including looking at new challenges and opportunities in the context of implementation.[8] It was decided that energy would be one of the central agenda items for the Ninth Meeting of the CSD (CSD-9) in 2001. The CSD-9 meeting then became the first time that energy issues from all dimensions of sustainable development

[8] See http://www.un.org/esa/sustdev/csd/csd_mandate.htm.

(economic, social and environmental) was discussed as a separate agenda item at the intergovernmental level (Mak and Soltau 2005). This ambition gave rise to considerable challenges, indeed conflicts particularly between the EU and its focus on promoting renewable energy sources because of the negative environmental impacts of fossil fuels and the G77/China that as a coalition stressed the importance of cheap energy—fossil fuels—for national development (Co-chairs 2013). The G77/China together with the major industrialized economies outside the EU (Japan, the USA, Canada, Australia and New Zealand) was strongly against any text that intended to limit countries' freedom to adopt their own energy priorities and policy instruments (Freudenschuss-Reichl 2002). The adopted decision included themes such as energy accessibility, energy efficiency, renewable energy, advanced fossil fuel technologies, nuclear energy technologies, rural energy, energy and transport. However, the language on all themes was very general without any targets or plan of action (Commission on Sustainable Development 2001).

In the year following CSD-9, the linkages between energy and environment became subject to some of the most difficult negotiations at the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg. The EU and some other countries including Norway, New Zealand, Switzerland, Iceland, Tuvalu and Eastern Europe pushed for time-bound targets on renewables—a quantifiable target on the percentage of the world's energy production that should come from renewables—but met hard resistance from, for example, G77/China that argued it would divert attention away from the primary goal of ensuring universal access to energy services for the poor (IISD 2002).[9] Opposition also came from the USA, Australia, Canada and Japan who were concerned about the 'one size fits all' approach (IISD 2002). In the end, the EU only managed to get a qualitative goal to 'substantially increase the global share of renewable energy sources … and regularly evaluate available data to review progress to this end' into the text (United Nations 2002a, p. 20e). Countries could also not agree on text for phasing out subsidies for fossil fuels where again the EU was leading the push and G77/China, the USA, Japan, Canada and Australia opposed (IISD 2002). The text on energy was still quite a step ahead in the development of global norms on energy as the outcome document was 'the broadest international instrument with the most extensive references to renewable energy and energy efficiency yet produced by the world community' (Steiner et al. 2006). However, the conflict between EU and G77/China on promoting renewable energy further escalated at the

[9] Kui-Nang and Soltau (2005) claim that Brazil had put in an even more ambitious quantitative target on renewable energy than the EU, thus indicating there were significant divisions within G77/China.

deliberations on energy in 2006 and 2007 when 'energy for sustainable development' came on the agenda of CSD-14/15.

Four years after the WSSD, when CSD had scheduled energy to be on its agenda again climate change had risen to the top of the international agenda, and the discussions on 'energy for sustainable development' at the CSD-14/15 went in parallel to discussing climate change, air pollution/atmosphere and industrial development. It was the negotiations on energy that in the end led to the first CSD without an agreed document. The G77/China repeatedly halted the negotiations on energy as they needed time to sort out their internal conflicts and at 4 am on the last morning negotiations broke down. The Chair presented a 'take it or leave it' compromise text at the end of that day, a text which G77/China and the USA accepted but which the EU and Switzerland rejected. There were multiple conflicts behind this lack of agreement on a decision text that all related to the energy–environment linkages:

- There was intense debate over language on what role fossil fuels would have in the coming decade with the dividing line running, not surprisingly, between oil-exporting and oil-importing countries.
- Proponents of fossil fuels made strong calls for cleaner technology including carbon capture and storage while others—such as the EU and many developing countries who were suffering from high oil prices—endorsed renewable energy; in every paragraph referring to energy sources and technologies, there was a fight over the balance between fossil fuels and renewables.
- A few countries—for example, Pakistan, Argentina, Chile and Algeria (IISD 2007)—wanted to refer to nuclear as a valuable source of energy; G77/China proposed ambiguous text on nuclear energy and on the cessation of the transport of nuclear materials through the regions of Small Island Developing States, but as these texts were rejected by Japan, the EU and the Russian Federation—quite likely for different reasons—no reference to nuclear remained in the Chair's compromise text (2007).

Perhaps the biggest conflict was on institutionalization of (renewable) energy in the UN System (discussed below). Renewable energy was pushed for by countries wishing to see strong action on climate change but it was also pushed for by many countries for its role for their economy—as they suffered from high cost of importing fossil fuels.

In parallel to the track of addressing energy in UN conferences on environmental development/sustainable development and their institutionalized follow-up, the negative impact on the climate system from fossil fuel use has been an implicit focus of the 1992 UN Framework Convention on Climate Change (UNFCCC) as well as subsequent negotiations and agreements under this convention. The rationale for this is the energy sector being the largest source of greenhouse gas emissions. However, the UNFCCC has mostly addressed energy in a very implicit way primarily because the convention and later the Kyoto Protocol leave it entirely to the states to decide on how mitigations in the various sectors—including energy—are achieved. Energy is nonetheless explicitly mentioned in the UNFCCC; particularly in the preamble stressing that the 'energy consumption will need to grow' in order to achieve sustainable social and economic development, and in the central paragraph four on commitments it is stated that all Parties are obliged to promote and cooperate 'in the development, application and diffusion, including transfer, of technologies … in all relevant sectors, including the energy' (United Nations 1992).

One exception for the silence on energy on the part of the UNFCCC is the Clean Development Mechanism (CDM) methodologies for energy technologies. The CDM has been successful in engaging project developers and companies in the climate mitigation agenda and in the industrial sector, for example, made companies focus on energy efficiency (de Coninck and Puig 2015). Mitigation through energy provision with renewable sources is by far the dominating one in terms of number of CDM projects and accounts for 28% of certified emission reductions. Another 5% reductions is provided by supply and demand side energy efficiency measures.[10]

Energy for Human Well-Being

The push of developing countries to get adequate access to energy sources for national development discussed above focused on the macro-scale of energy demands for economic development. A parallel more micro-scale theme for debate and development of norms is the energy needs of people in their daily lives that improves their well-being and reduces poverty. An obvious arena for this theme to emerge was the discussions on human security that took off in the 1990s. However, energy was not mentioned in the UNDP report of 1994 that had this as theme (UNDP 1994) or in the report of the Ogata–Sen Commission on Human Security (Commission on Human Security 2003). Energy can, however, be explicitly linked to at least four of the six security dimensions that were in the original UNDP definition of human security

[10] These figures are drawn from the UNEP DTU CDM/JI Pipeline Analysis and Database updated on 1 October 2015. See http://www.cdmpipeline.org/cdm-projects-type.htm.

(UNDP 1994): economic security, food security, health security and environmental security (Karlsson-Vinkhuyzen and Jollands 2013).

It took until the 2000s for the advocates of ensuring access to modern energy and electricity for the 2–3 billion people deprived of such modern energy services (AGECC 2010) to emerge in various UN fora. The CSD-9 in 2001 noted that energy services are crucial for eradicating poverty. The absence of any reference to energy in the Millennium Development Goals (MDGs) adopted in 2000 made some actors such as the EU to push hard at the WSSD to adopt an action plan with financial and technical assistance to improve energy access (IISD 2002). The resistance, however, was too big from the G77/China who thought that was premature and also the USA was hesitant stressing the need to consider national circumstances (IISD 2002). The outcome document instead included the weak text on agreeing to 'take joint actions and improve efforts to work together at all levels' to improve energy access (United Nations 2002b). Nonetheless, energy access was emerging as an issue around which all countries could unite. This was obvious in CSD14–15 where it was the one topic on which countries could relatively easily agree on the role of energy for reducing poverty and the need to reduce health impacts from certain types of energy use.[11] This emerging agreement had been enabled by the appearance in the late 1990s and early 2000s of several norm entrepreneurs, and an organizational platform both of which Finnemore and Sikkink (1998) consider prerequisites for the development of new international norms. Among the norm entrepreneurs were UNDP's energy and atmosphere programme that produced a number of reports on the links between energy and poverty and initiated the World Energy Assessment in time for the CSD-9 preparations as well as the WHO provided new research results on the links between energy and health, especially via indoor air pollution (Karlsson-Vinkhuyzen 2010).

3 Institutionalization

Many of the UN and Bretton Woods institutions have operational activities related to energy in various ways in developing countries but most of this work has been done without coordination and collaboration (Karlsson-Vinkhuyzen 2010). The lack of a strong normative framework on energy has also meant

[11] This refers particularly to serious health impacts from indoor air pollution; almost 2 million children that die each year from respiratory infections as a result of exposure to indoor air pollution from traditional cooking fuels (Commission on Sustainable Development 2006).

that each UN institution with operational activities have supported energy sources and forms of energy services according to their own mandate and priorities. Furthermore, there is no UN institution dedicated primarily to energy issues, with the exception of the International Atomic Energy Agency (IAEA).

The few attempts that have been made to institutionalize energy and cooperation on energy in the UN System have been of short duration and/or of a very 'light' character both in terms of politically mandated bodies and administrative ones. Possibly the first example of the former is the body dedicated to new and renewable sources that was established in line with a request from the Nairobi Programme of Action adopted in 1981 (Schechter 2005). When this request was up for discussion in the UNGA, both the USA and the Eastern European countries voted against resolution 37/250 that made provisions for creating the committee that was tasked to follow up the implementation of the programme of action (United Nations 1986). The new Committee on the Development and Utilization of New and Renewable Sources of Energy met every two years until it was dismantled in 1994 when its mandate was transferred to the Committee on New and Renewable Sources of Energy for Development under ECOSOC. This committee received the additional task to address energy-related issues in Agenda 21 and was in turn dissolved when its mandate was taken over by the CSD (United Nations Economic and Social Council 1993).

Moving from political to administrative institutionalization, there were several efforts made in the 1980s and 1990s to evaluate and develop the UN system-wide coordination on energy. The result of most of these efforts was, however, mere inventories of activities. Then in 1999, the Ad Hoc Inter-agency Task Force on Energy was created with a mandate to support the preparations of CSD-9 and later the WSSD (United Nations 1986). However, delegates from both developed and developing countries at the CSD-9 opposed the proposals by an ad hoc expert group to develop a system-wide coherent approach to energy (Freudenschuss-Reichl 2002). There was no mandate in either the CSD-9 or WSSD outcome texts for the UN to institutionalize inter-agency cooperation on energy. The WSSD did, however, give the international community a general mandate for inter-agency collaboration within the UN System, the international financial institutions, the Global Environment Facility and the World Trade Organization particularly to support the efforts of developing countries in implementing Agenda 21 (United Nations 2002a) Para 140b. The UN Secretariat then as a response set up UN-Energy in 2004 under the auspices of the UN Chief Executives' Board (United Nations 2004). This inter-agency mechanism is open to all organisations in the UN System including the Bretton Woods institutions and 23 agencies, programmes and organizations have become members.[12] UN-Energy operates primarily through electronic means but aims to meet at least once per year and it receives secretariat services from UN Department of Economic and Social Affairs (DESA).[13] The UN-Energy promotes itself as a knowledge network and its terms of reference—reviewed every four years—includes to promote coherence in the UN Systems multidisciplinary response to WSSD and to promote the interaction with non-UN stakeholders (United Nations 2004). One of its major focuses is to work on 'substance and collaborative actions both in regard to policy development in the energy area and its implementation as well as in maintaining an overview of major ongoing initiatives within the system based on the UN-Energy work programme at global, regional sub-regional and national levels'.[14]

Institutionalization of energy in the UN System is highly sensitive. Plausible reasons include that first that it resembles a constitutive type of norm as it would give energy a formal place in global governance, and second that there are general concerns around inter-agency cooperation due to the claim of independence by each UN organization and competition for the same resources. The negotiations at the CSD-15 are a good illustration of governments' reluctance towards institutionalizing energy in the UN System. There were no calls for improvements of system-wide cooperation among UN actors working on energy in government statements and negotiation inputs throughout CSD-14/15 and at CSD-15 probably the strongest disagreement concerned how to institutionalize a review of the implementation of the energy-related CSD and WSSD decisions. The EU and other members of the Johannesburg Renewable Energy Coalition (JREC)[15] presented a proposal for a review arrangement for 'energy for sustainable development'—partly building on the decision in the WSSD outcome text to 'regularly evaluate available data to review progress' on the goal to increase the share of renewable energy (United Nations 2002a: p. 20e). The proposal suggested that UNEP, UNDP and UNIDO through UN-Energy should establish a clear and effective review with a long-term perspective and engage a range of other international bodies and networks in the work, and that future CSDs should devote time to review and follow up (CSD Negotiations 2007). Other country groups had major problems with this elaborate review mechanism (Commission on Sustainable Development 2007). The only reference to the review issue in the Chair's final

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[12] See http://www.un-energy.org/members.

[13] See http://www.un-energy.org/about/terms-of-reference.

[14] See http://www.un-energy.org/about/terms-of-reference.

[15] This coalition that established by the EU after the WSSD to push the renewable energy agenda forward.

text was a general paragraph asking to follow up progress in the implementation of the CSD-15 decisions during one or two days at CSD sessions in 2010 and 2014 closely followed a G77/China proposal and this weak text on review was one of the major reasons that the EU rejected the text which has as consequence that there was no adopted decision text (Commission on Sustainable Development 2007). The EU's ambitious agenda was by some seen as unrealistic, inflexible and having underestimated the resistance it encountered from other countries. The changing global context meant that stakes had risen for states, primarily oil-exporting states, who may have been concerned of the signals that even a soft CSD output could give for a possible reduced importance for fossil fuels in the future. Because even if the CSD decisions are not legally binding 'they become "agreed language" that might be reintroduced in UN fora with greater authority' (Wagner 2003, p. 11). This created major rifts in the G77/China country group where stakes had also risen for, for example, Small Island Developing States (SIDS) who were more concerned about climate change impacts than ever.

4 Negotiating the Future: Energy for Climate Change and Sustainable Development

New normative and institutional developments for energy came in the UN context with the second decade of the twenty-first century along two strands: addressing climate change through the UNFCCC and addressing sustainable development through the post-2015 development agenda.

Energy in the UNFCCC

In efforts to repair the sense of tremendous failure that surrounded the lack of outcome of the 2009 Conference of the Parties (COP) of the UNFCCC in Copenhagen, the following COP in Cancun in 2010 took the, until then, most explicit step to push climate technology transfer for both mitigation and adaptation. It did so by setting up a Technology Mechanism composed of the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN) (Streck et al. 2011). The TEC has a broad mandate and multiple functions including providing an overview of technological needs and analysis of policy and technical issues, recommend guidance on policies and programmes related to technology transfer, catalyse the development and use of technology road maps.[16] The CTCN is the implementing body of the Technology Mechanism and provides technical assistance at the request of developing countries to accelerate the transfer of climate technologies, creates access to information and knowledge on climate technologies and fosters collaboration among climate technology stakeholders.[17] The list of requested assistance to the CTCN makes clear that in at least half of the cases it concerns either energy supply or energy use.[18]

There has also been an increased engagement directly with energy issues in the technical examination process that is part of seeking to strengthen the pre-2020 mitigation activities of countries who are parties to the UNFCCC. This process has as aims to examine effective emission reduction policies, barriers to their implementation as well as scaling up, incentives and feasible options for support and consists of a series of thematic technical expert meetings and focused follow-up by Parties, IOs and partnerships.[19] Five out of the eight technical workshops held in 2014 and 2015 concerned some aspects of energy production or use.[20]

The negotiations for a new climate change agreement to be adopted at COP21 in Paris in December 2015 have continued the earlier tradition of silence on energy. There were very few explicit references to energy in the official negotiation text for the Paris Agreement, one of the exceptions is the proposal to establish an 'international renewable energy and energy efficiency bond facility' (UNFCCC 2015).[21] The informal negotiation text coming out in the last negotiation week before Paris had no reference at all to energy (ADP 2015).

Energy and Sustainable Development

The negotiations on sustainable development had another turn on the international agenda starting in 2012 with the UN Conference on Sustainable Development (Rio+20) in which energy were linked not only to environment

[16] See http://unfccc.int/ttclear/templates/render_cms_page?s=TEM_FNC.

[17] See http://unfccc.int/ttclear/templates/render_cms_page?TEM_ctcn.

[18] See https://www.ctc-n.org/technical-assistance/technical-assistance-requests, accessed 31 October 2015.

[19] See http://unfccc.int/focus/mitigation/technical_expert_meetings/items/8179.php.

[20] See http://unfccc.int/focus/mitigation/technical_expert_meetings/items/8179.php.

[21] Depending on production process of the book this can be updated with the content of the Paris Agreement.

but also economy and well-being. The outcome document 'The Future We Want' emphasized 'the need to address the challenge of access to sustainable modern energy services for all, in particular for the poor' and the need to take further steps 'to improve these services in a reliable, affordable, economically viable and socially and environmentally acceptable manner in developing countries' (United Nations General Assembly 2012).[22] It also recognized that 'improving energy efficiency, increasing the share of renewable energy and cleaner and energy-efficient technologies are important for sustainable development, including in addressing climate change' and it noted the launching of the 'Sustainable Energy for All' initiative (United Nations General Assembly 2012).[23] The UN Secretary-General had launched this SE4All initiative as a partnership between governments, business and civil society that he believed could achieve his vision of achieving sustainable energy for all in 2030. The fact that governments did not endorse, encourage or support but merely 'note' the initiative—indeed the G77/China wanted no reference to the initiative while the USA wanted even stronger language on the enabling role of the private sector (2012)—could either be a reflection of resistance to institutionalize energy in UN based global governance or the resistance to the means of doing it through a partnership with non-state actors rather than as responsibility by states alone. Nonetheless, the Rio+20 became an important 'launch pad' for the SE4All action network and within short time it had registered 120 commitments and $320 billion in pledged. In addition, Brazil pledged at Rio+20 to achieve universal energy access within the country by 2014 and to invest $235 billion in renewable energy over the next ten years (Cutter et al. 2013).

The energy text in the Rio+20 outcome document was one of the most sensitive issues on the agenda and was subject to direct intervention by the host country (Brazil) who took a very proactive strategy to ensure agreement on the outcome (IISD 2012c). The very heading of the energy section was contested between the options of 'sustainable energy' (supported by eg EU and Norway) and 'energy' rejected by, for example, Belarus (IISD 2012a). A proposal by the EU that emphasized that every country should implement national energy policies and low-emission development strategies was

[22] Para 126.

[23] Para 128–129.

supported by Canada and New Zealand but opposed by the G-77/China (IISD 2012b). The final text on national efforts were only for providing access to 'modern' energy (United Nations General Assembly 2012). Old battles on the role of renewable energy versus cleaner fossil fuels surfaced again, and the paragraph on fossil fuel subsidies was one of the most heavily contested late in the negotiations (2012).

Whatever reason for the resistance towards the SE4All initiative, however, already in 2013 the UNGA adopted the resolution that launched the UN Decade of Sustainable Energy for All for 2014–2024 in which it '[r]eaffirms its determination to act to make sustainable energy for all a reality' (United Nations General Assembly 2013).[24] The resolution encourages states to take measures to promote new and renewable energy sources but also calls upon the UN Secretary-General to 'promote renewable energy and related sustainable practices in all United Nations facilities around the world' although no extra resources were provided for that (United Nations General Assembly 2013).[25] Strong support for the SE4ALL initiative came in the Addis Ababa Action Agenda, adopted in mid-July 2015 and capturing the agreements on how the post-2015 agenda should be financed. The outcome text not only 'welcomed' the SE4All initiative but also 'called for action on its recommendations' and noted the potential to raise over $100 billion in annual investments by 2020 'through market based initiatives, partnerships and leveraging development banks' (United Nations General Assembly 2015b).[26]

The resolution launching the new UN decade also highlighted the importance of 'giving appropriate consideration to energy issues' in the post-2015 development agenda (United Nations General Assembly 2013).[27] This agenda, referring to the negotiations of what would replace the Millennium Development Goals (MDGs) as guiding international development after their expiration in 2015, came to revolve around the decision at Rio+20 to adopt SDGs. These were officially negotiated by the Open Working Group (OWG) in the period from March 2013 to July 2014 after which the UNGA took over to negotiate the accompanying text for the goals (and also make minor changes to some of the goals). The goals were finally adopted at a

[24] Para 10.

[25] Para 18.

[26] Para 49

[27] Para 11.

special summit of the UNGA on 25 September 2015 (United Nations General Assembly 2015a). The OWG was limited to 30 seats but used an innovative, constituency-based system of representation that had not been tried earlier in new to limited membership bodies of the UNGA. This meant that most of the seats in the OWG were shared by several countries and not necessarily the most like-minded ones. The OWG process was also unusually open to input from non-state actors.

Many, but not all, actors argued for a separate SDG on energy. Among those who did was the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda (2013) who argued that there should be a goal to 'secure sustainable energy' with possible targets such as double the share of renewable energy in the global energy mix; ensure universal access to modern energy services; double the global rate of improvement in energy efficiency in buildings, industry, agriculture and transport; and phase out inefficient fossil fuel subsidies that encourage wasteful consumption. Others who came out strong for an SDG dedicated to energy were the SE4All initiative, the Global Thematic consultation, Save the Children and UN Compact (UN System Technical Support Team nd). Those, such as the EU Commission, who argued energy should rather be integrated in other SDGs sought to do this in order to limit the number of goals and allow related goals to be addressed together (UN System Technical Support Team nd).

The OWG discussions on energy started in their fifth session where there was, according to the Co-chairs' summary, convergence on a number of issues such as having a dedicated goal on energy. Indeed, the summary states that a majority of countries showed support for a dedicated goal on energy that incorporated the targets of the SE4ALL initiative on achieving universal access to energy, doubling the share of renewables in the global energy mix and doubling the rate of improvements in energy efficiency by 2030 (Co-chairs 2013). After having discussed all potential SDG themes in a series of eight sessions, the Co-chairs released a document that identified 19 focus areas, energy being one of them. They outlined possible elements of an SDG on energy—omitting the 'sustainable' concept in relation to providing access to 'affordable, modern and reliable energy sources' and there was only mention of 'increasing'—rather than doubling—the share of renewable energy in the global energy mix (OWG Co-chairs 2014). Energy issues were also highlighted in a number of other focus areas such as industrialization, gender equality and sustainable production and consumption (OWG Co-chairs 2014). In the ensuing discussions, a number of countries supported a stand-alone SDG on sustainable energy—including Germany, Austria, Australia, Guatemala, Republic of Korea, Nauru and Trinidad and Tobago—and some countries—notably Cyprus, Romania, Singapore and United Arab Emirates—explicitly found the SE4ALL goals a good basis for such an SDG (IISD 2014b). Other countries such as China, Tanzania and the least developed countries stressed the need to provide modern and affordable energy for development, to ensure, in the words of the Chinese delegate 'global energy safety' (IISD 2014b). Proposals for targets that did not make it to the final text included phasing out (inefficient or harmful) fossil fuel subsidies favoured by a number of European countries and reducing the per capita energy consumption of developed countries, the latter suggested by India and China (IISD 2014a).[28] Another theme raised by several countries—for example, Latvia and Sweden—that did not make it to the final text was the gender perspective on energy access (IISD 2014a).

Although the structure of the OWG to some degree reduced the role of the traditionally very influential coalitions such as G77/China and enabled, for example, small island states to voice strong support for renewable energy, some 'old' issues in the developed–developing country dynamic still had a strong presence. Developing countries tied what became goals 7.2 on increasing the share of renewables in the global energy mix, and 7.3 on doubling the global rate of improvement in energy efficiency to provisions of financial support and technology transfer, thus the goals on Means of Implementation 7a and 7b (see Box 5.1). For developing countries, the global character of the goal implied the relevance of the common but differentiated responsibilities and respective capabilities (CBDR) principle that means a leadership role for developed countries.[29] And the battle over the role of fossil fuels versus renewables that had been fought in every previous negotiation was also fought here; every additional placing of 'sustainable' as qualifier raised resistance as did any reference to cleaner fossil fuels. In the end, sustainable remained in the overall goal but not in the target on access (7.1), and it was kicked out of 7a on international cooperation but remained in 7b on infrastructure and technology in developing countries—where bilateral and multilateral donors will have a significant role.

[28] However, the Addis Ababa Action Agenda does contain text on fossil fuel subsidies in line with the Rio+20 outcome text (United Nations General Assembly 2015b).

[29] Interview NGO Official, 30 October 2015.

Box 5.1. Final version of Sustainable Development Goal No. 7

Goal 7: Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix
7.3 By 2030, double the global rate of improvement in energy efficiency
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, and small island developing States

Source: United Nations General Assembly (2015a).

5 Reflections for the Future

It is often claimed that the less powerful states have most to gain from universal multilateralism because the powerful states can simply have their way outside that system. Yet also the powerful states gain from operating within the boundaries of what is seen as legitimate institutions and can invest considerably in influencing what such legitimacy looks like (Clark 2005). The story of energy in the UN described in this chapter is a good illustration of this. The various efforts that have been made over time to develop international norms relevant for energy production and consumption and institutionalized collaboration among IOs of the UN on the theme show that even powerful actors spend considerable efforts in ensuring the outcome reflect their preferences. The universal membership of the UN does provide it legitimacy and convening power that for many developing countries the International Energy Agency will never have as a club with only developed country membership. It is against this backdrop that we should evaluate the implications of the strengthened position of energy in the UN landscape through primarily the SDG7 but also the SE4ALL partnership.

In the 2015 Summit outcome document—Transforming Our World—which includes the SDGs, states claim that through the goals and targets they 'are setting out a supremely ambitious and transformational vision' envisaging '[a] world where human habitats are safe, resilient and sustainable and where there is universal access to affordable, reliable and sustainable energy' (United Nations General Assembly 2015a).[30] Will such aspirations have influence? Will the SDG7 change the behaviour of states and IOs? The literature on the influence of international norms provide a mixed and uncertain picture particularly in relation to soft (non-legal) norms such as the SDGs. Rationalists will see limited impact of these if they are not associated with significant material or immaterial sanctions (Vihma et al. 2011). Constructivist see more potential for their contribution to learning and dialogue, a process of norm diffusion (Finnemore and Sikkink 1998). One element that will likely affect the ultimate influence of these new universal norms is the kind of follow-up and review that they will be subject to, indeed how states will be held to account for their (lack of) implementation by each other or other actors such as civil society. One of the few civil society actors that followed the SDG7 negotiations closely sees the new agenda on energy as a positive, if humble, step forward:

> one of the few things we got in Rio was the reference to fossil fuel subsidies and now we at least have a goal on energy. The energy sector is being pulled into multilateral agreements, monitoring, and accountability and that is hopeful … but it should have been much more focused on sustainable energy.[31]

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[30] Para 7.

[31] Interview NGO Official, 30 October 2015.

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6

The World Trade Organization's Role in Global Energy Governance

Timothy Meyer

1 Introduction

Since 1947, the international trade regime has brought increasing amounts of global economic activity within its ambit. The General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO), have reduced tariffs on an ever-increasing number of products. With the creation of the WTO in 1995, the international trade regime added disciplines on intellectual property (IP) and trade in services to its portfolio. Yet despite this expansion, and its incredible success in liberalizing trade, one sector of the global economy—perhaps the most important center of the global economy—has largely eluded comprehensive regulation by the multilateral trade regime: energy.

To be sure, WTO disciplines affect various aspects of the trade in energy. Energy-related goods, such as oil or solar panels, are governed by the GATT, including its rules on non-discrimination, freedom of transit, and its ban on import and export restrictions. Subsidies for energy products are governed by the Agreement on Subsidies and Countervailing Measures (SCM Agreement). The General Agreement on Trade in Services (GATS) governs trade in energy-related services. Consequently, the WTO Dispute Settlement Body (DSB) has decided a wide range of energy-related dis-

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putes, ranging from disputes about renewable energy subsidies[1] to disputes about the content and environmental consequences of gasoline.[2] Despite these disputes, however, nations and commentators alike seem to view the WTO as an inadequate framework for global energy governance. States have tried to overcome the WTO's shortcomings through the creation of comprehensive energy-specific institutions, such as the Energy Charter Treaty (ECT). The United Nations Framework Convention on Climate Change is to a very large extent an institution designed to address the environmental consequences of a global economy wedded to fossil fuels. Regional institutions such as the European Union (EU) have developed significant energy programs.

This patchwork of approaches has not, however, supplied a framework for reliable cooperation in international energy. In particular, major fossil fuel suppliers have remained outside of the ECT, while climate change negotiations have stumbled forward with limited effectiveness for nearly 20 years. In the meantime, the WTO has established itself as one of the most successful international organizations ever. Understandably, therefore, as the world tries to transition from a fossil fuel-based economy to a renewable energy-based economy, the WTO is increasingly thrust into the spotlight.

This chapter provides an overview of the way in which WTO rules have been, or might be, used to govern the energy sector. Part II gives a brief history of the GATT/WTO, with special attention to the role of energy. Part III describes the rules in the GATT that are most directly applicable to problems in the energy sector. Part IV discusses the SCM Agreement, an agreement of potentially great relevance to the highly subsidized energy sector. Turning to trade in services, Part V describes the GATS, while Part VI describes the Agreement on Trade-Related Aspects of Intellectual Property (TRIPS Agreement). Finally, Part VI turns to consider why the GATT/WTO has played a limited role in energy governance to date, and whether we might expect to see the WTO's role become more prominent in the future. In particular, I argue that the differential treatment between fossil fuels and renewable energy in the WTO reflects (a) the greater number, and the identity, of nations that aspire to be 'producers' of renewable energy, and (b) the expected growth in renewable energy in years to come.

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[1] Appellate Body Reports, *Canada—Certain Measures Affecting the Renewable Energy Generation Section, Canada—Measures Relating to the Feed-in Tariff Program*, 5.85, WTO Doc. WT/DS412/AB/R, WT/DS426/AB/R (adopted May 24, 2013) [hereinafter *Canada—Renewable Energy*].

[2] Appellate Body Report, *United States—Standards for Reformulated and Conventional Gasoline*, WTO Doc. WT/DS2/AB/R (adopted May 20, 1996) [hereinafter *United States—Gasoline*].

2 The GATT/WTO

The GATT's Origins

Originally negotiated immediately after the Second World War, the GATT was intended as a provisional agreement only. Its negotiation was accompanied by the negotiation of the Havana Charter of the International Trade Organization ('ITO'). States intended for the ITO to stand as the third leg of the Bretton Woods institutions, along with the International Monetary Fund and the World Bank. Unlike the GATT, the Havana Charter was comprehensive in its coverage, dealing with not only trade in goods but also investment. In part because of its view that the investment provisions in the Havana Charter favored capital-importing nations, however, the USA declined to ratify the treaty (Schill 2009, p. 33). The treaty thus never came into force and the ITO never came into being.

This failure left the original 23 GATT contracting parties with a provisional agreement only, one that lacked any significant institutional structure to support its operation. Nevertheless, the GATT contracting parties proceeded to apply the agreement with great success for nearly 50 years. The GATT evolved through a series of negotiating rounds during which the GATT parties would elaborate more detailed trade liberalization commitments. The early negotiating rounds dealt principally with reductions in tariffs among member states. By the 1970s, however, most of the gains among member states from reduced tariffs had been achieved. Beginning with the Tokyo Round (1973–1979), nations thus shifted their attention increasingly toward non-tariff barriers to trade, including rules on health and safety measures and technical measures or regulations.

In addition to opening markets through reduction in tariffs and then later through the discipline of non-tariff barriers, parties also reduced global barriers to trade in products by expanding the ranks of their membership. While the GATT had 23 original contracting parties in 1947, by 1994 the GATT had 128 parties.[3] As of 2015, the WTO had expanded further to 161 parties.[4]

[3] *World Trade Organization*, The 128 countries that had signed GATT by 1994, available at: https://www.wto.org/english/thewto_e/gattmem_e.htm (accessed Sept. 10, 2015).

[4] *World Trade Organization*, Members and Observers, available at: https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm (accessed Sept. 10, 2015).

The Creation of the WTO

Despite its success, or perhaps because of it, by the 1980s, member states keenly felt some of the GATT's shortcomings. Most prominently, the GATT did not have an especially well functioning dispute resolution system. Under the GATT dispute settlement system, a panel of arbitrators heard disputes between member states and issued reports. These reports, however, did not bind the parties unless all member states agreed to the adoption of the panel report (Davey 2003). Practically speaking, this consensus rule meant that the losing party also had to agree before the panel's opinion could be adopted. Indeed, parties to a dispute could invoke consensus decision-making as a means of slowing down the dispute resolution process, such as by blocking the appointment of a panel (Davey 2003).

In addition to the deficiencies in the dispute settlement system, the GATT applied only to trade in goods and thus did not reach increasingly significant sectors of the global economy, most notably trade in services and IP. To address these concerns, during the Uruguay Round (1986–1994) GATT parties began negotiating what would become the Marrakesh Agreement Establishing the WTO. At the close of the Uruguay round in 1994, the USA and the EU withdrew from the GATT and signed the Marrakesh Agreement (Steinberg 2002, pp. 359–360). Nations wishing to maintain preferential market access with the USA and the EU had to follow.

The Marrakesh Agreement had a number of important features. First, it reincorporated the GATT along with a series of understandings the parties had worked out as to how the GATT was to be interpreted.[5] Second, the parties included a series of agreements fleshing out the rules governing different types of non-tariff barriers to trade in goods. These agreements included the Agreement on Sanitary and Phytosanitary Measures, the Agreement on Technical Barriers to Trade (TBT), and the SCM Agreements. Third, the parties included comprehensive agreements on trade in services (the GATS) and IP (TRIPS Agreement). Fourth, the Marrakesh Agreement included a revamped dispute settlement system. Most importantly, the WTO's Dispute Settlement Understanding (DSU) created a process through which dispute settlement reports are automatically adopted as binding unless all parties agree not to adopt the report.[6] This 'reverse consensus rule' ensures that even

[5] The GATT that currently applies to WTO members is the GATT (1994), which incorporates the GATT (1947), that is, the original GATT, plus some understandings and protocols adopted by GATT parties over the years.

[6] *See* Understanding on Rules and Procedures Governing the Settlement of Disputes arts. 16.4 & 17.14, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 2, 1867 U.N.T.S. 410 [hereinafter 'DSU'].

the prevailing party in a dispute must agree not to adopt the report in order to block it. Additionally, the DSU introduced a procedural timeline designed to ensure that parties could not unduly delay the progress of a dispute.[7] Finally, the DSU introduced appellate review by an Appellate Body.[8]

The WTO also strengthened non-judicial forms of monitoring and enforcement. The WTO created councils for each of the three main areas of trade: goods, services, and IP.[9] These councils are empowered to create subsidiary bodies, which now exist for many of the specialized agreements on trade in goods (e.g., a Committee on Sanitary and Phytosanitary Measures, a Committee on TBT, etc.).[10] Parties can thus bring complaints to the relevant council or committee, rather than go straight to the more judicialized DSB. For example, after the USA initiated a dispute with India through the DSB in 2013 over the alleged illegality of India's Jawaharlal Nehru National Solar Mission program, India responded by raising questions about the WTO consistency of a variety of local renewable energy subsidy programs in the USA. India did not, however, raise these disputes within the DSB. Rather, it raised them as requests for information in the Committee on SCM and the Committee on Trade-Related Investment Measures (TRIMs).[11] Discussions within the committees and councils can clarify how the parties understand the applicable WTO rules, how they apply them to certain factual situations, and can facilitate negotiated resolutions to disputes without the need to resort to formal dispute settlement.

The close of the Uruguay Round and the creation of the WTO are the high water mark for the expansion of liberalized trade through the WTO. In 2001, the parties initiated the Doha Round, which to date has accomplished relatively little. Deeper levels of trade liberalization have been accomplished through larger and larger preferential trade agreements among subsets of WTO membership. The two most important such agreements currently under discussion already are Trans-Pacific Partnership and the Trans-Atlantic Trade and Investment Partnership (for more on the latter, see Chap. 8). The WTO's

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[7] *See* DSU arts. 6–8 (establishing timelines for the establishment of a panel).

[8] DSU Article 17.

[9] Marrakesh Agreement Establishing the World Trade Organization Article IV.5, April 15, 1994, 1867 U.N.T.S. 410 [hereinafter 'Marrakesh Agreement'].

[10] Marrakesh Agreement Article IV.6.

[11] Subsidies questions posed by India to the United States under article 25.8 of the Agreement on Subsidies and Countervailing Measures—State Level Renewable Energy Sector Subsidy Programs With Local Content Requirements. WTO Committee on Subsidies and Countervailing Measures; Certain Local Content Requirements in Some Of The Renewable Energy Sector Programs—Questions By India to the United States. WTO Committee on Trade-Related Investment Measures.

most substantial success has been its dispute settlement process. Since its inception on January 1, 1995, the DSU has received approximately 500 complaints. While not all have resulted in panel or Appellate Body reports, those that have, enjoyed high levels of compliance by member states (Davey2009). Indeed, the WTO DSB is among the, if not the, most successful international tribunals ever to exist.

Energy in the GATT/WTO

WTO rules fully apply to energy and energy-related products (Selivanova 2012; Marceau 2012). These products include fossil fuels themselves, such as oil, natural gas, or coal. They also include derivative products of those fuels, such as gasoline for automobiles and energy-related equipment, including not only equipment related to traditional energy sources such as fossil fuels, but also renewable energy generation equipment. The GATT thus applies, for example, to wind turbines, photovoltaic cells, and biodiesel fuels. Indeed, because of the comprehensive coverage of the GATT, new energy products will be covered by the GATT as they are invented.

The potential significance of the GATT/WTO for energy trade is clear when one realizes that fuel exports are the single largest category of global merchandise exports in the world. In 2013, fuel exports ran to $3258 billion, which constituted 17.8% of global exports (WTO 2013).[12] Given the prominence of trade in energy, it would be surprising if the original GATT contracting parties had intended to exclude energy products from the scope of the GATT. Nevertheless, the absence of specific reference to energy products in the GATT and, indeed, in the negotiations leading up to the GATT in 1947, have led some to suspect that energy was not included (Selivanova 2010, p. 52).

This view has very little to recommend it. Although the GATT does not explicitly make reference to energy anywhere, it does contain a provision in Article XX(g) permitting parties to deviate from their GATT commitments in order to 'conserve[e] exhaustible natural resources.'[13] GATT negotiators understood this phrase to refer to stock resources capable of depletion, a view of the original meaning of Article XX(g) adopted by the WTO's Appellate

[12] Chemicals, *International Trade Statistics 2013*, available at: https://www.wto.org/english/res_e/statis_e/its2014_e/its14_merch_trade_product_e.pdf. Chemicals were the second largest exported product at $2001 billion and 10.9% of world merchandise trade.

[13] GATT Article XX(g).

Body (Charnovitz 1991, p. 45).[14] Similar references to natural resources can be found in the Havana Charter of the ITO.[15] Furthermore, where parties wish to accord special treatment to certain products within the GATT, as in the case of agriculture and textiles, they have done so explicitly.[16]

Member states have also felt free to raise energy issues within the GATT/WTO in the years since the GATT's initial negotiation. International law rules on treaty interpretation dictate that 'subsequent practice in the application of the treaty' shall be considered in interpreting a treaty's meaning, further bolstering the view that energy is within the GATT's ambit.[17] During the 1970s, the USA unsuccessfully sought to address export restrictions and dual pricing of fossil fuels within the GATT's Tokyo Round (Leal-Arcas et al. 2014). [18] More recently, states have included energy issues within the larger mandate of the current Doha Round of negotiations. Among its priorities, the Doha Round includes liberalizing trade in environmental goods, increased liberalization of trade in services, and trade facilitation.[19] Under these rubrics, member states have introduced proposals for the reduction on tariffs for green energy technologies such as wind turbines and solar panels; proposed discipline on export restrictions and taxes; considered ways to improve on transport under the rubric of trade facilitation; and several nations such as the USA and Norway included energy as a separate sector in their services proposals (Marceau 2012, p. 387).

Energy negotiations have also played an important role in WTO accessions. Unlike many international treaties, which new members may simply join, the WTO requires new members to make specific commitments unique to the acceding member. These commitments become part of new member's WTO commitments through their accession protocols. Existing members have frequently used accession protocols to target energy policies that they have had little success pursuing in multilateral negotiations. Under the GATT, for example, Mexico explicitly preserved the right to maintain

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[14] Apellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products*, WT/DS58/AB/R (adopted November 6, 1998) 128 (holding that living resources qualify as 'exhaustible natural resources' in the same way that non-living natural resources such as, inter alia, petroleum do).

[15] *See* United Nations Conference on Trade and Employment, March 1948, Havana Charter for an International Trade Organization, articles 10 & 45, U.N. Sales No. 48.II.D.4, E/CONF.2/78 (1948).

[16] Agreement on Agriculture & Agreement on Textiles and Clothing, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 410.

[17] Vienna Convention on the Law of Treaties Article 31.3(b), May 23, 1969, 1155 U.N.T.S. 331.

[18] Dual pricing refers to a situation in which a country mandates a domestic fuel price lower than the global price of the same fuel. The artificially low domestic price of fuel acts both as an export restriction (because more fuel is consumed domestically rather than exported) and as a subsidy to domestic industries that consume fossil fuels.

[19] WTO, Ministerial Declaration of November 14, 2001, WT/MIN(01)/DEC/1.

export restrictions in the energy sector in its 1986 accession protocol (Leal-Arcas et al. 2014, p. 125). In 1990, however, Venezuela—a member of the Organization of Petroleum Exporting Countries (OPEC), which had at the time recently begun imposing production quotas—declined to push for a similar exemption, despite expectations that it would (Leal-Arcas et al. 2014, pp. 125–26).

Under the WTO, states have secured accession protocols to obtain a range of potentially important country-specific concessions. Most importantly to date, China agreed in its 2001 accession protocol to do away with export restrictions on certain raw materials and rare earths used in the production of a range of technology, including wind turbines and other energy technologies. Beginning in 2009, the USA successfully challenged China's continued imposition of these export restrictions through the DSB.[20] In this way, China's accession protocol has provided a basis for liberalizing trade in factors of production critical to renewable energy technologies. At the same time, the case may signal an effort to develop a WTO jurisprudence limiting export restrictions. Other accession protocols with energy-specific provisions include Ukraine's, which makes energy-specific commitments regarding transport of energy through Ukraine, and Saudi Arabia's, which includes provisions on dual pricing (Marceau 2012, p. 387).[21]

Beyond facilitating energy-related negotiations, the WTO DSB also plays an increasingly important role in the adjudication of energy-related disputes. In one of its earliest cases, for example, Venezuela and Brazil challenged a US regulation imposed under the Clean Air Act that permitted gasoline refiners and importers to sell only gasoline of a certain cleanliness.[22] In a pattern that has recurred in energy-related disputes (and environmental disputes more generally) at the WTO, the complainants did not directly challenge the USA's right to impose environmental regulations. Instead, they prevailed in the case by arguing that the US regulation imposed a harsher standard on foreign gasoline than on gasoline refined in the USA. More recently, the EU has become embroiled in a series of disputes about the biofuels sector. In 2012 and then in a separate action in 2013, Argentina challenged certain measures applied to the biofuels sector by the EU and some of its member

[20] Appellate Body Report, *China—Measures Related to the Exportation of Various Raw Materials*, WT/DS394/AB/R, WT/DS395/AB/R, WT/DS398/AB/R (adopted February 22, 2012); Appellate Body Report, *China—Measures Related to the Exportation of Rare Earths, Tungsten, and Molybdenum*, WTO Doc. WT/DS431/AB/R, WT/DS432/AB/R, WT/DS433/AB/R (adopted August 29, 2014).

[21] The Saudi concessions, for example, provided that pricing of domestic sales of natural gas would be on the basis of commercial considerations, with an eye toward recovering costs plus a reasonable profit.

[22] *See United States—Gasoline*, *supra* note 2.

states.[23] In 2013 and 2014, Argentina and Indonesia separately challenged European anti-dumping duties (ADDs)—duties imposed on imported products that are sold below 'normal' (ideally market) value—on biofuels.[24] Also in 2014, Russia challenged the EU's Third Energy package as violating a range of WTO disciplines on both products and services insofar as it prevents the vertical integration of natural gas and electricity production with transmission (Russian energy companies are vertically integrated) and contains allegedly discriminatory certification requirements for third countries.[25] Russia's challenge represents a rare case by an energy supplier challenging restrictions on international trade in fossil fuels.

A raft of disputes have focused on other kinds of renewable energy technology. Most prominently, in 2011 Japan and the EU challenged a feed-in tariff (FIT) program created by the Canadian province of Ontario on the grounds that it provided an unlawful subsidy and also that it was discriminatory in violation of the WTO's national treatment (NT) obligation. The program required payments to electricity generators who generated a certain portion of their electricity using renewable sources, provided that the renewable energy generation equipment was local in origin. The WTO Appellate Body upheld a finding that this latter 'local content requirement' unlawfully discriminated against foreign products. In the wake of *Canada—Renewable Energy*, research has indicated that a wide range of subnational renewable energy support programs may be vulnerable to WTO challenge on similar grounds (Meyer 2015). Indeed, India and China have already raised several such programs within the USA, although both have done so outside the DSB (Meyer 2015). The USA

[23] Request for Consultations by Argentina, *European Union and a Member State—Certain Measures Concerning the Importation of Biodiesels*, WTO Doc. WT/443/1 (August 17, 2012); Request for Consultations by Argentina, *European Union—Certain Measures on the Importation and Marketing of Biodiesel and Measures Supporting the Biodiesel Industry*, WTO Doc. WT/DS459/1 (May 23, 2013).

[24] Request for Consultations by Indonesia, *European Union—Anti-Dumping Measures on Biodiesel from Indonesia*, WTO Doc. WT/DS480/1 (June 17, 2014); Request for Consultations by Argentina, *European Union—Anti-Dumping Measures on Biodiesel from Argentina*, WTO WT/DS473/1 (January 8, 2014). Anti-dumping duties are duties imposed on imported products that are sold below 'normal' value. The idea is to impose a duty equal to the difference between the 'normal' value (ideally the market value if there is a free market price) and the price at which the goods are actually sold. Such a duty should, in theory, level the playing field between 'dumped' imports and domestic products. Anti-dumping duties, because they respond to the private pricing decisions of importers, are imposed at the national level. An exporting country whose importers are subject to anti-dumping duties may then challenge the imposition of those duties before the WTO. *See* Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade, April 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, Legal Instruments—Results of the Uruguay Round, 33 I.L.M. 1125, 1141 (1994).

[25] Request for Consultations by Russia, *European Union and its Member States—Certain Measures Relating to the Energy Sector*, WT/DS476/1, S/L/409, G/L/1067; G/SCM/D102/1; G/TRIMS/D/40; S/L/409; WT/DS476/1, May 8, 2014.

has challenged certain Indian measures supporting the solar sector.[26] Similarly, China has challenged the EU, Greece, and Italy, for imposing a range of allegedly discriminatory renewable energy support measures, including local content requirements.[27] These disputes are ongoing as of the time of writing. China also successfully challenged the USA's application of countervailing duties (CVDs) (duties imposed to offset subsidization) and ADDs to a range of products, including Chinese wind turbines.[28]

These cases reveal a trend toward using the WTO to challenge measures designed to support, and allegedly provide unlawful protection for, the renewable energy sector. Indeed, while the GATT and the WTO in its early years saw few cases directly about energy (*US—Gasoline* being the notable exception), the last five years have seen an explosion of such cases. The WTO thus promises to play an important role in regulating how governments facilitate the transition away from a fossil fuel-driven economy.

Interestingly, despite the number of challenges brought recently to renewable energy measures, the GATT/WTO dispute settlement system has never seen a direct challenge to fossil fuel support measures, including subsidies. In the words of former WTO Director-General Pascal Lamy, 'discussion on the reform of fossil-fuel subsidies has largely bypassed the WTO. This is a missed opportunity' (Lamy 2013). This juxtaposition is especially puzzling because fossil fuel subsidies are many times the size of renewable energy subsidies. The International Energy Agency (IEA) estimates that global fossil fuel subsidies were $550 billion in 2013.[29] By contrast, global renewable energy subsidies are relatively modest, totaling only $120 billion in 2013.[30] Lawyers and political scientists have puzzled over this absence of WTO challenges to fossil fuel measures at a time when world leaders are proclaiming an interest in reforming fossil fuel subsidies and when governments seem eager to use the WTO as a vehicle to regulate renewable energy subsidies. Using the WTO to challenge renewable measures but not fossil fuel measures risks further slowing

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[26] Request for Consultations by the United States, *India—Certain Measures Relating to Solar Cells and Solar Modules*, WTO Doc. WT/DS456/1 (Feb. 11, 2013).

[27] Request for Consultations by China, *European Union and Certain Member States—Certain Measures Affecting the Renewable Energy Generation Sector*, WTO Doc. WT/DS452/1 (Nov. 5, 2012).

[28] Appellate Body Report, *United States—Countervailing and Anti-dumping Measures on Certain Products from China,* WTO Doc. WT/DS449/AB/R (July 7, 2014). China challenged, inter alia, the application of countervailing and anti-dumping duties to 'non-market' economies, as well as the resulting duties.

[29] World Energy Outlook 2013, International Energy Agency, available at: http://www.iea.org/textbase/npsum/weo2014sum.pdf. Depending on what one classifies as a subsidy, the amount of fossil fuels subsidies can be quite a bit higher.

[30] World Energy Outlook 2013, International Energy Agency, available at: http://www.iea.org/textbase/npsum/weo2014sum.pdf.

the transition away from a carbon-based economy by imposing burdens on government support for renewable energy not faced by fossil fuels, renewable energy's primary competitor for both market share and government support.

3 Rules on Trade in Products

WTO rules distinguish between three kinds of trade: trade in goods, trade in services, and trade-related aspects of IP. This Part describes the rules applicable to trade in goods. Part IV gives an overview of the rules applicable to trade in services, while Part V describes WTO rules applicable to IP.

GATT

The original, and still most important, WTO agreement is the GATT. The GATT contains a number of rules of importance to trade in energy products. Additionally, at the close of the Uruguay Round parties concluded a series of agreements applicable to trade in goods that, for the most part, elaborated on rules already present in the GATT. This section briefly describes the rules contained in the GATT itself, while the sections that follow describe these additional agreements.

Tariffs

The GATT is deservedly famous for reducing tariffs across a wide range of products. When nations join the GATT/WTO, they agree to 'bind' their tariffs at a ceiling described in a document known as a Schedule. Article 2 of the GATT requires that nations imposed tariffs that are no higher than those contained in their schedules, although many nations have 'applied' tariffs—actual tariff rates—lower than their bound rates. Unlike most WTO obligations, tariff concessions are individual to each state and therefore vary among states.

Energy-related tariffs can be divided along two lines: traditional fossil fuels and renewable energy products. Tariffs on traditional fossil fuels are low. A 2010 WTO report estimated that in 2007 the average bound tariff rate for fuels was 25.3% globally, while the average applied rate was 5.8% (WTO 2010). These numbers mask significant differences between developed and developing countries. The average bound and applied rates among developed countries are 1.5% and 0.5%, respectively. Among developing and least-developed countries, the average bound and applied rates are 27.5% and 6.2%, respectively. These rates reflect the fact that the trade in fuels does not follow the logic of competition among producers. Many nations, especially developed nations, are not significant fossil fuel producers but require fossil fuels to satisfy their energy demands. Lacking any producers to protect through high tariffs or other import barriers, these nations will tend to have low tariffs in order to ensure an orderly energy supply.

Trade in renewable energy products such as biofuels and renewable energy-generation equipment presents a different problem. Natural resource endowments do not limit a nation's ability to produce these energy products. Indeed, any nation with the technical sophistication may enter the market for the production of renewable energy products. Consequently, nations may have an incentive to protect their renewable energy producers from foreign competition. Moreover, the expected growth of the renewable energy sector in the coming decades as fossil fuel resources are depleted or kept in the ground to reduce emissions increases the value to nations of developing a robust renewable energy sector today. As a consequence, we observe significantly higher tariff rates on renewable energy products, especially among developed countries. The EU, for example, has one of the most highly protected biofuels markets in the world, imposing tariffs that work out to a rate of between 39% and 63% (Kutas et al. 2007).[31] When renewable energy equipment is concerned, Burns reports that the mean global tariff on wind turbines is 7.4%, on solar panels is 8.8%, and on large gas turbines is 6.6% (Burns 2010).

In part because of these protectionist tendencies that attach to renewable energy equipment, WTO members have begun discussions on an Environmental Goods Agreement aimed at lowering trade barriers, most significantly tariffs, on environmental goods such as renewable energy products and services. To date, these discussions have not moved very far along. Should they pick up speed, however, they may well provide an impetus for the reduction in tariffs on renewable-energy generation equipment. Other countries have moved unilaterally to drop their tariffs. The USA, for example, allowed a 54-cents/gallon tariff on ethanol to expire in 2012, substantially opening the US ethanol market to imports. The US move followed a similar move in 2010 by Brazil (Winter 2012). The USA and Brazil are the world's largest ethanol producers.

[31] As discussed above and below, the EU also imposes anti-dumping duties on biofuels from certain countries (Indonesia and Argentina).

Non-discrimination

The GATT contains two non-discrimination rules: most-favored nation (MFN) and NT. The MFN obligation provides that a WTO member must extend any market concession made regarding the products of one state to the 'like' products of all other member states.[32] Although subject to exceptions, the MFN obligation applies broadly, including to member states' tariff schedules, which can be challenged as inconsistent with the MFN obligation if they attempt to impose different tariff on 'like' products. The chief exception to the MFN obligation comes from preferential trading agreements such as the North American Free Trade Agreement or the nascent Trans-Pacific Partnership and Trans-Atlantic Trade and Investment Partnership.[33] Nations are not legally required to extend concessions made within preferential trade agreements satisfying the GATT's requirements to other nations. Although not energy specific, the shift of trade negotiations from the WTO to preferential trade agreements has undercut the reach of the WTO's MFN obligation.

NT requires that the products of one member receive treatment no less favorable than the member state accords to 'like' domestic products.[34] NT applies both to internal taxation measures (such as sales tax or value-added tax) as well as internal regulations.

The NT obligation prohibits, or at least casts doubt upon the legality of, a number of measures of high relevance to the energy sector. For example, as discussed in Part II, in *Canada—Renewable Energy*, a WTO panel applied NT to strike down an FIT Ontario had put in place to pay its electricity generators for using renewable energy equipment. To qualify for the FIT program, electricity producers had to source their renewable equipment locally, a so-called local content requirement common in renewable energy support programs.

The NT obligation also calls into question the legality of carbon taxes. GATT Article III generally confers upon a member state the right to tax imported 'products' so long as the tax is not in excess of the tax applied on 'like' domestic 'products.' The NT obligation does not, in principle, allow states to tax 'processes or production methods,' even if the tax is equivalent to one applied to domestic products. Trade scholars refer to whether a particular feature of a product may be taxed as whether that feature of the product is 'border-tax adjustable.' For example, both imported and domestic products can be charged sales or excise taxes. These taxes are border-tax adjustable. But

[32] GATT Article I.

[33] GATT Article XXIV.

[34] GATT Article III.

a country may not impose a tax on imported products designed to offset the social security taxes paid by domestic producers. Such a tax is not a tax on a 'product' within the meaning of Article III, so it would be evaluated as a tariff governed by GATT Article II. It must, in other words, comply with a country's schedule of concessions.

This distinction means that a country might not be able to tax imports based on the carbon emitted in their production, even if the country imposes a similar domestic tax. Such a tax is not on the product itself, but rather the method through which it is produced. It is thus not adjustable at the border. If nations may not adjust carbon taxes at the border, they may be reluctant to impose them domestically for fear that industry will flee to countries without carbon taxes (so-called trade leakage). The question of whether at least some kinds of carbon taxes might be deemed to fall within Article III, and thus have only to satisfy its non-discrimination rule, is of critical importance in designing measure to combat climate change. At the same time, however, there is little WTO case law on the subject.

Non-tariff Barriers and Export Restrictions

Article XI of the GATT bans all prohibitions or restrictions, other than duties, taxes, or other charges, by WTO members on either the *import or export* of products. The provision is designed to encompass virtually all non-tariff barriers to trade, including quantitative restrictions such as quotas.[35] Import restrictions are not a significant issue in the energy sector for the same reasons that tariffs on energy products are not especially high. Export restrictions, however, are a large problem.[36] Many fossil fuel producing nations, from OPEC nations to the USA, restrict their export in some way. Export restrictions can create scarcity globally, driving up energy prices because countries cannot easily substitute other energy forms for fossil fuels. However, despite the broad language of Article XI (or perhaps because of it), few cases challenge export restrictions explicitly.

This reluctance may be explained in part by difficult questions about whether certain activities that have the economic effect of restricting exports actually qualify as restrictions under Article XI. For example, production quotas such

[35] Not surprisingly, although the ban is written in absolute terms, it is subject to exceptions. *See,* for example, GATT Article XIII.

[36] Export duties are not covered by Article XI, although export duties can restrict exports in similar ways to non-tariff barriers. For that reason, some nations have proposed binding export duties as well as import duties. *See* Alan Yanovich, *WTO Rules and the Energy Sector*, in Regulation of Energy in International Trade Law: WTO, NAFTA, and Energy Charter 9 (Yulia Selivanova, ed. 2011).

as those employed by OPEC have the effect of restricting the global supply of oil, but it is not clear that they qualify as export restrictions. Similarly, fossil fuel producing nations often employ 'dual pricing,' in which they mandate a domestic price for fuel that is below the global market price. The effect of this measure is to decrease exports by boosting domestic consumption (dual pricing also serves as a subsidy to energy-intensive domestic industries). Again, though, whether Article XI reaches this conduct is unclear. As a result, nations have raised export restrictions in the context of negotiations at the WTO and have sometimes sought concessions from new members (such as Saudi Arabia and China) on measures such as dual pricing, rather than bringing disputes based on the general language of Article XI (Milthorp and Christy 2011).

More recently, challenges to export restrictions have picked up, in part relying on these more specific concessions in accession protocols as the basis for the WTO challenges. The USA has led two cases—the *Raw Materials* case and the *Rare Earths* case—against China. Those cases challenged Chinese restrictions on the exports of minerals useful in a variety of industrial and manufacturing processes, including the production of some renewable energy equipment. In both cases, the Appellate Body upheld rulings finding the Chinese export restrictions incompatible with its Accession Protocol and Article XI.[37]

Transport

GATT Article V declares that '[t]here shall be freedom of transit through the territory of each contracting party … for traffic in transit to or from the territory of other contracting parties.'[38] Article V also requires MFN in the application of fees and formalities associated with transit, and limits the kinds of charges states may impose.[39] These rules on freedom of transit have potentially important significance in the energy sector. Trade in certain kinds of energy products, such as fuels that move through pipelines, are subject to hold up by transit states. Despite its potential significance, however, Article V has been of relatively limited use in the energy sector. The provisions were not drafted with energy-specific issues in mind, including making clear that the article does in fact apply to movement of goods through fixed infrastructure such as pipelines or electricity grids. This deficiency contributed to the negotiation of the ECT, as well as to proposals in the current Doha Round trade facilitation negotiations to clarify Article V's applicability. However, the

[37] *China—Raw Materials; China—Rare Earths*, *supra* note 31.

[38] GATT Article V(2).

[39] GATT Article V(3)–(5).

Trade Facilitation Agreement adopted in 2013 does not deal with energy specifically (Nedumpara 2014). Other proposals include requiring that private enterprises that operate transit facilities pursuant to the grant of 'exclusive or special privileges' from the government comply with the terms of Article V (WTO rules only apply to government actors) (Yanovich 2011).

Exceptions

Finally, the GATT contains a number of exceptions to its rules. The most important for energy is that contained in Article XX(g), which provides for an exception to GATT rules for efforts 'relating to the conservation of exhaustible natural resources.' This exception provides potential relief for nations, such as OPEC members, seeking to avoid legal responsibility for imposing restrictions on the export or production of fossil fuel resources, or for member states seeking to subsidize the renewable energy sector in otherwise GATT-inconsistent ways. Article XX(b) also provides an exception for measures 'necessary to protect human, animal, or plant life or health.'

Over the years, the DSB has gradually enlarged its understanding of the kinds of measures that might fall within the scope of the GATT Article XX exceptions. In general, though, panels remain suspicious of otherwise-inconsistent measures that member states seek to justify on Article XX grounds. To date, the most direct attempt to use Article XX(g) to justify export restrictions in a formal dispute was made by China in the *Raw Materials* and *Rare Earths* cases. China invoked both the Article XX(b) and XX(g) exceptions. In both cases, the panels held that China could not invoke the exceptions because its obligation to eliminate the relevant export restrictions came from its Accession Protocol and the general exceptions were not available as defenses to breaches of the Accession Protocol (the Appellate Body upheld this finding on appeal). In the alternative, the initial panels also found the exceptions inapplicable, holding in essence that China pursued economic purposes with its export restrictions, rather than health or environmental restrictions.

The China cases indicate the difficulty that nations would have invoking Article XX to justify export restrictions on other kinds of natural resources such as fossil fuels. When such restrictions operate to manipulate the price of a scarce commodity or to confer a commercial advantage on the nation imposing the restriction, the DSB is likely to strike the measure down. Measures supporting clean energy on the grounds that they protect human, animal, and plant life, or to conserve the atmosphere, which the Appellate Body has held to be an exhaustible natural resource, might have a better chance.

Even here, however, many measures would not survive review under current doctrine. Even if a measure falls within the scope of one of the Article XX exceptions, the measure must still satisfy the chapeau of Article XX. The chapeau prohibits measures that fall within the scope of one of the listed exceptions but nevertheless constitute arbitrary or unjustifiable discrimination or a disguised restriction on international trade. In practice, many measures that support an environmental purpose will fail this test. For example, in *United States—Gasoline,* the USA sought to defend its Gasoline Rule, which treated foreign importers of gasoline differently from domestic producers in violation of the NT obligation, on the grounds that the measure conserved exhaustible natural resources under Article XX(g). The Appellate Body agreed that the measure fell within the scope of the exception, but still held that the USA could not take advantage of the exception because the measure constituted unjustifiable discrimination and a disguised restriction on trade.[40]

Subsidies

The SCM Agreement, one of the Uruguay Round Agreements, has potentially broad implications for trade in energy. Fortunately or unfortunately, depending on one's perspective, the technicalities of bringing a case under the SCM Agreement may limit its application. In order to bring a claim under the SCM Agreement, a WTO member must show (1) a subsidy, (2) that is 'specific,' (3) and that is either (a) prohibited or (b) actionable. This test turns out to be difficult to satisfy.

In order to qualify as a subsidy within the meaning of the Agreement, the complainant must identify a financial contribution by a government that provides a benefit to the recipients. The financial contribution can take many different forms, including direct financial contributions, tax breaks, of in-kind provisions of goods or services. While the definition of a financial contribution is broad, the requirement that a contribution provides a 'benefit' is more difficult to satisfy. To provide a benefit within the meaning of the SCM Agreement, a financial contribution must, in general, provide greater value than the recipient could have obtained by looking beyond the government.[41] For example, if a government extends a loan to a solar panel manufacturer at the market interest rate, there is no subsidy. The loan qualifies as a financial contribution by the government, but there is no benefit because the terms

[40] *See United States—Gasoline*, *supra* note 2.

[41] *See* SCM Agreement Article 14.

of the loan are no better than what the solar panel manufacturer could have obtained in the private market. The government has not, in other words, provided the recipients with something it could not have obtained elsewhere. By contrast, if the loan were interest-free, then the loan would qualify as a subsidy. The benefit to the recipients would be the difference between the prevailing market interest rates and zero, the interest on the government loan.

In principle, determining whether there is a benefit is thus relatively simple. In practice, however, demonstrating there is a benefit can be extremely difficult, especially when one remembers that the complainant—the WTO member attempting to prove an unlawful subsidy—bears the burden of proof. In *Canada—Renewable Energy*, Japan and the EU challenged Ontario's FIT Program as an unlawful subsidy under the SCM Agreement. The initial panel determined that Japan and Canada failed to carry their burden of showing that the financial contributions provided a benefit. While the Appellate Body reversed this finding, the Appellate Body was unable itself to determine whether the FIT program provided a benefit because it had insufficient evidence about the relevant benchmark against which the payments under the FIT program should be compared.[42] In highly regulated markets such as energy, this difficulty in determining an appropriate benchmark against which to assess whether a benefit has been provided may be a recurring problem.

Even if a complainant is able to show a subsidy, only 'specific' subsidies are problematic. Subsidies can be specific in one of two ways. First, a subsidy is specific if it is limited to certain enterprises or industries. Second, a subsidy is automatically deemed specific if it is 'prohibited.'[43] Like 'benefit' analysis, 'specificity' represents a potential bar to the SCM Agreement's applicability to energy. For example, consumption subsidies for fossil fuels, including dual pricing measures, are often available to any purchaser. As a consequence, they would not be 'specific' and would thus not be incompatible with the SCM Agreement.

The final requirement is that a subsidy be either prohibited or actionable. Two kinds of subsidies are prohibited. First, subsidies that are contingent upon the use of domestic over foreign products are prohibited. Japan and the EU had hoped to have Ontario's FIT Program declared a prohibited subsidy under this provision. However, since they were unable to show a benefit, they never reached this stage of the analysis. Second, the Agreement prohibits subsidies that are contingent upon export performance.[44] These two categories of

[42] *Canada—Renewable Energy* 5.246.

[43] SCM Agreement Article 2.

[44] SCM Agreement Article 3.

subsidies are those WTO members deem most obviously protectionist and trade distorting. As mentioned above, prohibited subsidies are automatically deemed specific, and thus there is no need for an independent showing of specificity. Moreover, there is no need to show harm where prohibited subsidies are concerned. Having demonstrated a prohibited subsidy, the respondent nation is obliged to remove the subsidy. Unlike prohibited subsidies, actionable subsidies require the complainant to demonstrate some form of harm, referred to in the Agreement as 'adverse effects.'[45]

Anti-dumping and Countervailing Duties

WTO rules allow national governments to unilaterally impose so-called trade remedies in certain situations.[46] Of particular importance to international energy are ADDs and CVDs. Both of these remedies are duties that may exceed the bound tariff rate a nation is permitted to impose. ADDs respond to a situation in which foreign products are 'introduced into the commerce of another country at less than normal value'—in essence, predatory pricing.[47] CVDs refer to 'a special duty levied for the purpose of offsetting any bounty or subsidies bestowed, directly, or indirectly, upon the manufacture, production, or export of any merchandise.'[48] In practice, ADDs may also respond to subsidization if a product is sold at less than normal value as the result of a subsidy. In principle, governments should not impose both ADDs and CVDs in response to the same subsidy.

In order to impose duties, a nation must conduct a domestic investigation to determine that the prerequisites to the imposition of ADDs or CVDs have been met. Critically, the member state need not first seek WTO permission to impose the duty. Instead, once ADDs or CVDs are imposed, the targeted nation may bring a WTO challenge contending the imposition of ADDs or CVDs fail to comply with the relevant WTO rules embodied in GATT Article VI and either the Anti-Dumping Agreement or the SCM Agreement (which expand on the requirements contained in GATT Article VI).

The fact that ADDs and CVDs can be imposed by a member without first seeking WTO approval is an important deviation from the principle that members should not impose retaliatory measures without first seeking multilateral approval through the WTO process. Not surprisingly, the fact that they

45 SCM Agreement Article 5.

46 GATT Article VI.

47 GATT Article VI.1.

48 GATT Article VI.3.

can be imposed unilaterally makes them an attractive tool for protectionism. Indeed, many of the recent energy disputes before the WTO, described in Part II above, are ADD or CVD disputes. The USA and the EU have been particularly active in deploying trade remedies in the renewable energy sector, provoking challenges from Argentina, China, and Indonesia.[49] Notably, the effect of using trade remedies is to protect the domestic renewable energy sector at the expense of domestic consumers that are denied access to cheaper renewable energy products from abroad. The justification for trade remedies is thus really more political than economic. They permit governments to protect their industries in certain limited situations. Given the prevalence of subsidization in the renewable energy context, ADDs, CVDs, and the resulting WTO disputes seem likely to be a fixture in coming years.

Technical Barriers to Trade

TBT Agreement provides another agreement of potential future relevance to the energy sector. The TBT Agreement sets out rules governing technical regulations and product standards. Member states may adopt technical regulations so long as they comply with both NT and MFN obligations.[50] Technical regulations must also not be more trade restrictive than necessary to satisfy a legitimate objective, which includes protecting human and animal health or the environment.[51] The TBT Agreement promotes harmonization of technical regulations. It does this in two ways. First, it requires members to base their technical regulation on international standards where they exist unless they can demonstrate that the international standard is inappropriate to fulfill the regulation's legitimate purpose.[52] Second, it encourages members to accept the regulations of other members as equivalent to their own provided the foreign regulations adequately achieve the domestic regulation's underlying objective.[53] Finally, the TBT Agreement also applies to voluntary standards, establishing a code of conduct for the drafting of such standards and imposing an obligation on members to ensure that standardizing bodies adhere to the code.[54]

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[49] *See supra* notes 34–39.

[50] TBT Agreement Article 2.1.

[51] TBT Agreement Article 2.2.

[52] TBT Agreement Article 2.4.

[53] TBT Agreement Article 2.7.

[54] TBT Agreement Article 4.1. The obligation distinguishes between central government standardizing bodies and local and non-governmental standardizing bodies. The former are required to adhere, while the central government must only make best efforts to ensure that the latter adhere. The Agreement also

The TBT Agreement has potentially enormous importance for energy matters. The first WTO complaint raising the TBT Agreement in the context of energy was filed by Argentina against the EU in 2013.[55] The EU and various of its member states used regulations to impose sustainability criteria on biofuels. Biofuels that did not satisfy the relevant criteria could not be considered in EU member states' efforts to meet renewable energy targets, and therefore did not qualify for certain incentives for their use. Without challenging the idea of renewable energy targets, Argentina challenged the specific criteria as arbitrary and neither based on science nor based on an international standard. The measure had the effect of creating a barrier to Argentinian biofuels. The dispute thus hinges on the EU's ability to justify the specific criteria in its regulation as fulfilling the objective of protecting the environment and climate, given that the standards are not based on an international standard.

A number of organizations have adopted international standards for energy that could come into play in disputes similar to the Argentina–EU biofuels dispute. The International Organization for Standardization (ISO) has developed energy efficiency standards for a range of renewable energy products, including solar, wind, and biofuels.[56] The compatibility of the many energy efficiency regulations, especially in developed countries, with these standards could present an issue in coming years. The ISO also has standards for activities involved in the production of fossil fuels, including standards on materials and equipment used in drilling, production, and transport by pipelines.[57] Private bodies such as the American Petroleum Institute formulate standards as well (Yanovich 2011, p. 15). Beyond regulations directly about energy, rules on labeling have become increasingly important in the WTO in recent years.[58] Many countries, again especially developed countries, have energy efficiency labeling schemes. Mandatory labeling schemes are subject to the TBT Agreement's rules on technical regulations. Member states can thus not evade the strictures of the TBT Agreement by recasting an allegedly discriminatory regulation as a labeling scheme.

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establishes procedures for assessing the conformity of regulations and standards. *See* TBT Agreement Article 5.

[55] Request for Consultations by Argentina, *European Union—Certain Measures on the Importation and Marketing of Biodiesel and Measures Supporting the Biodiesel Industry*, WTO Doc. WT/DS459/1 (May 23, 2013).

[56] WTO-UNEP, *Trade and Climate Change*, Report by the United Nations Environment Programme and the World Trade Organization 118 (2009).

[57] *Id.*

[58] *See,* for example, *United States—Certain Countries of Origin Labeling (COOL).*

TRIMs Agreement

The WTO rules on trade in products by and large do not apply to investment. The exception to this rule is the TRIMs Agreement. The TRIMS Agreement incorporates the NT obligation and the ban on quantitative restrictions found in the GATT, as well as the GATT exceptions, and applies them to investment measures related to trade in goods.[59] The Annex to the TRIMS Agreement gives illustrative examples of what constitute unlawful TRIMS. The illustrative examples focus on measures that condition benefits on the use of local products or local production. Measures that violate the TRIMS Agreement may also independently violate the GATT's obligations regarding NT and quantitative restrictions on products, but the TRIMS does expand the reach of those rules somewhat to measures that might arguably be investment measures related to products but not about products themselves. Interestingly, in *Canada—Renewable Energy*, the DSB formally held that Ontario's FIT program constituted a TRIM in violation of the NT obligation and declined to make a finding that the measure independently violated GATT Article 3.[60]

State Trading and Government Procurement

The WTO also contains rules on 'State Trading Enterprises' and government procurement. GATT Article XVII provides that a State Trading Enterprise is a public or private entity that has been granted 'formally or in effect, exclusive or special privileges.' Such enterprises are required to act in a non-discriminatory fashion. In effect, the rules on state trading enterprises seek to ensure that governments cannot create a market participant to achieve through its market activities what the GATT prohibits governments from doing through laws or regulations. Recent estimates are that governments own or control more than two-thirds of the oil and gas production globally, largely through state-owned enterprises (Bast et al. 2014, p. 32). GATT Article XVII thus creates a possible vehicle for applying GATT rules to the increasingly important state-owned enterprises operating in the fossil fuel sector.[61]

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[59] TRIMS Articles 2 & 3.

[60] *See Canada—Renewable Energy* 5.104.

[61] A complication that Yanovich notes is that not all states consider state-owned enterprises operating in the energy sector to be State Trading Enterprises within the meaning of GATT Article XVII. Alan Yanovich, *WTO Rules and the Energy Sector*, in Regulation of Energy in International Trade Law: WTO, NAFTA, and Energy Charter 28 (Yulia Selivanova, ed. 2011).

Finally, the WTO contains an Agreement on Government Procurement (GPA). The agreement is a 'plurilateral' agreement, meaning that WTO members are not required to sign up for the agreement. Moreover, even those countries that do sign up may choose which sectors of the economy they wish to apply the agreement to. The Agreement prohibits discrimination in government procurement. While some countries, such as the USA, have subjected government fuel purchases to the GPA, the agreement is at present of limited application in the energy sector due to its optional nature.

4 GATS

The GATS applies to all internationally traded services.[62] The GATS creates a range of obligations for member states similar to those obligations found in the GATT: MFN, NT, and market access, among others. The primary difference between the GATS and the GATT is that not all of these obligations apply to all services automatically. Instead, the GATS distinguishes between obligations that apply to all trade in services and those that only apply to those sectors of the economy that a member chooses to opt in to. All trade in services are subject to the MFN obligation, as well as transparency obligations and limits on monopolies, among other obligations.[63] The rules on monopolies are particularly interesting. The obligations are rather limited, requiring only that members subject their monopolies to the MFN obligation and the member's specific commitments and that members consult on business practices other than monopoly or exclusive service provider agreements that have the effect of restricting trade in services.[64] Modest though they may be, these rules are potentially important for the energy sector, which depends on transportation and distribution networks that are frequently monopolies. The GATS also contains a similar set of exceptions to those found in GATT Article XX.

By contrast, only sectors that are subject to specific commitments are bound by the NT obligation and market access obligations.[65] As a result, members may not discriminate among foreign service providers, but unless they make specific commitments they may discriminate in favor of their own

[62] The only exceptions are services 'supplied in the exercise of governmental authority,' GATS Article I.3(b), and air traffic rights and services directly related to the exercise of such rights, GATS Annex on Air Transport.

[63] GATS Articles II, III, and VIII.

[64] GATS Articles VIII and IX.

[65] GATS Articles XVI and XVII.

service providers. Energy is itself not a sector used as a basis for scheduling members' specific commitments. The GATS does include three relevant subsectors: services incidental to mining, services incidental to energy distribution, and pipeline transportation (Yanovich 2011, p. 31). And, of course, other services such as engineering might be relevant to energy. Russia's challenge to the EU's Third Energy Package raises MFN, NT, and market access challenges under the GATS (in addition to claims under the GATT, SCM Agreement, and TRIMs Agreement), making it potentially the first major GATS energy case.

Members may also make services commitments that go beyond market access and NT.[66] For example, Ukraine committed itself to providing 'full transparency in the formulation, adoption, and application of measures affecting access to and trade in services of pipeline transportation. Ukraine undertakes to ensure adherence to the principles of non-discriminatory treatment in access to and use of pipeline networks under its jurisdiction' (Yanovich 2011, pp. 30–31). Marceau reports that 'Ukraine is now pushing other acceding countries to accept the same commitments' and argues that such commitments could provide a basis for further multilateral negotiations on liberalization of the services sector (Marceau 2010).

Perhaps the chief issue that arises with energy services is simply whether a particular type of trade is a trade in services or a trade in goods. To illustrate the difference, consider drilling. When a company drills for oil owned by another entity in exchange for a fee, it is providing a service subject to the GATS rules. When a company drills for oil that it owns, the company creates value added for its own product—and thus its activities are governed by the GATT.[67]

The distinction can potentially make a huge difference. If subject to the GATT, the NT obligation (among others) would automatically govern the drilling. If subject to the GATS, drilling would only be covered if the relevant member state had made a specific commitment. Moreover, owing to the lack of an energy sector within the GATS schedule, a drilling services provider might be providing services across sectors, some of which may be part of a member's specific commitments and some of which may not be. This fragmentation of rules applicable to a single economic enterprise complicates the international energy business. As a result, commentators have called for—and (as noted above) several nations proposed within the Doha Round—that energy receives a more holistic treatment as a single sector (Marceau 2012,

[66] GATS Article XVIII.

[67] *See* WTO, *World Trade Report 2010: Trade in Natural Resources* 194–95 (2010).

p. 387). Such treatment would recognize that the energy production and trade are tightly bound together in ways that legal rules cannot neatly separate.

5 TRIPS

To date, the major WTO agreement least connected to energy, the TRIPS Agreement has potentially enormous significance in the years to come. The TRIPS Agreement establishes certain minimum IP protections that member states must accord to patents, copyrights, trademarks, geographical indicators, and several other categories of IP. Beyond establishing minimum standards, it also includes MFN and NT obligations designed to ensure that member states do not discriminate in the administration of their IP laws.[68]

Technology is increasingly important in the energy sector, making the TRIPS Agreement a potential source of rules for the energy sector going forward. Renewable energy in particular is technology-dependent, with a wide range of patentable ideas ranging from production processes to designs for solar panels. A recent report from the World Intellectual Property Organization estimated that the volume of patents filed for renewable technologies in the period from 2006 to 2011 exceeded the volume of patents filed in the same areas for the prior 30 years (Helm et al. 2014, p. 3). Moreover, as indicated above, disputes over the renewable energy sector have been especially fierce. Although they have not yet taken the form of challenges under the TRIPS Agreement, challenges to nations' respect for patent rights could be a potential concern in the future.

Beyond potential challenges, critics may wonder about the role of IP in helping provide energy security and reducing global carbon emissions. IP rules are sometimes criticized for impeding the flow of ideas. IP is, after all, a monopoly right in the use of a particular idea. The TRIPS Agreement, by requiring all nations to recognize certain minimum IP standards, allows intellectual property rights (IPR) holders in one country to register their rights in another country, thereby extending their monopoly across borders. This feature of TRIPS could potentially impede the spread of renewable technology.

The TRIPS Agreement contains certain provisions designed to prevent this outcome. For example, Article 66 requires that developed countries 'shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed

[68] TRIPS Agreement Articles 3 and 4.

countries.'[69] Beyond that, early research suggests that global IPR may not significantly impede the spread of renewable energy technologies in the same way that IPR inhibited, for example, the spread of medicines (Barton 2007). The reason appears to be that the basic renewable energy technologies in the solar, wind, and biofuels areas are old enough that they are now off patent. Contemporary patents tend to be improvements to these basic, unprotected, technologies (Barton 2007, p. 4). Moreover, new entrants into the field are relatively common, including from developing countries such as Brazil, India, and China (p. 4). John Barton has thus argued that competition among different renewable technologies and conventional energy sources keeps prices down even in the face of IPR. At the same time, robust IPR may encourage greater licensing and technology transfer, ultimately facilitating the diffusion of renewable energy and greater innovation (p. 4).

6 Conclusion: The Future of Energy Governance at the WTO

International energy governance as such is an alphabet soup of institutions with partial competence and often limited membership (Meyer 2012, p. 389). The United Framework Convention on Climate Change governs the environmental consequences of fossil fuel consumption; OPEC sets rules governing fossil fuel production; and the IEA coordinates energy policies among major OECD energy consumers. The G20 has taken on certain energy-related issues, such as fossil fuel subsidies. Institutions such as the International Atomic Energy Agency and the International Renewable Energy Agency tackle fuel-specific issues.

Nations have mounted efforts to surmount this fragmented landscape. The ECT tried to create a comprehensive framework dealing with investment, trade, and (to a lesser extent) environmental issues. Thus far, however, its effectiveness has been limited by narrow membership. The International Energy Forum (IEF) brings supplier and consumer nations together to discuss and hopefully facilitate energy cooperation. To date, the results have been modest, and the IEF has abstained from acting as a forum to negotiate international energy rules.

The WTO offers a possible alternative. Its ministerial conference, councils, and committees offer established institutional mechanisms for discussing and negotiating rules on a wide range of economic issues. The DSB provides the

[69] TRIPS Agreement Article 66.2.

most successful standing international tribunal ever created. The WTO has a legal framework—even if not an ideal one—in which to consider the environmental consequences of trade in energy. While the WTO does not have well-developed rules dealing with transit or investment issues, especially as applied to the energy sector, its existing rules and negotiating agendas offer the hope that more detailed rules might be worked out over time.

Most importantly, addressing energy head-on in the WTO offers the possibility of linking energy cooperation to general market access provisions. The WTO is built on reciprocity of market access concessions across products, services, and IP. Until recently, the world's energy supply remained too dependent on fossil fuel exports from a small number of countries for these linkages to support energy governance through the WTO. Fossil fuels are distributed unevenly around the globe but consumed in all countries, especially in developed or rapidly developing countries. As noted in Part III.a, governments have thus had little reason historically to limit imports of fossil fuels. If a nation did not have fossil fuel resources, it did not have domestic fuel producing markets that needed protection. Such nations did have, however, other domestic producers, requiring access to cheap energy, who would push for lower barriers to imports.

This logic suggests that trade conflict about fossil fuel should have emerged as conflict over export restrictions. Such conflict is limited, though, and formalized trade disputes about fossil fuel export restrictions are nonexistent. This absence can be explained in part by the historic limitations of GATT membership. Prior to the formation of the WTO, many major fossil fuel-exporting nations, such as OPEC members, were outside of the trade regime and thus not bound by its rules. Institutional path dependence may have also played a role (Van de Graaf 2013). States structured international energy institutions dedicated to fossil fuels around producer/supplier dynamics, with the IEA representing major consumers and OPEC representing nations with the majority of the world's production capacity. Combined with the dispersion of power and interests in the energy sector—a degree of fragmentation not found in areas like international security—states' institutional choices in the energy area have historically been fragmented (Meyer 2012, p. 389). Finally, the doctrinal difficulties with challenging export restrictions in energy may also have played a role in deterring legal challenges.

These explanations do not satisfactorily explain the absence of WTO disputes about fossil fuels today. Since 1995, most major energy exports have joined the WTO, most recently Russia in 2012. Moreover, as discussed in the context of GATT Article XI, a jurisprudence on, and a willingness to challenge, export restrictions seems to be developing. Alongside these developments, the robust set of disputes in the renewables sector described in Part II has emerged in the last five years. Together, these developments raise the question whether the WTO will play a greater role in energy governance in the future.

There are reasons to think so. Perhaps most importantly, governments may become more willing to impose import barriers to fossil fuels based on environmental concerns. Carbon taxes, for example, would constitute an import barrier to fossil fuels and fossil fuel-intensive projects. Rather than acting as respondents, fossil fuel-exporting countries thus might find it in their interest to use the WTO to limit or shape environmental trade barriers. Indeed, Russia's challenge to the EU's Third Energy Package suggests the viability of this approach. Russia joined the WTO in 2012 and has gone on the offensive in an effort to limit the effect of EU regulations on its vertically integrated natural gas companies. Nations may also be developing the doctrinal framework necessary to challenge export restrictions that was lacking prior to the OPEC members' accession to the WTO. The *Raw Materials* and *Rare Earths* cases indicate an increased willingness to strategic export restrictions that act as subsidies to domestic producers. Similarly, as concerns about carbon leakage rise, nations may become more willing to use ADDs and CVDs as a means of reducing the benefits energy-intensive industries in fossil fuel producing countries receive from artificially low energy prices.

At the same time, renewable energy and fossil fuels may be fundamentally different. A significant literature on dispute resolution posits that states choose respondents on WTO challenges in accordance with the expected gains prevailing in a case (see, e.g., Guzman and Simmons 2005; Bown 2004). For at least three reasons, the expected gains from challenging fossil fuel restrictions may not be as high as those in the renewables sector. First, states may continue to fear that fossil fuel exporters, especially OPEC nations, may further restrict production and/or exports in response to a WTO challenge to their right to such limits. Given the economic costs of such actions and their effect on world markets, leaders may be unwilling to risk such a challenge.

Second, winning a case against a fossil fuel exporter may be of limited value. The WTO itself does not provide sanctions to enforce its judgments; rather, it authorizes prevailing parties to withdraw concessions in the event a losing respondent does not bring itself into compliance. Where OPEC nations are concerned, however, the withdrawal of concessions may be insufficient to induce compliance. Of course, since the goal of such a challenge is to reduce export restrictions, a prevailing nation would not respond by imposing import restrictions on fossil fuels. Rather, it would have to restrict some other product or, perhaps, services or IP (so-called cross-retaliation). Many fossil fuel-exporting nations may have economies that are not sufficiently diversified for retaliation of this kind to be effective. A 2014 paper from the International

Monetary Fund found that minerals and raw materials make up roughly 90% of the exports of Saudi Arabia, Kuwait, and Qatar, and more than 60% of the exports of Oman and the United Arab Emirates (Callen et al. 2014). Such limited diversification means that a prevailing complainant may not be able to impose restrictions on other imports that matter enough to the respondent to induce it to remove its fossil fuel export restrictions.

Third, fossil fuels are a mature industry with high barriers to entry that lead to high concentrations in wealth. As a result, few concentrated domestic groups stand to benefit from a WTO attack on fossil fuel policies. The scarcity of fossil fuels means that new entrants are relatively rare. WTO challenges are thus unlikely to affect the concentrated nature of the fossil fuel sector and nations cannot use WTO policies as a way to give their own domestic fossil fuel industries a leg up. Moreover, studies have repeatedly found that natural resource-endowed countries have a difficult time diversifying their economies, in part because mineral extraction does not require broad-based industrialization or development (Callen et al. 2014). Efforts to level the playing field among producer nations thus have limited development impacts outside of the fossil fuel industries themselves. Finally, some estimates are that a transition to renewable energy will not happen fast enough to prevent fossil fuel exporters from selling all of the proven reserves known today. Consequently, nations may be looking past fossil fuels in terms of their long-term growth policies.

Notably, renewable energy differs from fossil fuels in both of these respects. Countries that are major renewable energy producers tend to be developed or rapidly developing countries with diversified economies. A 2014 World Intellectual Property Organization report, for example, examined the distribution of patent filings across four renewable technologies: solar thermal, solar PV, wind, and biofuels (Helm et al. 2014). Although the precise distribution varied, the top five countries in terms of patents in each category were: China, Japan, Germany, South Korea, and the USA—all countries with diversified economies that actively participate in WTO dispute settlement.

Moreover, renewable energy relates to two features of the economy that developed countries have long had an interest in promoting and protecting. On the one hand, technologies such as solar and wind are technology and manufacturing intensive. They are thus innovation-driven products that potentially support skilled manufacturing jobs—jobs for which developed countries compete. Second, biofuels provide an important new end-use for agricultural products. For reasons of domestic politics, both the USA and the EU have relatively highly protected agricultural sectors. Both countries are thus keen to use trade policy as a vehicle to find new global markets for their domestic food industries. This race to establish a presence in the global biofuels market may explain in part the rash of biofuel-related disputes.

Taken together, these trends suggest that the WTO will play an ever-more important role in energy governance going forward. Even if changes in international fossil fuel markets and environmental regulations do not lead to more WTO governance of fossil fuels, fossil fuels are finite. Over time, even fossil fuel exporters may become more amenable to trading energy cooperation for other market access concessions. And the rising number of renewable energy cases attests to the belief among nations that the logic of trade governance can work in the energy sector.

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Part III

Energy Trade, Finance and Investment

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7

Clean Energy Trade Conflicts: The Political Economy of a Future Energy System

Arunabha Ghosh

Trade in energy and energy products accounts for more than 20% of global trade (UNEP 2013, p. 212). Much of this is accounted for by trade in primary fossil fuels, namely coal, oil and gas. Most of the trade in renewable energy (RE), by contrast, is related to manufactured products and components. But this market has expanded rapidly. For the solar photovoltaic (PV) sector, the market has grown from \$7.2 billion in 2004 to \$91.6 billion in 2011; for wind the progression has been from \$8 billion to \$71.5 billion; and for biofuels, the market more than doubled between 2008 and 2011 (from \$34.8 billion to \$83 billion). More significantly, growth in imports in RE equipment outpaced overall global merchandise imports during 2007–2011 (UNEP 2013, p. 213). This is the basis of the new green economy on which many countries have hinged their bets for future innovation, growth and jobs.

Yet, and not entirely surprisingly, the RE sector has also attracted a number of trade disputes, whether through multilateral legal channels or via unilateral trade remedy measures. At a time when the global trade regime is under scrutiny for its inability to deliver success under the Doha round of trade negotiations, rapidly expanding trade in RE products and services is a source of both hope for global trade and of growing trade litigation. What

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factors are contributing to the rise of clean energy trade conflicts? And what measures are being considered to resolve them?

The primary source of conflict is industrial policy. Many countries have used domestic support measures to promote their nascent RE manufacturing sectors. Such measures include production subsidies, tax relief, land concessions, subsidized credit and regulatory support. The incentive is to capture a slice of the rapidly growing global market for RE. Over the past decade, more than \$2 trillion have been invested in RE plants, with the largest share of new investment flows in 2014 going to solar (\$150 billion) and wind (\$100 billion). In addition, global production networks for RE have emerged, tempting governments to try and attract some of the investment to their domestic firms (Ang and Steenblik 2015).

Another driver is trade policy. Tariffs against clean energy technologies as well as non-tariff barriers such as cumbersome standards, which might vary from country to country, serve as another obstacle. Customs duties or import tariffs can curtail trade in environmental goods and services. Multiple standards add to costs. Countries could also promote their exports with export subsidies, tax credits and attractive lines of credit. In retaliation, importing countries could impose countervailing duties (CVDs) against subsidized exports or anti-dumping (AD) duties against products, which are allegedly sold below production cost in export markets.

Often embedded in both industrial and trade policy are provisions for local content requirements, a tool intended in part to promote domestic industry and nurture local jobs. However, by requiring that a minimum share of local content be used in the final product, these measures actually result in reduced competition, hindered or delayed technology deployment and higher prices for renewables.

The logic behind these measures is flawed on two counts. For one, it assumes that the RE pie will always remain small, when current trends indicate otherwise. As the pie expands, all countries could benefit, from either improved access to cheaper technologies or newer markets. Another logical fallacy is the assumption that if one country has a large share of the market for clean energy products today, it would always remain in pole position. In reality, a global supply chain for RE products is developing, with components produced in several countries assembled together or deployed in others.

Some of these measures correct market failures, while others distort trade. Rather than focusing on energy access (a key imperative for the fight against poverty), RE policies have, instead, become tools to achieve other objectives:

generating fiscal revenue, developing local industries, creating jobs and stimulating the economy, to name a few. As a result, renewables remain artificially more expensive than they need to be, delaying access to the poor and postponing the day when they can serve as viable substitutes for fossil fuels. This is why disputes are emerging across the world over clean energy subsidies, even though subsidies for fossil fuels—which the International Energy Agency (IEA) estimated at $548 billion in 2013—actually far exceed those for RE, estimated at $121 billion (see Chap. 11).

In short, efforts to scale up RE are being obstructed by a range of barriers to sourcing the best technologies from global markets. Clean energy trade disputes can turn trade relationships sour and make the investment climate for clean energy more uncertain. The formal dispute settlement process at the World Trade Organization (WTO) has delivered judgments against measures, which are explicitly forbidden. But there is still lack of clarity on other measures, where the trade impacts might be mixed or not large enough to warrant retaliatory measures.

In order to get more clarity, countries and companies are seeking alternative forums and rules to govern and arbitrate trade and investment in renewable and clean energy. These include a separate sectoral agreement, a list of traded goods, a regional agreement or a complete revision of rules within the multilateral regime. Different interest groups would find merits and lacunae in each approach. But all agree that the current system is unlikely to deliver clear policy direction for a significant upscaling of RE globally.

The chapter proceeds in five sections. The first section explores the nature of trade and investment disputes as have arisen in recent years. The second section analyses the types of industrial and trade policy measures, which countries have adopted, and identifies key areas or sub-sectors of national or private interest. It explores how these policies have, at times, resulted in protectionist outcomes drawing opposition from other countries. The third section examines the dispute settlement process to inquire whether it has provided adequate legal guidance. The fourth section discusses some alternative mechanisms to reconcile the need to promote clean energy but also maintain open and competitive markets. The fifth section concludes with a reference to the implications of clean energy trade conflicts on the broader political economy of international energy—how prices are set, subsidies measured and treated, and the role of trade and investment regimes to govern energy globally during a time of climate-related upheaval.

1 The Rise of Green Trade and Investment Disputes

A fundamental tension is emerging around the promotion of and trade in RE. Nearly two billion people have no access to modern sources of energy. Increasing energy access is one of the key ingredients for human development. One of the Sustainable Development Goals, agreed in 2015, includes the access to affordable, reliable, sustainable and modern energy for all (which had been glaringly missing from the Millennium Development Goals). At the same time, and despite country-specific pledges to mitigate greenhouse gas emissions at the UN Framework Convention on Climate Change (UNFCCC), energy-related emissions will continue to rise over several decades before peaking and tapering downwards. The rapid deployment of clean energy, especially in developing countries, is intended to support two simultaneous transitions: from no energy to energy access; and from fossil fuel-based energy to a low-carbon energy pathway. In principle, most countries agree that these transitions are desirable. The tension arises when each country takes steps to promote clean energy industry at home, steps that threaten others about loss of competitiveness or limited market access. International trade rules frown upon the use of tariffs, non-tariff barriers or subsidies, even if they are for clean energy. These rules exist to prevent distortions and discrimination in international trade. So far, there has been no reconciliation between these two imperatives, of promoting a clean energy transition and of adhering to a rules-bound, open and non-discriminatory international trade system. This fundamental tension is at the heart of a rise in trade disputes over clean energy.

A New Source of Trade Disputes

As Table 7.1 shows, trade disputes over clean energy began in 2010, when two disputes were launched at the WTO. In 2011, the USA and China launched investigations against each other. Six more WTO disputes or unilateral investigations arose in 2012. And in 2013 and 2014, four more complaints were lodged at the WTO. In all, since 2010, 8% of new disputes at the WTO have been related to clean energy. If the three disputes filed against China (by Japan, the European Union [EU] and the USA) for its restrictions on rare earth exports were also counted, then 11% of disputes at the WTO in the past six years have implications for trade in clean energy.

This is not a trivial number, but a signal of growing political and economic sensitivity over any restrictions on overseas markets for clean energy.

Table 7.1 Trade disputes over clean energy

Date Launched	Measures Challenged	Forum	Complainant	Respondent	Third Parties	Industry or Programme Targeted	Status (as of 31 August 2015)
September 2010	LCRs, ASCM, TRIMs, GATT 1994	WTO	Japan, EU (2011)	Canada	USA	Ontario province's FiT Policy	Canada asked to come into compliance
December 2010	LCRs, GATT 1994, ASCM, Protocol of Accession	WTO	USA	China	EU, Japan	Chinese wind subsidy	Resolved in bilateral negotiations
November 2011	AD/CVD investigation	US Department of Commerce/ITC	USA	China	NA	Solar Panels	Tariffs implemented then scope subsequently broadened and tariffs increased
November 2011	LCRs, subsidies	MOFCOM	China	USA	NA	State-level RE support programme	Pending
January 2012	AD/CVD investigation	US Department of Commerce/ITC	USA	China, Vietnam	NA	Wind components	Tariffs in place

(*continued*)

Table 7.1 (continued)

Date Launched	Measures Challenged	Forum	Complainant	Respondent	Third Parties	Industry or Programme Targeted	Status (as of 31 August 2015)
May 2012	ASCM, AD, GATT 1994, Protocol of Accession	WTO	China	USA	Australia, Brazil, Canada, EU, India, Japan, Korea Norway, Russia, Turkey, Vietnam, Saudi Arabia	Solar panels, wind towers and others	Appellate body and or/Panel found Dispute trade measures inconsistent with WTO laws. Recommendations to bring the measure(s) in conformity with WTO law is adopted by the DSB
July 2012	AD/CVD investigation	MOFCOM	China	USA, South Korea, EU	NA	Polysilicon	Tariffs imposed
July 2012	AD/CVD investigation	European Commission	EU	China	NA	Solar Panels	Price undertaking arranged, including an import quota and minimum price
November 2012	AD/CVD investigation	Indian Ministry of Commerce	India	China, Taiwan, Malaysia, USA	NA	Solar panels	Pending
November 2012	LCRs, subsidies	WTO	China	EU, Greece, Italy	Japan, Australia, Argentina	Feed-in-Tariffs of certain EU member states	Pending
February 2013	LCRs, subsidies	WTO	USA	India	Japan, Australia	India's National Solar Mission	Judgment not announced

May 2013	GATT 1994, TBT, Agreement establishing the WTO, TRIMs, ASCM	WTO	Argentina	EU	–	Biodiesel	Pending
December 2013	AD, Agreement establishing the WTO, GATT 1994	WTO	Argentina	EU	Australia, China, Malaysia, Norway, Russia, Saudi Arabia, Turkey, USA, Colombia, Indonesia, Mexico	Biodiesel	Pending (Panel composed)
June 2014	AD, Agreement establishing the WTO, GATT 1994	WTO	Indonesia	EU	USA, Japan, Turkey, Singapore, India, China, Canada, Argentina, Australia, Norway, Russia	Biodiesel	Pending (Panel yet to be composed)

Source: Author's compilation based on Espa and Rolland (2015), Lewis (2014), WTO (various), Wu (2015), Wu and Salzman (2014)

Investments in RE have surged over the past decade. Between 2004 and 2014, global RE investment grew from \$45 billion to \$270 billion (Fig. 7.1). In absolute terms, capacity addition for renewables-based electricity crossed 80 gigawatts (GW) in 2010 and 100 GW in 2013 (Fig. 7.2). This rapid growth and the potential size of the market in future (India, alone, plans to deploy 175 GW of renewable capacity by 2022), have shifted the sector from a fringe area of infrastructure investment to one 'no longer immune to high-profile WTO challenges' (Lewis 2014, p. 16).

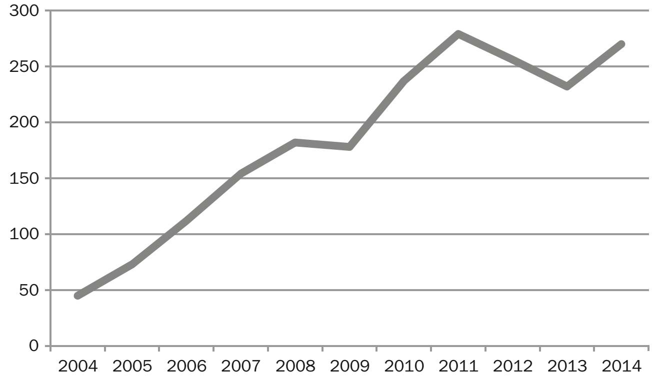

Fig. 7.1 New investment in renewable energy (USD billions), 2004–2014 (*Source*: FS-UNEP, Bloomberg New Energy Finance (2015))

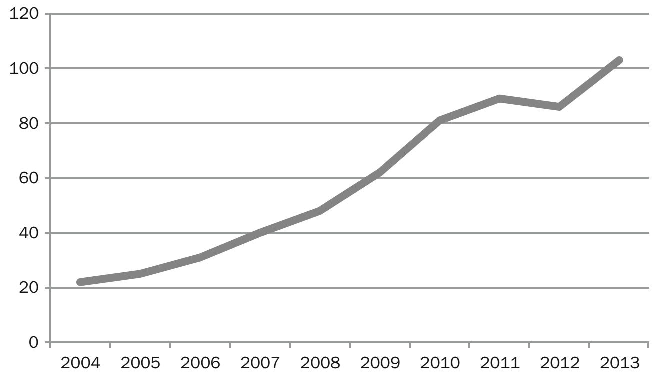

Fig. 7.2 Renewable energy generation capacity additions (in GW), 2004–2013 (*Source*: IEA (2015), REN21 (2015))

Beyond Disputes, Rise in Unilateral Actions

Disputes at the WTO are not the only signs of trade tension. Members can start by expressing concern about others' policies during WTO committee meetings. The next option is to raise the issue more formally during the periodic trade policy review of another member state, although the effectiveness of such a procedure depends on the thoroughness of the analysis of the controversial policy and its impact (Ghosh 2010). Further, rather than go through the usually lengthy WTO dispute settlement mechanism (DSM), countries might decide that it makes more sense for them to conduct their own investigations and use trade remedies in retaliation (Wu and Salzman 2014, pp. 406, 432–443). Several countries have been questioning the legality of RE-related policies through dozens of unilateral measures. During 2010-2014, 45 WTO members also applied CVDs against energy products (including both fossil fuels and RE). An even larger number, 87 members, applied AD measures during 2012-2014 (Espa and Rolland 2015, pp. 7, 10).

Among the most contested policies are those relating to local content requirements, that is, those promoting the procurement of locally manufactured equipment. Another set of disputes and remedial actions target direct subsidies provided to domestic firms. Members draw on the rules under the WTO's Agreement on Subsidies and Countervailing Measures (ASCM) and the Trade-Related Investment Measures (TRIMs) Agreement to raise complaints or impose remedial actions of their own. A third set of disputes arose not with regard to import restrictions but export controls. These were related to export restrictions in China on nine minerals and a group of rare earth elements, which were valued inputs in downstream manufacturing (including of clean energy products). The next section discusses these policies, their motivations and their contestations in more detail.

2 What Roles for Industrial and Trade Policy?

Several motivations have driven government support for RE in recent years. The most obvious one is a public good argument in favour of levelling the playing field for RE, especially if negative externalities from the use of fossil fuels (local environmental pollution, public health losses or global climate change) are not accounted. Left to their devices, private technology and project developers underinvest in RE sectors because the wider social benefits are disregarded (Ghosh and Gangania 2012, pp. 13–15). Public intervention, in the form of subsidies, tax breaks or regulatory support could increase deployment of new RE technologies, increase learning and economies of scale and help to bring down costs for RE closer to those of non-renewable sources. A related driver is the use of RE-related industrial policy to promote access to energy. In Kenya, for instance, with limited grid connectivity, off-grid energy solutions, such as solar home systems, are rapidly growing, thereby creating new political incentives to promote solar energy (Newell et al. 2014, p. 3). Nampoothiri and Manoharan (2013, p. 14) list RE promotional policies (from feed-in tariffs [FiTs] to regulatory frameworks to those directed at rural electrification) in Botswana, Ghana, Kenya, Mauritius, Nigeria and Uganda. In India alone there are more than 400 companies delivering decentralized energy services while in Bangladesh, millions of solar home systems have been deployed (Ghosh and Ray 2015, p. 3).

Green energy trade disputes, however, have more to do with the other drivers of government support, namely the desire to support an emerging domestic industry, the aim to establish footholds in overseas markets or the political imperative of creating jobs. In other words, industrial policy, trade policy and job creation are increasingly becoming equally, if not more, important as reducing the use of fossil fuels or curbing environmental externalities. In the process, new interest groups are created, which have their own competing demands to secure economic rents. The aggressive push for policies in developed *and* developing countries, which have both environmental benefits and increase protectionism, is resulting in what scholars now call the 'Next Generation of trade and environment disputes' (Wu and Salzman 2014, pp. 416, 432).

A Range of Policies and Support Measures

The case for trade and industrial policy as a means to support RE development and deployment rests on two premises. The first is the possibility that for an emerging industry, some amount of government support could create opportunities to demonstrate technological leadership and create a domestic ecosystem geared towards new drivers of productivity and growth in the economy. Should such technologies gain widespread demand, within and outside the country, domestic firms could enjoy competitive advantage. In the early stages of a sector's development, firms demand support from government for multiple reasons: to help secure access to patents and new technologies; to spread the burden of risk; to get easy lines of credit, especially for the high capital investments for renewable energies compared to fossil fuel sources; to secure land, water and other resources; to gain entry into the power market or access to the grid; and so forth.

Such a premise is not unlike the public good argument. If the expected wider societal benefits outweighed the costs of supporting a particular sector or sub-sector, then governments might be inclined to extend support. China, for instance, elevated alternative energy and environmentally friendly and energy-efficient technologies to the level of 'strategic emerging industries' for its 12th Five Year Plan, banking on the relatively small gap between developed and developing economies in these sectors (People's Daily Online 2010). An aggressive industrial policy has ensured that China accounts for three-fifths of the world's solar panel production, 95% of which is exported (Bradsher 2011). Similarly, the US Department of Energy's Sun Shot Initiative was designed to support solar innovators and resulted in a steep fall in utility-scale solar prices. Four years into the programme, the price per kilowatt-hour of a utility-scale PV project had fallen 70% of the way to reaching the goal of $0.06 by 2020 (US Department of Energy 2014).

The second premise is weaker. The assumption is that governments will be able to pick winners better than the market and, therefore, can decide which firm or sector deserves its support. Critics argue, however, that governments are not good venture capitalists and are likely to allocate resources inefficiently (Mufson 2011). Further, if private investors choose to not support risky emerging technologies, then the riskiest projects are left for government to bear, compounding the challenge of picking winners. State support also increases the risk of policy capture, especially if there are no provisions for levelling off government support at a future date or procedures to allocate support are not transparent. Moreover, maintaining trade barriers could have a counterproductive impact, if the prices of RE products remain high as compared to the lowest cost options available from overseas suppliers.

The expectations from industrial policy for RE have likely outweighed the reservations over its efficacy. In recent years, there has been a surge in policies across both developed and developing countries. By early 2015, Ang and Steenblik (2015) counted that 145 countries had introduced some kind of national or sub-national policies to support RE, including FiTs, quotas, and financial support. Table 7.2 gives illustrative examples of industrial and trade policies in various countries. These policies include fiscal incentives in the form of subsidies and tax breaks for both producers and consumers. Other financial support has included loans and loan guarantees, preferential loans for particular sectors, and R&D support for clean energy. Government support also takes the form of regulations intended to mandate actions in favour of RE development and deployment. These have included infrastructure support (such as for land acquisition), standards and certification for manufactured products and RE purchase obligations imposed on utilities or provincial gov-

Table 7.2 Industrial and trade policies for clean energy

Type of incentive		Country	Policy and year enacted
Fiscal Incentives	1. Subsidies		
	Producer	Australia, Austria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain, Switzerland, UK, Algeria, Argentina, Bosnia/Herzegovina, Bulgaria China, Dominican Republic. Ecuador, Iran, Jordan, Kazakhstan, Latvia, Lithuania, Macedonia, Malaysia, Mauritius, Montenegro, Panama, Peru, Serbia, Thailand, Turkey, Uruguay, Armenia, Ghana, Honduras, India, Indonesia, Lesotho, Moldova, Mongolia, Nicaragua, Nigeria, Pakistan, Palestinian Territories, Philippines, Senegal, Sri Lanka, Syria, Ukraine, Kenya, Rwanda, Tajikistan, Tanzania, Uganda	Feed-in-tariff (FiT)
		EU, USA	Direct expenditure: agricultural subsidies supporting the production and export of biofuel or biofuel feedstock
		India	Capital Subsidy: Maharashtra's capital subsidy of 11% for wind energy projects; Central government's viability gap funding for solar projects
	Consumer	Some EU countries	FiT to individual producer/consumer

2. Taxes		
Producer	USA	Tax incentives on underlying property if used for renewable energy production; tax breaks for commercial and residential energy conservation upgrades
	EU countries, USA	Reduced taxes on biofuels
	India, USA	Investment tax credits to attract investors to RE sector
	Brazil	Lower service and other taxes for ethanol and flex-fuel vehicles
	China, Germany, Spain	
Consumer	Brazil	Todos (Light for All) electrification programme (2003)
	Germany	Tax exemptions: Environment and Energy Efficiency Programme, RE Act (2004)
	India	Tax exemptions (via Indian Renewable Energy Development Agency)
	Spain	Exemption from hydrocarbon tax for biofuels sales
	USA	Biodiesel income tax credits (expired 2011)
		Residential RE tax credit (2006–2016)

(*continued*)

Table 7.2 (continued)

Type of incentive		Country	Policy and year enacted
Trade Policies	1. Import Tariffs	Brazil (Wind, 2009), Russia, Belarus and Kazakhstan (Solar, 2010), China (Wind, multiple years)	Use of custom duties/import tariffs to favour domestic goods or promote domestic manufacturing
		Japan, Germany, France, Italy, Canada, Taiwan, Korea, India, South Africa	
		USA	Solar import tariff on China
		India	Concessional custom duty on certain wind turbine components such as gearboxes, yaw components, Rotor blades (raw materials, parts and subparts), and wind turbine controllers
	2. Export Subsidies	Denmark (Wind), USA (Green Products to Korea, 2009, RE to Abu Dhabi, 2013, Others), OECD (All RE, 2012)	Export credit assistance
Financial Support	1. Loans and Loan Guarantees	USA	Support production of components (batteries, solar panels), to scale up R&D
		China	Support to production of solar and wind components
			Energy concept (2010)
		Germany	KfW Renewable Energies Programme (KfW-Programm Erneuerbare Energien) (2009)
			KfW-Programme Energy-Efficient Rehabilitation (Energieeffizient Sanieren) (2009)

	2. Preferential Loans	India	Wind Power Development (2002)
			Rajasthan's low interest loans against capital costs
		China	Supplementary policy initiatives under the new Renewable Energy Promotion Law (effective January 2006)
		Korea (Japan RPS link)	
		Poland	
	3. R&D support	China (Wind, Solar, various years), USA (Solar, Offshore Wind, 2011/2013), Denmark (Wind, various years), Germany (Wind, Solar, various years)	Research, development and demonstration support for domestic companies
		UK, Australia, Czech Republic	R&D subsidy
		Spain	R&D subsidy for biodiesel and bioethanol
Regulation	1. Infrastructure Support	China, India	Government land acquisition/land transfer below market price for solar and wind installations
	2. Local Content Requirements	China (Wind, 1997), Brazil (Wind, 2002), India (Solar, 2010), Canada (Wind, 2003, Wind/Solar, 2009), Ukraine (Wind/Solar, 2013), USA (Wind/Solar/Others, 2009), Spain (Wind, 1994), Italy (Solar, 2011), France (Solar, 2012), Croatia (Wind/Solar/Others, 2012), South Africa (Wind/Solar, 2011), Turkey (Wind/Solar/Others, 2011), Argentina (Wind, 2005), Malaysia (Wind/Solar/Others, 2010)	

Table 7.2 (continued)

Type of incentive	Country	Policy and year enacted
3. Certification/ Standards	573 standards in the renewable energy sector International Standardization (313), Regional Standardization (150), National Standardization (13), Organizational Standardization (97)	Mostly manufacturing and product standards
4. Quota/ Renewable Portfolio Standards	Kenya	Solar Water Heating Regulations (2012)
	USA	RPS; Implemented in California (March, 2010)
		RPS; Massachusetts Green Communities Act
	China	RPS; Renewable Energy Law (enacted 2006)
	India	RPO; Wind, solar and other clean energy sources for states
	Japan	RPS
Others	Brazil	National Social Economic Development Bank (For wind energy investment)

Source: Author's compilation based on Espa and Rolland (2015), Ghosh and Gangania (2012), Ghosh et al. (2014b), IEA and IRENA (2015), IRENA (2013), Jha (2013), Kuntze and Moerenhout (2013), Lewis (2014), Nampoothiri and Manoharan (2013), OECD (2013), Polish National Energy Conservation Agency (n.d.), Sugathan (2015), UN DESA (2009) ernments. In trade policy, governments have used import tariffs, import duty reductions, export quotas and export subsidies. Finally, regulatory backing for local content requirements are found in more than a dozen countries, intended to encourage domestic manufacturing.

The policies outlined in Table 7.2 are by no means comprehensive. But they give a sense of how several countries have developed commercial interests in the RE sector within a matter of a few years. As is evident, the solar and wind sectors have received the greatest attention in the form of industrial policy support across several countries. Other RE sub-sectors, such as biofuels, biomass, geothermal and hydropower, have also benefited along with cross-cutting areas including energy storage and R&D in batteries (Wu 2015).

Creating New Trade-Related Tensions

Green industrial and trade policy have generated complex motivations and frictions at the intersection of trade and environment. The most contentious has been on the issue of local content requirements (LCRs). LCRs have been used in at least two ways, either by linking them to FiT schemes (Canada) or by making government procurement contingent on use of local content (such as the Chinese wind programme) (Kuntze and Moerenhout 2013, p. 35; Lewis 2014). In the first such dispute (Canada vs the EU and Japan), the complainants argued that Ontario's FiT programme was not intended only to promote renewable electricity generation (as Canada argued) but was explicitly tied to the use of domestic inputs and RE products, at the expense of imported goods (Nedumpara 2013, pp. 11, 18). LCRs have triggered disputes with complainants arguing that they violate the WTO's national treatment principle, the TRIMs Agreement and the ACSM (Espa and Rolland 2015, pp. 6, 10; Cosbey and Rubini 2013).

But there have also been cases where a strict interpretation of WTO law combined with robust domestic lobbying has resulted in disputes being initiated even though the adverse commercial impacts have been negligible. A case in point is the US complaint against India's LCR associated with its National Solar Mission. India originally introduced a LCR for only crystalline silicon-based cells and modules while thin-film-based installations were exempted. The ostensible reason was for the government not to be seen to be favouring a single thin-film manufacturer in the country. But this resulted in distortions in the choice of technology, with India installing a far higher share of thin-film-based capacity than the rest of the world (Jaiswal et al. 2012, p. 21). Moreover, the policy was focused on manufacturing of cells and modules rather than value addition in the balance of systems of the projects. At the same time, other countries bypassed the policy, particularly the USA, which used its donor and export credit agencies to finance installations using thin-film technology (Ganesan et al. 2014, pp. 80–81). Despite having commercially gained from the distortion in the policy, the USA filed a complaint against India as soon as there was an attempt to include thin-film within the LCR's ambit as well.

Whereas LCRs are used to protect and promote the domestic market, subsidies and dumping have been used to make inroads into foreign markets (Meyer 2013). In turn, they have given rise to opposition from affected interests in the importing country. CVD investigations regarding RE have a longer history than formal WTO disputes. Mark Wu (2015, p. 7) lists CVD investigations by the EU from 2008 onwards (targeting US subsidies on biodiesel), actions which were followed by Peru and Australia in 2009 and 2010, respectively. The USA and China have targeted each other on solar PV subsidies since 2011. The USA also claimed that Chinese subsidies allowed Chinese manufacturers to sell wind turbines in international markets at prices lower than their competitors. The EU and China have been investigating their respective subsidy regimes on solar PV and polysilicon since 2012. In fact, the EU case against Chinese solar PV imports was the largest trade remedy case in history (Cosbey 2013, pp. 3–4). Australia, Canada, India and Peru are other examples of countries using CVD investigations in relation to RE products.

Behind the disputes have been domestic political economy pressures. On one side, oversupply of Chinese-manufactured equipment, in part thanks to excessive government subsidies, had the consequence of prices of solar panels falling 30% (Balasubramanian 2013). On the other side, seven US manufacturers of solar panels filed a case in domestic courts that the Chinese manufacturers received subsidies, which were allowing them to dump panels at prices below manufacturing and transportation costs (Carbaugh and St. Brown 2012).

In the case of rare earth export controls, domestic concerns were again at play in China. In 2010, China curbed the export of rare earths, elements that are used in high-tech equipment including clean energy products; in the first half of 2011 China cut export quotas again by 35%. Accounting for about 95% of global supply, China's export restrictions triggered a fourfold rise in prices in 2010 and a doubling again by April 2011 (Bacchus 2011). From the Chinese perspective, the quotas and taxes on rare earth exports was driven by the desire to reduce the inputs costs of downstream domestic industries. Moreover, the expectation was that downstream domestic manufacturers could partly pay (through taxes) for the environmental remediation of rare earth mining, a source of revenue that would be otherwise lost when the same minerals were used instead by overseas manufacturers (Wu and Salzman 2014, pp. 418–430).

With the Desired Impact?

The promise of creating 'green jobs' and, in some cases, moving up the technological value chain, has been an underlying theme in many green industrial policy initiatives (Wu and Salzman 2014, pp. 416–432). By 2012, California already had one-fourth of all US jobs in the solar sector and Germany's RE industry was employing 380,000 people (Ghosh and Gangania 2012, p. 17). More recent analysis of job creation in India's solar and wind sectors found that the country's aggressive targets for 100 GW of solar and 60 GW of wind could generate more than 1,000,000 jobs in solar and nearly 200,000 jobs in wind by 2022 (Ghosh et al. 2015a). Even when trade disputes have been launched, policymakers have explicitly defended the rationale for their policies. When the EU complained against LCR provisions in Ontario's Green Energy and Green Economy Act, 2009, the Ontario Energy Minister argued, '[W]e will [stand up] against anybody outside of Ontario that wants to threaten our efforts to create jobs' (ICTSD 2011).

But have these trade and industrial policies been worth it despite the rise in international disputes? One study finds that the removal of LCRs, FiTs and reducing import tariffs to 0, together, would decrease GDP in most countries and significantly increase RE prices (from 2% to 3% for China and India to 7% for Germany or more than 8% in Italy) (Jha 2013). Others agree that FiTs have been effective in increasing RE deployment across dozens of countries (Cosbey and Rubini 2013). But scholars argue that the results are at best ambiguous, especially with regard to using LCRs to create jobs or manufacturing opportunities. Instead, LCRs have kept power costs high and resulted in inefficient resource allocation (Kuntze and Moerenhout 2013; Nampoothiri and Manoharan 2013; Cosbey 2013). Further, whereas FiTs have the potential to attract both domestic and foreign investment into RE sectors, combining them with LCRs dampens the enthusiasm for foreign investors to direct funds in restricted markets (Ang and Steenblik 2015). Moreover, policymakers often fail to realize that the manufacture of solar modules contributes only about a quarter of jobs in the sector. The bulk of job creation and value addition occurs downstream—in designing, building, commissioning, operating and maintaining projects—benefits that would not accrue entirely if LCRs kept costs artificially high for downstream project developers (Jaiswal et al. 2012, p. 19; Ghosh et al. 2014a, p. 15).

On the whole, scholars contend that LCRs have resulted, more often than not, in trade-distorting protectionism. For a few countries, especially China, the use of subsidies and LCRs have created employment, facilitated technology transfer and driven down costs of RE equipment. But they have also resulted in creating a global supply glut, creating fertile ground for accusations of dumping and counteracting trade remedy measures (Wu and Salzman 2014). Scholars have also found that many RE subsidies have trade-distorting effects (Espa and Rolland 2015). In fact, even for China, there remain concerns about potential large revenue and job losses if exports markets, such as the EU, were to impose high tariffs on Chinese RE equipment, even as the EU's trade remedial actions also have adverse impacts for its own welfare (Bai et al. 2012). Thanks to domestic administrative rulings, the USA has already imposed higher tariffs on solar and wind equipment from China; China has also raised tariffs against foreign suppliers; and India is considering similar moves. Notwithstanding the short-term benefits, if all countries were to adopt similar policies, combined with restrictions on imports or subsides for exports, it would only promote beggar-thy-neighbour protectionism (Carbaugh and St. Brown 2012).

3 Has Dispute Resolution Cleared the Air?

With the growing number of trade disputes over clean energy, there is an expectation that the WTO's DSM will add clarity to trade rules and the legality of various trade and industrial policies. But that has not been the case so far.

The first ruling to be issued, in December 2012, was in the case concerning Ontario's FiT programme. The Dispute Settlement Panel found that it violated both GATT and TRIMs, arguing that the LCR embedded in the programme conferred a 'advantage' to domestic producers over foreign ones but also argued that the scheme did not 'benefit' the relevant sectors (Cosbey and Rubini 2013). When Japan filed a cross-appeal, the Appellate Body ruled that the FiT programme had indeed conferred a benefit. This raises a degree of uncertainty over how future disputes might be interpreted. Lewis (2014) argues that, in order for the panel or Appellate Body to adjudicate whether a benefit is conferred or not, an existing competitive market is a prerequisite so that benefits accrued and losses incurred can be computed. Despite the rapid growth of RE markets worldwide, clean energy still remains a very small share of the global energy system. Competitive markets with multiple players (domestic and foreign) might not have fully established in many jurisdictions, making it likely that the Canada-type of indefinite conclusion will emerge in other disputes as well. As a result, other countries have continued to introduce LCR provisions and subsidies for consumption, production and export of RE products and have continued to trade allegations and counter-allegations against each other.

Another problem is that subsidies can be used for many purposes (Wu 2015). Some are intended to reduce the cost of production (through direct financial grants or tax exemptions). Others seek to improve the productivity of producers through investments in energy infrastructure or in building the human resource base in the RE sector via skills and training programmes. There are also subsidies to reduce uncertainty of returns (via FiTs) to protect developers entering what they might consider as a risky sector. Still other subsidies could be targeted at consumers to increase the adoption of RE technologies (tax credits, capital subsidies, public procurement) or merely to increase access to energy for those currently outside the formal energy infrastructure. Such subsidies—to target energy poverty or environmental externalities—are different in intent and impact than subsidies intended solely to boost domestic manufacturing (in the classical industrial policy sense) or expand export markets (in the classical trade policy sense) (Ghosh and Gangania 2012, pp. 39–42). Treating them in the same manner creates inconsistencies between the demands for promoting clean energy access to hundreds of millions of people, on one hand, and the threat of disputes from trading partners, on the other.

These legal uncertainties aside, the DSM has been effective in fostering compliance. A month after the Appellate Body's judgment, Canada agreed to bring its policies in line with the rulings, and year later it had informed the WTO that it was no longer imposing LCRs on large RE procurement projects. A WTO panel had also ruled that China's restrictions on rare earth metals did not have legal basis, forcing it ease the restrictions in due course.

In some instances, countries have also found consensual routes to resolving disputes (Lewis 2014; Meyer 2013). China agreed to a settlement when the USA challenged its LCR provisions for wind power equipment in 2010. Here, the push had come not from US wind turbine producers but from a major trade union, the United Steelworkers, which feared loss of jobs at home. When China voluntarily dropped the policy, it was considered a victory for RE technology innovators and for American workers. In another case, between China and the EU, the Chinese agreed in July 2013 to the EU imposing an import quota on Chinese-made solar panels, as well as a minimum price. Companies that did not agree to this arrangement would find their exports to the EU facing high import duties. These instances are not ideal however. The outcomes depend on the power of domestic lobbies and calculations by exporting countries about how much market share to maintain against more aggressive trade action. Moreover, they do not provide any guidance on how other industrial and trade policies will be treated. Either way, a rational and optimal outcome in terms of economic welfare is not guaranteed.

4 What Other Governance Solutions?

In an ideal scenario, a separate agreement should have already been in place to carve out the requisite policy space to promote RE while remaining consistent with GATT, ASCM and TRIMs. In its absence, each case has to be reviewed separately by WTO panels and the Appellate Body (Nedumpara 2013). Under the present circumstances, the challenges with using formal dispute resolution to get legal experts to adjudicate on generally applicable rules has been recognized by other scholars, who are seeking second-best solutions (Sykes 2015). In response, a range of alternative governance arrangements is being discussed.

The first proposal is for a Sustainable Energy Trade Agreement (SETA). The idea is that an agreement on energy could provide a new product classification system for clean energy equipment, lower import duties and taxes, gradually phase out LCRs (if a domestic industry were not established within a stipulated time period), establish common standards to facilitate innovation, expedite customs clearance procedures, and bring clarity to the treatment of subsidies, government procurement and other regulatory support measures. In this manner, RE-related trade and investment rules could be made more consistent and predictable (Ghosh and Gangania 2012, pp. 40–42; Kuntze and Moerenhout 2013).

There are also alternative ways by which a SETA could be agreed. One precedent is the Government Procurement Agreement or the Information Technology Agreement (both plurilateral agreements under the WTO), drawing on a 'positive list approach' or coming into force if the signatories collectively account for a significant share (say, 90%) of world trade. Alternatively, the SETA could be negotiated as a standalone agreement outside the WTO framework as well.

In a similar vein, negotiations on an Environmental Goods Agreement (EGA) have progressed through nine rounds (until September 2015). Seventeen WTO members have identified 650 tariff lines and more than 2000 products over which to negotiate further liberalized trade (ICTSD 2015). The EGA negotiations, although also plurilateral in nature, are already building on a list of 54 tariff lines that were agreed by the 21-country Asia-Pacific Economic Cooperation (APEC) alliance for reducing tariffs to 5% or less by the end of 2015. Eventually, the expectation is that the EGA negotiations will include many more products than the APEC group agreed. In this way, one form of plurilateral agreement could evolve into a larger grouping, a form of creeping multilateralism.

Secondly, there has been the suggestion to negotiate SETA as an energy agreement altogether (similar to the WTO Agreement on Agriculture) (Cottier et al. 2009). Other efforts in this regard have continued in parallel. In May 2015, the Netherlands hosted a Ministerial Conference to facilitate an International Energy Charter, as a political declaration for international cooperation on energy (liberalization of trade, protection of energy investments, access to energy sources, energy efficiency, and environmental protection). Signed by 65 countries and international organizations, this is an attempt to modernize and broaden the membership of the earlier European Energy Charter (European Commission 2015).

A third route is to encourage a shift away from mercantilist and protectionist policies altogether and, instead, facilitate multilateral cooperation on RE development and deployment. More detailed proposals have emerged recently, drawing on lessons of past partnerships on climate-friendly energy technologies, to promote effective partnerships of developed and developing countries on areas of common interest, such as energy access, decentralized energy and energy storage (Ghosh et al. 2015b; Ghosh and Ray 2015). At the Paris Conference of the Parties for the UNFCCC, the Governments of India and France announced an International Solar Alliance, bringing together countries with solar energy potential or technologies to establish scalable markets, facilitate solar finance, and encourage collaborative R&D. Developing and coordinating joint subsidy regimes across member countries could reduce the threat of loss of competitiveness while contributing to a more rapid decline in global RE costs (Lewis 2014).

In the minimum, adjustments could be made within the existing WTO provisions. An expansion of the Trade Facilitation Agreement, for instance, could cover sustainable investment (Sauvant and Hamdani 2015). Similarly, the scope of subsidies and government support measures, which could be considered 'non-actionable', could be broadened in order to give countries the policy flexibility to promote a transition to a cleaner energy mix (Ghosh and Gangania 2012, p. 41). Wu (2015) offers several suggestions for how this could be achieved: a fixed allowance (similar to the Agreement on Agriculture) with members permitted a fixed allowance on a negotiated list of environmentally beneficial subsidies; balancing tests (based on the GATT Article XX Chapeau test) for a range of subsidies intended to have positive environmental impacts; and restricting the application of CVDs and other trade remedies against a list of environmental goods. For the last route to be credible, it would still have to impose time limits on subsidy measures, and assess whether they result in private benefits instead of supporting the provision of public goods. Others have also argued that a change in the general trade rules, to make them more conducive to RE investments, should have 'pro-competitive disciplines' for energy as a whole, rather than merely restrict them to clean energy and create further market distortions (Selivanova 2015).

All the above options indicate that there is a growing sense of urgency to find a rules-based solution to reconciling the push for RE with maintaining competitive trade and investment regimes. If parallel multilateral agreements on subsidies and trade remedies cannot be agreed, then regional agreements or sectoral agreements will become necessary (Espa and Rolland 2015). Some suggest that mega-regional agreements, such as the Transatlantic Trade and Investment Partnership (TTIP) or the Trans-Pacific Partnership, could become the forums for negotiating clean energy and energy efficiency issues (Reiter 2015, pp. 4–7; see also Chap. 8). The worst of the options is the current state of legal ambiguity and policy uncertainty with a growing disposition to raise trade and investment disputes.

5 Conclusion: An Unsettled Political Economy

In a section on energy trade, finance and investment, this chapter draws attention to the newest arena for disputes between countries and among firms within and across national boundaries. RE, while rapidly growing (in annual investment and capacity addition), is still at the margins of the global energy system, let alone all global trade. But it has been become the source of far more trade disputes and trade remedy measures than its share in global trade would have warranted. In other words, clean energy trade disputes have less to do with protecting market share today; they are the first forays in what is likely to be an increasingly contested terrain as the global energy system undergoes a transformation over the coming decades. In that sense, the political economy of clean energy trade and investment is still unclear and unsettled. How rapidly the transition to a lower-carbon energy system occurs will have implications in two ways: contestation *between* proponents of clean energy versus those favouring continued investment in fossil fuels; and contestation *within* the clean energy sector, with some favouring a mercantilist approach (seeking greater market share abroad and more investment and jobs at home) and others seeking more open markets for trade and investment in clean energy (in anticipation of an expanding global clean energy pie).

The resolution of disputes—through unilateral measures, bilateral consultations or multilateral legal processes—is going to be only a partial solution. Trade disputes are time-consuming and expensive procedures, which countries do not like to take lightly, whether as complainants or respondents. But WTO rules are challenged in the energy domain. The WTO is just one of many institutions governing energy (see Chaps. 2 and 6). This fragmentation of institutions has resulted in conflicting rules, some urging and promoting the clean energy transition while others restricting the policy tools with which governments hope to facilitate that process (Ghosh 2011). Until those rules cohere, clean energy trade disputes will, at best, offer some signals about which measures are entirely prohibited (such as trade-distorting local content requirements). But legal experts on dispute panels would not have the expertise or the authority to determine which rules should be used for the provision of global public goods (i.e. a cleaner energy system). Policy (national and international) must guide dispute resolution, not the other way round.

This unsettled political economy raises several questions for further research. Firstly, who wins and who loses? Despite the growing policy concern about clean energy trade disputes, much more analysis is needed about the explicit winners and losers in each case and the domestic and international processes and institutions that mediate their interests. As van Asselt and Skovgaard argue in Chap. 11, there are some hypotheses about what factors create, sustain or wind down fossil fuel subsidies but little on RE support measures. A growing literature on green industrial policy should be expanded to include, explicitly, analysis of decisions to raise disputes and the relative merits of different ways to resolve them. Such analysis could help in evaluating which of the numerous alternative mechanisms that are being contemplated are likely to succeed.

Secondly, how does the pricing of energy products and services impact clean energy investments and how might it, in turn, affect trade disputes? As Ustina Markus (Chap. 9) shows, oil and gas pricing worldwide is a complex interaction of costs, profits, taxes, subsidies, commodity markets, speculators and producer cartels. Yet, for the average consumer they are an 'indicator of supply and demand, and confidence in [energy] markets'. RE does not enjoy a similar status yet, hindered instead either by ill-designed subsidy programmes or by frequently fluctuating policy. Combined with the absence of clear pricing of environmental externalities (despite the persistence of 'zombie carbon markets' as Lane and Newell describe in Chap. 10), there is no level playing field for RE. Instead, which constellation of political actors and commercial interests might create a price for energy (oil, gas, coal or renewables)?

And, if that were to occur, would it reduce the temptation for protectionist measures for clean energy and increase the scope for a genuinely integrated global (clean) energy market?

Thirdly, the role of institutions has to be investigated more closely. The WTO's DSM has gained much credibility over the past two decades. Yet, the WTO's broader failings have tempted countries to sign even more regional and bilateral trade agreements. The trend towards mega-regional agreements is driven, at least in part, by energy security concerns, as Leal-Arcas and Grasso explain in their chapter on the TTIP. What would such trends mean for the clean energy transition? Would countries shift from unilateral mercantilism to plurilateral cooperation? The proposals for a SETA or the negotiations on a list of environmental goods and services indicate that one constellation of commercial interests is keen to push ahead with like-minded firms and governments. But would that make the WTO solely the forum for contestation rather than consensus? Who would support multilateralism then?

Clean energy trade conflicts are neither solely about clean energy nor about the effectiveness of dispute settlement. They are, in fact, a signal that the global energy system is changing and the actors, rules, procedures and institutions to govern this new energy system are still evolving. There is likely to be far more conflict for now before the dust settles.

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8

The Transatlantic Trade and Investment Partnership, Energy, and Divestment

Rafael Leal-Arcas and Costantino Grasso

1 Introduction

The Transatlantic Trade and Investment Partnership (TTIP) is a proposed international trade and investment agreement (IIA) between the USA, on the one hand, and the European Union (EU) and its Member States, on the other. IIA might be included in free trade agreements (FTA),[1] bilateral investments treaties, and other investment instruments negotiated and concluded by two or more States (the so-called contracting States) (Weaver 2015). In particular, the TTIP would fall in the category of FTAs, such as the North American FTA (NAFTA) established between the USA, Canada, and Mexico. FTAs are characterized by the fact that trade is free within the bloc, but the member countries independently select import tariffs on goods from non-Member countries (Bagwell and Staiger 1997, p. 291). FTAs are, in principle, compatible with the World Trade Organization (WTO) regime.

In fact, the WTO rules on both goods and services allow WTO Member States to establish regional preferences and set out the formal and substantive requirements under which they have the conditional right to enter into

[1] For a definition of a free trade area, see GATT Article XXIV: 8.b.

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Custom Unions, FTAs, and interim agreements. For instance, paragraph 5(b) of GATT Article XXIV provides that FTAs may not impose rules that are higher or more restrictive than the regulations existing in the same constituent territories prior to the formation of the FTA.[2]

The idea of the establishment of a trans-Atlantic FTA has been discussed for decades (Barker and Workman 2013). The benefits of this FTA for the EU and the USA in terms of trade liberalization, investment, and regulatory convergence are potentially substantial. The TTIP would create the world's largest FTA encompassing about 50% of global output, 30% of global trade, and 20% of global foreign direct investment (Palmer 2013). It is estimated that the economic profits would amount to a $125 billion annual GDP boost for each party (Ikenson 2013). Whilst the completion of TTIP is an economic priority for both the USA and the EU, negotiations have gone slower than anticipated (Benes 2015), having just completed their 11th round in October 2015.[3]

The TTIP aims to enhance economic growth, investment, and trade between the USA and the EU. It will tackle this objective through two main routes: (1) the reduction or removal of tariffs and (2) the elimination of the so-called behind the border technical barriers to trade. A further goal of the TTIP is to open markets for services, investment, and public procurement.[4] More importantly for our purposes, it is expected that the TTIP will promote sustainable development, energy efficiency, and energy security through the agreement's terms and the prospected increase in trade (Leal-Arcas and Wilmarth 2015).

Notwithstanding such worthy and ambitious aims, the TTIP is a highly controversial subject. In fact, since FTAs have the potential to become major political instruments with great social, environmental, and cultural effects, it is likely that the TTIP will have profound consequences on everyday lives of the US and EU citizens (Matinić and Maljak 2014). For instance, as argued by the UN's special rapporteur on promotion of a democratic and equitable international order, the TTIP might pose the risk of creating a separate legal system, based on the establishment of international arbitration rules for the benefit of multinational corporations that represent a threat to basic human rights (Inman 2015). Having said that, the degree to which the TTIP will succeed in this enterprise will largely depend on the quality of its environ-

[2] For an in-depth analysis of the Compatibility between WTO and regional trade agreements, see Leal-Arcas et al. (2015b).

[3] European Commission, '11th Round Transatlantic Trade and Investment Partnership Negotiations,' available at http://trade.ec.europa.eu/doclib/events/index.cfm?id=1375.

[4] European Commission, 'About TTIP' http://ec.europa.eu/trade/policy/in-focus/ttip/about-ttip/.

mental provisions, transparency, enforcement, and monitoring mechanisms (Leal-Arcas and Wilmarth 2015).

Sustainable development is one of the goals of the Lisbon Treaty,[5] which means that the EU will strive for policies that ensure such an objective in the ongoing TTIP negotiations. The EU already has its own Sustainable Development Strategy, aiming to identify and develop actions that will enable it to reach its sustainable development goals through efficient resource use, realizing ecological and social innovation potential, environmental protection, and, ultimately, achieving prosperity.[6]

This chapter assesses in Sect. 2 the central role that energy plays in the TTIP negotiations and the growing importance that energy security is acquiring in the US-EU political agenda. Section 3 analyses the potential effects that the liberalization of trade in energy and raw materials is supposed to exert in the involved economies, whereas Sect. 4 analyses the way in which the so-called US shale gas revolution will drive major changes in the commercialization of energy products. Section 5 illustrates the main problematic aspects currently under discussion in relation to the application of the TTIP to the energy sector. Section 6 discusses how divestment campaigns might constitute a valid instrument of sociopolitical pressure to induce energy companies and governments to adopt more ethical and environmentally friendly policies. Section 7 concludes the chapter.

2 The Role of Energy in the TTIP and Its Growing Importance

From a geopolitical perspective, energy has recently acquired a growing relevance in the TTIP negotiations. In fact, the recent conflict between Russia and Ukraine and the fact that Russia may not be a reliable energy supplier for the EU have surely enhanced the importance of energy security in the US-EU political agenda (Leal-Arcas and Schmitz 2014). Whilst the EU is interested in reducing its dependence on Russia, from the American perspective, lifting the current export ban could improve the geopolitical situation of the USA in the global energy economy (Summers 2014). In fact, by becoming a major energy exporter and a very alluring alternative to Russia for the EU, the USA would strengthen its power and influence on the international energy trade market. In a similar vein, as noted by Cimino and

[5] Articles 3 and 21 of the Treaty on EU, as amended by the Treaty of Lisbon.

[6] Council of the EU, 'Renewed Sustainable Development Strategy' http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%2010917%202006%20INIT.

Hufbauer (2014, p. 9), 'free exports of LNG, crude oil, and other energy products are an essential complement of US international economic policy, which has long advocated free trade in raw materials, unconstrained by export barriers or restrictions. Free exports to Europe are a geopolitical necessity in the wake of Russia's annexation of Crimea and its continued adventurism in East Ukraine.' In other words, the presence of more US crude oil in the market, whilst enhancing the energy security of key US partners, will provide an alternative supply option and mitigate commercial concerns to many countries (Brown 2015).

The Joint Statement issued by the EU-US Energy Council on 3 December 2014 appears highly illustrative of this situation. The Council 'reiterated the resolve of the EU and the USA to stand shoulder-to-shoulder in their support for Ukraine's new government, and underlined the necessity of continuing the reforms in Ukraine's energy sector in line with its Energy Community commitments to integrate progressively the Ukrainian energy market with that of the EU, whilst highlighting the need to protect vulnerable segments of the population.'[7] Moreover, the Council 'reaffirmed that energy should not be used as a political tool' and stated that the territorial integrity, independence, and sovereignty of Ukraine must be respected recognizing the illegal nature of Russian annexation of Crimea as well as the Russian Federation's responsibilities in supporting Ukrainian separatists (Ibid.).

The TTIP negotiations over energy are driven by radically different interests in terms of critical geopolitical and economic implications. On the one hand, one of the EU's main challenges is securing more open, diversified, stable, and sustainable access to energy and raw materials (Leal-Arcas et al. 2015a). In particular, concerned with energy security (Leal-Arcas 2015), diversification, and the safeguard of its own natural gas reserves, the EU is insistently looking for importing energy from other countries.[8] On the other hand, as highlighted below on the US shale gas revolution, the USA offers one of the most promising responses to this need for diversification, especially regarding natural gas and crude oil, which would be a welcome addition to today's growing trans-Atlantic trade in energy products (Buzek 2015).

Due to the 'very idiosyncratic approach to energy' adopted by the USA, which has been characterized by the so-called energy independence theme, both crude oil and natural gas exports have been heavily restricted for many years to protect American domestic energy security (European Parliament

[7] See European Commission, Joint Statement EU-US Energy Council (3 December 2014) available at http://europa.eu/rapid/press-release_IP-14-2341_en.htm.

[8] See 'European countries anxious to buy US natural gas—report' Reuters (17 January 2014) http://www.reuters.com/article/2014/01/17/usa-lng-europe-idUSL2N0KR0Y220140117.

2015, p. 28). In fact, whilst the USA allows unlimited exports of refined products, exports of crude oil are restricted, allowed only under certain circumstances, due to several pieces of legislation enacted during the oil crisis of the 1970s.[9] Furthermore, natural gas imports and exports are bounded by the 1938 Natural Gas Act, according to which exporters must apply for licenses, which have a cumbersome and tedious approval process.[10] As a consequence, the EU currently does not import crude oil or natural gas from the USA (European Parliament 2015, p. 28).

Notwithstanding this limitation, the volume of trade in energy goods between the USA and the EU is already conspicuous. Coal is the main imported commodity from the USA, accounting for 18% of the EU's total coal demand—US solid fuels imports have nearly tripled since 2006 (Ibid.)—and, in 2012, the EU-US trade in gasoline and diesel products was worth US$32 billion (Van Renssen 2013). Taking into consideration, the fact that crude oil and natural gas are the two most important energy sources in the EU, as well as the sources with the highest import dependence ratio,[11] it is easy to imagine that the already considerable energy trade between the EU and the USA will be substantially enhanced if, through the TTIP, the USA lifts the current ban imposed on crude oil export.[12]

As a result, the TTIP represents a chance to make a real difference pursuing at the same time two different objectives that are crucial for the EU: promoting sustainability in the use of traditional fuels and developing the new green

[9] By the early 1970s, American crude oil consumption was rising even and domestic oil production was declining, leading to an increasing dependence on oil imported from abroad. Moreover, the situation was exacerbated by the fact that the Organization of the Petroleum Exporting Countries issued an oil embargo against the USA in retaliation for its involvement in the 1973 Arab-Israeli War. As a result, the USA enacted in 1975 an extremely broad ban on US crude oil exports. See Roger and Asmus (2015).

[10] Section 3 of the Natural Gas Act requires federal approval by the Department of Energy for the import and export of natural gas, including LNG, and approval by the Federal Energy Regulatory Commission for the siting, construction, and operation of onshore LNG import and export facilities. See US Energy Information Administration 'Natural Gas Act of 1938' available at http://www.eia.gov/oil_gas/natural_gas/analysis_publications/ngmajorleg/ngact1938.html.

[11] Currently, the EU's energy dependency rate is 88% for crude oil and 66% for natural gas. See European Parliament, 'TTIP Impacts on European Energy Markets and Manufacturing Industries,' (2015) at p. 28, available at http://www.europarl.europa.eu/RegData/etudes/STUD/2015/536316/IPOL_STU(2015)536316_EN.pdf.

[12] On 4 February 2015, a bill was presented in the US Congress (H.R.702) 'to adapt to changing crude oil market conditions.' It aims to amend the Energy Policy and Conservation Act to repeal authority to restrict the export of coal, petroleum products, natural gas, or petrochemical feedstocks, and to prohibit any federal official from imposing or enforcing any restriction on the export of crude oil. On 9 October 2015, the bill passed in the US House of Representatives with 261 favourable votes and 159 adverse ones. However, the bill will now be engrossed and sent to the Senate for consideration. President Barack Obama has threatened to veto the bill and it seems unlikely at present that both houses of Congress can muster the required votes to override a veto. See Roger and Asmus (2015).

energies of the future.[13] Therefore, it is not surprising that, with the EU seeking to diversify its energy sources and US companies eager to export their 'unconventional' oil and gas riches, energy has become a major focus of the agreement (Solomon 2014).

In particular, to achieve its objectives, the EU intends to use the TTIP, on the one hand, as an instrument to create a strong set of sustainable trade and investment rules in order to facilitate access to energy and raw materials, and, on the other, as an essential agreement to obtain a diversified access to raw materials and energy suppliers (Ibid.). The objectives in which the Europeans' hopes lie have been clearly expressed by the European Parliament when, on 8 July 2015, it adopted a resolution containing the European Parliament's recommendations to the European Commission on the negotiations for the TTIP. This document appears to have central importance because, on the one hand, it reflects the increased role of the European Parliament as granted by the Treaty of Lisbon, and on the other, it focuses on energy as one of the most significant areas of interest to European citizens (European Parliament 2015). In the resolution the European Parliament recommended the Commission, inter alia, 'to ensure that in course of the negotiations the two sides examine ways to facilitate energy exports, so that TTIP would abolish any existing restrictions or impediments of export for fuels, including LNG and crude oil, between the two trading partners, with the aim of creating a competitive, transparent and non-discriminatory energy market thereby supporting a diversification of energy sources, contributing to security of supply and leading to lower energy prices' (Ibid.).

Notwithstanding such an apparent cohesion, there are still substantial differences between the Americans and Europeans over the role that energy should play in the TTIP. In particular, whilst the EU is trying to make a more cogent and strategic case for the inclusion of a separate energy chapter within the accord, the Americans appear unconvinced of the strategic value of this approach and believe that energy is already sufficiently covered in other chapters on goods and services.[14] As a result, at the moment, the discussion on the importance of establishing twenty-first-century rules that will gov-

[13] See European Commission, 'Energy and raw materials in TTIP' available at http://trade.ec.europa.eu/doclib/docs/2015/january/tradoc_153015.2%20Energy%20and%20raw%20materials.pdf.

[14] In December 2014, the EU foreign affairs Chief Federica Mogherini pushed for the inclusion of an energy chapter in the TTIP during talks with US Secretary of State John Kerry. See Crisp (2014)). Such approach has also been adopted by the European Parliament, which recommended the European Commission to retain the objective during the negotiations 'of dedicating a specific chapter to energy, including industrial raw materials.' See the European Parliament resolution of 8 July 2015 containing the European Parliament's recommendations to the European Commission on the negotiations for the TTIP,

ern global trade in energy appears to be quite vague and still inconclusive (Livingston 2015).

3 Raw Materials and Natural Resources in the TTIP

In relation to natural resources, in its initial position paper, the EU aired concerns about WTO rules not fully reflecting issues related to international production and trade in raw materials and energy.[15] More concretely, the EU contends that the WTO has firm rules addressing import barriers, but the rules dealing with export barriers are weaker. Moreover, the General Agreement on Trade in Services does not include a definition of the term ‘energy services’ or adequate rules for governing international trade in energy goods. In addition, trade and distribution monopolies, local content requirements, and the absence of transparency in licenses for exploitation or trade in energy products are also gaps and issues affecting the current framework of international trade in energy.[16]

Therefore, the TTIP could contribute to the development of the multilateral trade system by implementing a stronger set of rules (Leal-Arcas et al. 2014, Chap. 2) for the application of market principles in the area of energy and raw materials.[17] Given the importance of the agreement, an energy chapter in this FTA would likely constitute a blueprint for future agreements.[18] If the TTIP will successfully liberalize trade in energy and raw materials, one of the anticipated advantages would be the increased US exports of liquefied natural gas (LNG) to the EU (Leal-Arcas and Wilmarth 2015).

available at http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P8-TA-2015-0252+0+DOC+PDF+V0//EN.

[15] European Commission, ‘EU-US Transatlantic Trade and Investment Partnership: Raw Materials and Energy: Initial EU Position Paper’ http://trade.ec.europa.eu/doclib/docs/2013/july/tradoc_151624.pdf.

[16] *Ibid.*, p. 1. For further analysis on legal issues arising from international trade in energy, see Leal-Arcas and Abu Gosh (2014).

[17] European Commission, ‘EU-US Transatlantic Trade and Investment Partnership: Raw Materials and Energy: Initial EU Position Paper’ p. 1 http://trade.ec.europa.eu/doclib/docs/2013/july/tradoc_151624.pdf. That said, one could have a situation where fragmented global governance of energy is also incoherent in the application of rules. See Ghosh (2011).

[18] ‘Energy Trade in the Trans-Atlantic Trade and Investment Partnership: Endangering Action on Climate Change’ Sierra Club http://action.sierraclub.org/site/DocServer/Analysis_of_EU_Energy_Proposal_TTIP.pdf?docID=15744.

Hence, one may argue that, should the EU and the USA manage to overcome these technical and legislative barriers, the prospective benefits in terms of energy (let alone in other areas addressed by the TTIP) could be remarkable for the two parties: the USA would become a major energy exporter, which would provide it with a much needed investment stimulus (Cimino and Hufbauer 2014) whilst fostering the consumption of more environmentally friendly energy sources than coal—something already happening even without the TTIP; for its part, the EU would greatly benefit from such a turn of events. US LNG would stimulate the diversification of EU energy supplies and hopefully spur further steps towards the transition to next-generation energy technologies and renewable energy, which could ultimately lead to the demise of Russia's overdominance of energy supply within the European continent. As a result, 'if freeing crude exports makes America richer, its allies stronger, its foes weaker and the world safer, what stands in the way?' ('American energy exports: crudely put,' 7 February 2015).

4 The US Shale Gas Revolution

Due to the so-called shale gas revolution, the USA offers one of the most promising responses to the EU's need for energy diversification. It is no coincidence that energy prices have recently fallen in the USA, with the consequence that EU gas prices are now around three times higher than those of the USA.[19] As mentioned above, at the moment, a cumbersome bureaucracy is seriously restricting US natural gas exports. Nonetheless, this process is smoother for export to territories with which the USA has an FTA (Rostowska 2014). Consequently, becoming preferential partners would help the EU and no adjustments would be needed in the USA's regulatory scheme to open trade. Moreover, negotiations may spur the USA to reduce or even eliminate this permit scheme as well as other existing tariffs or licensing programmes so that energy products and raw materials can cross borders more freely (Leal-Arcas and Wilmarth 2015).

In spite of the TTIP's enormous potential to open trade in energy and raw materials, especially in the field of LNG,[20] the resulting economic benefits are more nebulous. Indeed, even if the USA were to lift its restrictions, it remains to be seen whether the EU would truly benefit from liberalized gas exports.

[19] International Energy Agency, World Energy Outlook 2013, 2013 (at p. 12), available at http://www.iea.org/newsroomandevents/speeches/131112_weo2013_presentation.pdf.

[20] LNG can be sold without a permit only to the few countries with which the USA has FTAs.

That said, the EU could well be the ultimate beneficiary of the anticipated LNG cargoes from the USA as a result of the weak demand and falling prices in Asia.[21]

However, on the European side, the EU needs considerable investments in building the necessary infrastructure to transport gas from the USA (eg, liquefied gas terminals). Moreover, changes are required in the US legislation to allow exports of energy resources (eg, elimination of various forms of export quantitative restrictions, such as bans and discretionary licensing procedures). In fact, by its very nature, any international trade agreement inherently undermines the national laws of the countries that enter into it. To give a glaring example, although on 8 May 2015 President Obama affirmed that 'no trade agreement is going to force us to change our laws,'[22] on 20 May 2015 the House Agriculture Committee voted to repeal in its entirety country-of-origin-labelling (COOL) for beef, pork, and poultry in response to a ruling issued on 18 May 2015 by the WTO,[23] where the WTO decided that the USA had violated global trade rules by requiring supermarket labels on beef and pork to indicate where livestock was born, raised, and slaughtered (Sharma 2015). It follows that, if the TTIP is adopted, such a legal instrument will sooner or later be used to shape the contrasting domestic regulations in such a way that they will eventually be compliant with the international trade rules provided by the treaty.

Regarding the first hurdle of investment in liquefied gas terminals in the EU, the EU has already initiated a number of projects. In 2013, the European Commission approved an investment of €223.7 million in the construction

[21] European Commission, 'Quarterly Report on European Gas Markets,' 2014 (at p. 3), available at https://ec.europa.eu/energy/sites/ener/files/documents/quarterly_report_on_european_gas_markets_2014_q4.pdf.

[22] See Brence M, 'Read Obama's speech at Nike: Full text' (8 May 2015), *The Oregonian/OregonLive*, available at http://www.oregonlive.com/politics/index.ssf/2015/05/read_obamas_speech_at_nike_ful.html.

[23] The issue originated on 1 December 2008, when Canada requested consultations with the USA concerning certain mandatory COOL provisions in the Agricultural Marketing Act of 1946 as amended by the 2008 Farm Bill and as implemented through an Interim Final Rule of 28 July 2008. From the Canadian perspective, the mandatory COOL provisions were inconsistent with the US's obligations under WTO law. On 29 June 2012, the WTO's Appellate Body confirmed that the COOL measures violate Article 2.1 of the Technical Barriers to Trade Agreement by according less favourable treatment to imported Canadian cattle and hogs than to like domestic cattle and hogs. As a result, the United States was given a 'reasonable period of time' to implement the WTO recommendations. In 2013, Canada and Mexico challenged the treatment accorded to imported Canadian cattle and hogs and to imported Mexican cattle under the USA's amended COOL rules for beef and pork and requested the establishment of a compliance panel. The matter was eventually resolved on 18 May 2015 by the WTO's Appellate Body, which held that the amended COOL measures adopted by the USA increase the record-keeping burden for imported livestock entailed by the original measures. See *United States—Certain Country of Origin Labelling (COOL) Requirements*, WT/DS384/AB/R.

of the Świnoujście LNG terminal in Poland.[24] This investment will increase security of energy supply as well as help diversify energy sources.[25] The terminal is expected to begin importing Qatari gas starting from 2015 (Wagner et al. 2014). An additional example of the EU's commitment of investing in the necessary infrastructure for increased LNG imports is a financial contribution of €107 million approved by the European Commission in 2014 to upgrade the Greek liquefied gas terminal of Revithoussa.[26]

Furthermore, the European Investment Bank (EIB) has been providing more than €2 billion for energy infrastructure in the Netherlands over the last five years, thereby endorsing large-scale investment in electricity transmission and in the Maasvlakte LNG terminal, located in Rotterdam harbour.[27] Such investments in adequate infrastructure for LNG imports from the USA will place a severe economic strain on the EU. Nonetheless, taking into account the projects that ambitious enterprises have already been undertaken in this area, whilst others are on their way, one may argue that it is a price that the EU would be happy to pay in the long run to overturn Russia's pipeline-based natural gas market dominance in the European continent.

As far as the US legislative snag is concerned, the issue is, at the time of writing, being discussed in the US Congress. Whilst in the USA there are still supporters of the ban on crude oil exports, who aim at keeping American petrol prices low, 'the consensus among economists is that prices of refined products such as petrol are set in the world market,' which means that, 'with American crude bringing that price down, the cost of fuel may even fall a bit for Americans' ('NaftaNaphta,' 22 August 2015). In particular, many authoritative voices and pundits advocate lifting the various forms of export quantitative restrictions, such as bans and discretionary licensing procedures (eg, Summers 2014). There are indeed many reasons for such a move.

The shale gas revolution in the USA has profoundly transformed global energy production, consumption, and trade. In fact, over the past decade,

[24] European Commission, 'A boost for clean and secure energy in Poland: European Commission approves more than € 200 million EU regional funds for liquefied natural gas terminal' press release (16 July 2013) http://ec.europa.eu/commission_2010-2014/hahn/projects/pdf/pl_2013_07_16_liquefied_natural_gas_terminal.pdf.

[25] *Ibid.*

[26] 'EUR 107 million of EU regional funds to optimize natural gas supply in Greece' (12 August 2014) http://ec.europa.eu/commission_2010-2014/hahn/projects/pdf/el_31072014_energy.pdf.

[27] Counter Balance, 'Myths and Facts: The Netherlands as a Gas Roundabout and EIB Investments in Excess Capacity,' http://www.counter-balance.org/wp-content/uploads/2014/06/Gas-Roundabout-finalweb.pdf.

the USA has become a net exporter of coal[28] and petroleum products[29] and is planning to increase considerably natural gas exports in the coming years.[30] Although, as it will be further analysed, the environmental consequences of the technique used to extract natural gas is still being debated, the overall production is certainly booming (Cunningham 2013) to the extent that some have dubbed this period as the 'dawn of a US oil and gas renaissance' (Houser and Shashank 2014, p. 15).

There are many reasons for lifting the current US restrictions on crude oil export as well as natural gas. First, the USA has a long-standing tradition of deference towards free trade (Summers 2014). Second, contrary action by the USA would infringe WTO rules (ie, GATT Article XI)[31] and might spur other countries to follow suit (Hufbauer et al. 2013, p. 18). Third, removing the current quantitative restrictions would be in line with the Obama administration's stated aim of expanding US exports (Ibid.).

5 Problematic Aspects Related to the TTIP and the Energy Sector

Over the course of the last years, negotiations over the TTIP have caused considerable concerns, specifically in relation to the effects the TTIP might produce in the energy sector. Such concerns are primarily related to climate change and the need to pursue a transition to a low-carbon energy future. In

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[28] Since 2010, the US coal exports have amounted to some 100,000 thousand short tons that represent almost the double of the precedent figure. See US Energy Information Administration, 'Quarterly Coal Report (Abbreviated) January-March 2015,' available at http://www.eia.gov/coal/production/quarterly/pdf/qcr.pdf.

[29] In 2014, the amount of US petroleum product exports have amounted to 1,525,641 annual-thousand barrels whilst in 2009 this figure was just 738,803. See US Energy Information Administration, 'Petroleum & Other Liquids—Exports,' available at http://www.eia.gov/dnav/pet/pet_move_exp_dc_NUS-Z00_mbbl_a.htm.

[30] See US Energy Information Administration, 'Annual Energy Outlook 2013 with Projections to 2040,' available at http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf.

[31] Incidentally, US energy export restrictions are in manifest violation of GATT Article XI, and yet have never been challenged at the WTO. Since WTO law is about economic interests, and WTO Members may obtain cheap coal from other countries, this may explain why no WTO Member has ever challenged this GATT Article XI violation by the USA. Bringing a complaint before the WTO is costly and countries can certainly find cheap coal elsewhere. That said, the USA has long argued that its energy export restrictions are excused by GATT Article XXI(b)(iii), which states that 'Nothing in this Agreement shall be construed … to prevent any contracting party from taking any action which it considers necessary for the protection of its essential security interests… taken in time of … emergency in international relations.' The legal basis of the US export restrictions is the 1975 Energy Policy and Conservation Act, which was a response to the 1973 oil crisis, and which expressly mentions that its measures are intended to prepare for energy emergencies.

the near future, the world will have to meet the energy needs of a growing and fast-developing world population, whilst mitigating the impacts of climate change (Ladislaw et al. 2008). As a result, the complex and evolving links between energy security and climate change challenges need to be taken into consideration very carefully.

In fact, both energy security and climate change might have broad economic, political, and societal consequences. For instance, on the one hand, a lack of energy security can exacerbate geopolitical tensions and impede development; whilst, on the other, impacts of climate change might carry both short-term and long-term adverse implications. Mitigating the threat of climate change by reducing carbon dioxide (CO_2) emissions is a global societal challenge that requires response by governments, businesses, and civil society (Foxon and Pearson 2013). Although, at times, energy security and climate change interests conveniently align, some supply-side measures present conflicts between energy security and climate goals (Ibid.). Consequently, harmonizing the possible solutions to these two key requirements might represent a major conundrum, which has been so far described as the energy 'trilemma' (Boston 2013, p. 55).

For instance, a government might adopt a policy focused on fostering improvements in energy efficiency and reductions in energy demand. Such an action might enhance energy security and reduce greenhouse gas (GHG) emissions that have negative environmental and climate impacts. On the other hand, a different policy aimed at fostering energy security might focus on increasing the local production and imports of fossil fuels that result in higher CO_2 emissions (eg, oil shale, oil sands, and extra-heavy oil deposits). Therefore, it is policymakers' responsibility to ensure that energy choices, on the one hand, do not produce major security problems and, on the other, do not exert negative impacts on climate change.

The EU currently faces such a thorny dilemma, whose energy policies aim both at enhancing energy security and drastically reducing harmful GHG emissions. In fact, following the European Council's target to reduce GHG emissions by 80–95% below 1990 levels by 2050 in order to keep climate change below 2°C, the European Commission released an energy roadmap for a more sustainable and secure energy system and which sets the scene for new EU level policy actions.[32] Since the energy generated to provide electricity, heat, and transport services is a major source of CO_2 and other GHG emissions, meeting the 2050 GHG emissions reduction goal implies a radical

[32] See The European Commission, 2050 Energy strategy, available at https://ec.europa.eu/energy/en/topics/energy-strategy/2050-energy-strategy.

transformation of systems in order to meet energy service demands (Foxon and Pearson 2013).

Taking into account such a complex situation, the TTIP negotiations have caused serious concerns.[33] In particular, from an environmental perspective, the following two major issues related to the adoption of the TTIP appear to be the most significant ones. The first one concerns the environmental issues connected to the extraction procedure of hydraulic fracturing, so-called fracking, which is the process of drilling and injecting fluid and chemicals into the ground at a high pressure in order to fracture shale rocks to release natural gas inside.[34] Recently, in many EU countries, fracking has become a very controversial topic as mining companies are searching for new locations to obtain gas from the ground due to its potential adverse health effects connected with the injection of dangerous chemicals[35] into the ground (such as lead, uranium, and mercury).[36] For such a reason, although in some European countries mining companies are receiving permits to continue with prospecting and even commercial mining, in some others these activities have been prohibited. For instance, in France the Constitutional Court has upheld a ban on this extracting technique for environmental reasons ('France cements fracking ban,' 2013). Similarly, Germany, Scotland, and Bulgaria have imposed a temporary ban on fracking whilst they are conducting the necessary public health and environmental assessments (Good 2015).

Regarding the TTIP, many European citizens are afraid that this agreement, by liberalizing investment rules in the area of energy, would allow US firms to build gas wells in European territory in order to produce shale gas by means of hydraulic fracturing.[37] The threat appears quite concrete because, although the European institutions have confirmed that each EU member country will remain responsible for deciding whether to allow shale

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[33] For instance, it has been argued that 'by directing economic development towards exports and external competitiveness at all costs, these policies make our economies and our societies ultra-dependent on fossil fuels imports and exports, and provide to economic actors instruments that are preventing the implementation of genuine policies able to achieve the energy transition.' See Combes M. and Canonne A. 'Climate or TTIP make your choice!' available at https://france.attac.org/IMG/pdf/note_tafta_lima_-en.pdf.

[34] As of 2009, there were already more than 493,000 active natural gas wells in the USA, almost double the number in 1990. Around 90% of them have used hydrofracking to get more gas flowing. See Urbina, I. 'Regulation Lax as Gas Wells' Tainted Water Hits Rivers' *The New York Times* (26 February 2011) http://www.nytimes.com/2011/02/27/us/27gas.html?_r=2&pagewanted=all.

[35] For a complete list of chemicals potentially used in a hydraulic fracturing job, see 'What Chemicals Are Used' FracFocus https://fracfocus.org/chemical-use/what-chemicals-are-used.

[36] See 'NO to shale gas extraction (fracking) in Europe' EuropeanGreenParty http://europeangreens.eu/news/no-shale-gas-extraction-fracking-europe.

[37] See European Commission, 'Energy and raw materials in TTIP' available at http://trade.ec.europa.eu/doclib/docs/2015/january/tradoc_153015.2%20Energy%20and%20raw%20materials.pdf.

gas production, the majority of the EU Member States do not currently forbid fracking and the above-mentioned bans are only temporary in nature. Furthermore, such concerns appear even more concrete after September 2013, when oil and gas company Lone Pine Resources filed a $250-million NAFTA lawsuit against Canada over Quebec's moratorium on fracking for oil and gas underneath the St Lawrence River (Patterson 2015). At the same time, however, the same removal of major trade barriers in the energy sector, like the so-called Buy American provision that demands companies to source a certain percentage of goods and employment locally in the USA, might also have a very positive impact on the environment, allowing, for instance, renewable energy companies to become more profitable and competitive, no longer forcing them to 'buy local' as part of energy deals (Smedley 2015).

The second major concern is represented by the current absence of a specific provision about renewable energy in the TTIP.[38] Such a lacuna might potentially lead to an increase in fossil fuels consumption in the EU, with the environmental hazards connected with the usage of such energy sources.[39] As a matter of fact, at the moment, the only energy sources traded in significant amounts between the EU and the USA are refined petroleum products and solid fuels. In such a context, it is likely that the adoption of TTIP, allowing Europe to gain access to US crude oil and natural gas resources, will increase the European dependence on fossil fuels that, although representing an enhancement of energy diversification, may raise significant environmental issues in the near future (Smedley 2015).

As many have commented, this drive for unrestrained fossil fuel trade, reinforcing a dangerous and obsolete model of producing and selling energy sources, could be disastrous for the climate (Solomon 2014). In particular, it appears that, as the TTIP is currently drafted, it will likely limit the ability of the USA and the EU to put in place and implement policies to combat the climate change crisis and protect human health; this, despite the fact that climate experts warn that the vast majority of fossil fuel reserves must stay in the ground and that countries must urgently scale up renewable energy development (Ibid.). To give an example, it has been calculated

[38] The only section of the draft text to deal specifically with renewable energy—Article O: Localization in the renewable energy sector—actually serves to restrict the ability of governments to create localized clean energy economies and build domestic manufacturing of renewable energy technologies. See Solomon, I. 'The EU's drive for free energy trade in the TTIP endangers action on climate change' EnergyPost (3 September 2014) http://www.energypost.eu/pursuit-free-energy-trade-trans-atlantic-trade-investment-partnership-ttip-endangering-action-climate-change.

[39] See European Commission, 'Energy and raw materials in TTIP' available at http://trade.ec.europa.eu/doclib/docs/2015/january/tradoc_153015.2%20Energy%20and%20raw%20materials.pdf.

that, on average, a $10 increase in crude oil prices would lead to 9.9 billion barrels of additional US oil production between 2015 and 2050; this can be translated in more than 4.4 billion tons of CO_2 into the atmosphere when burned, that is, the equivalent of lifetime emissions from 42 coal plants.[40] On the contrary, many specialists have argued that allowing the lift of natural gas bans would benefit the environment. From their perspective, in fact, increased natural gas exports would reduce the use of coal, which releases greater amounts of CO_2 when burned and is, hence, more harmful to the environment (Summers 2014).

Such concerns are strengthened by those who fear that combining US and EU regulatory systems becomes a 'race to the bottom' that will lower the environmental and public health protections that are currently applied in both legal systems.[41] Recital F of the resolution containing the European Parliament's recommendations to the European Commission on the TTIP confirms these fears.[42] In the recital, the European Parliament called for an intervention of the agreement in this area, recognizing that the EU's attempts to deal with the challenges of climate change, environmental protection, and consumer safety have resulted in high regulatory costs for EU enterprises, which—if left unaddressed in the TTIP—may accelerate the process of delocalization, deindustrialization, and job losses, thereby threatening the very policy targets that EU regulations seek to achieve.[43] Such formal recognition of the ineffectiveness of the currently adopted EU environmental policies appears to pave the way for an easement of regulations in this area to be implemented through the adoption of the TTIP. However, in the same document, the European Parliament recommended the European Commission 'to ensure that TTIP serves as a forum for the development of ambitious and binding common sustainability standards for energy production and energy efficiency, always taking into account and adhering to existing standards on both sides such as the EU energy labelling and eco-design directives and to explore ways to enhance cooperation on energy research, development and innovation and

[40] See 'Lifting the Ban, Cooking the Climate—The Climate Impact of Ending the US Crude Oil Export Ban' Oil Change International (March 2014) available at http://priceofoil.org/content/uploads/2014/03/LiftingTheBanFinal.pdf.

[41] See 'Transatlantic trade deal must not dilute environmental safeguards' Parliament UK (10 March 2015) http://www.parliament.uk/business/committees/committees-a-z/commons-select/environmental-audit-committee/news/ttip-report-announcement/.

[42] See the European Parliament resolution of 8 July 2015 containing the European Parliament's recommendations to the European Commission on the negotiations for the TTIP, available at http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P8-TA-2015-0252+0+DOC+PDF+V0//EN.

[43] *Ibid.*

promotion of low-carbon and environmentally friendly technologies.'[44] As a result, since the TTIP might represent a double-edged sword, the way in which it will actually be implemented may be the keystone for a transition to a real low-carbon energy future.

6 Divestment Campaigns in the Energy Sector

Taking into consideration what has been discussed so far, it appears extremely important that the European institutions firmly pursue the objective of including rules in the TTIP that will promote renewable energy and energy efficiency. At the same time, adopting a policy of directing investments towards greener technologies and energy sources can represent another fundamental element to assure the protection of the environment. Whilst awaiting such kind of policies to be formally adopted by the authorities, it is possible to welcome the campaigns launched on this issue in the private sector.

For instance 350.org, a global climate movement founded in 2008 by a group of university students in the USA,[45] has recently launched a wide campaign that seeks to dissuade investors from owing shares in the companies that produce fossil fuels and thus contribute to climate change.[46] In other words, the so-called divestment campaigns aim at deviate investment flows from a commercial activity that generates concerns to another one that is considered more ethical and sustainable. Their purpose is to generate a form of dissent in which shareholders intentionally sell their assets from a corporation in order to enact social change.[47]

Historically, divestment campaigns were launched in South Africa as a way to oppose the apartheid regime. Thanks to these campaigns, from 1985 to 1990, over 200 US companies cut all ties with South Africa, resulting in a loss of $1 billion in direct American investment, and the consequent economic situation contributed significantly to abolish apartheid.[48] Another example of divestment campaign is the one that has been conducted against Israel since the outbreak of Palestinian violence in September 2000. It aims to boycott products made in Israel or in its West Bank settlements, and to divest from

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[44] *Ibid.*

[45] See the organization's website at http://350.org/.

[46] See 'Divestment campaign—Fight the power' The Economist (27 June 2015) http://www.economist.com/news/finance-and-economics/21656204-investors-are-being-pressed-sell-their-holdings-coal-oil-and-gas-fight.

[47] See Gethard, G. 'Protest Divestment And The End Of Apartheid' Investopedia (16 July 2008) http://www.investopedia.com/articles/economics/08/protest-divestment-south-africa.asp.

[48] *Ibid.*

firms that are profiting from Israel's occupation of the West Bank and Gaza. Caterpillar, whose earth movers are used for demolishing Palestinian homes and building on settlements, and Motorola, whose clients for communications equipment include the Israeli army, represent the most popular targets.[49]

From a financial perspective, divestment campaigns are based on the assumption that ethical investing, sustainable investment, environmental, social and governance policies, and corporate social responsibility do not imply lesser returns for corporations.[50] In any case, the importance of divestment is more connected with the cultural effects that these campaigns might produce than with their concrete economic results. In fact, as highlighted by those opposed to divestment, selling a security does not materially reduce the price if there are lot of buyers still out there.[51] However, whilst they are quite ineffective in a financial sense, they can have a real impact by shaping public discourse. As a result, if they follow the divestment campaigns, private funds and other investors (such as universities) will divest from corporations that trade in fossil fuels, such a gesture could help to reignite public debate on climate change and energy security.[52] Such an outcome can be regarded as desirable, taking into consideration that, after the economic crisis of 2008, climate change mitigation and the other environmental issues have actually been pushed somewhat into the background, even in the TTIP context.[53]

7 Conclusions

This chapter has shown the considerable relevance that energy bears to international trade negotiations. It has illustrated the profound geopolitical and economic implications that lie behind the adoption of the TTIP in relation to the energy sector. It has also highlighted, from an ecological and environmental perspective, the dangerous consequences that may ensue with the liberalization of the energy market following the adoption of the TTIP. Economic and strategic interests, which are pursued for obvious political reasons, are

[49] See 'Boycotting Israel – New pariah on the block' The Economist (13 September 2007) http://www.economist.com/node/9804231.

[50] See 'Divestment campaign - Fight the power' The Economist (27 June 2015) http://www.economist.com/news/finance-and-economics/21656204-investors-are-being-pressed-sell-their-holdings-coal-oil-and-gas-fight.

[51] See 'Fossil-fuel divestment - No smoking' The Economist (27 June 2015) http://www.economist.com/news/leaders/21656183-institutional-investors-should-divest-oil-gas-and-coal-only-if-their-beneficiaries.

[52] See Hendey, E. 'Does Divestment Work?' Harvard University Institute of Politics http://www.iop.harvard.edu/does-divestment-work.

[53] *Ibid.*

traditionally the key drivers of legislative and regulatory changes. However, as has been underlined in this chapter, potential dangers might arise where such changes are introduced without taking into serious consideration the profound environmental and social shifts they can produce. Divestment campaigns might play a fundamental corrective role as an effective tool to establish a higher level of awareness amongst an easily confused and too often distracted public opinion.

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9

The International Oil and Gas Pricing Regimes

Ustina Markus

The pricing regimes of energy commodities have undergone several evolutions since oil and natural gas began being traded on a global scale. The mechanisms for setting prices are meant to reflect the value of those commodities based on supply and demand, and the overall value of that energy trade. In reality, while the trading prices reported by futures exchanges do reflect what the market believes those commodities are worth at a particular time, they do not accurately show the price of oil and gas being consumed throughout the world since there are numerous energy deals that are made outside of the scope of commodities exchanges, making it impossible to gage the value of the trade looking strictly at futures prices. The anomalies between exchange prices and prices charged domestically by energy producers or those charged by exporters vary because so many countries that are energy exporters have nationalized energy industries which allow the governments of those states to intervene in energy deals and often sell that energy at prices that are not connected to the trading price at exchanges. Thus, oil and natural gas are somewhat unique among the many commodities that are traded on exchanges with private companies often being the producers in countries with nationalized energy sectors, making it impossible to completely separate business from politics in oil and gas pricing.

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1 The Evolution of the Pricing System

In the early days of the global oil market, spot markets determined the price of oil. Once the American oil magnate John D. Rockefeller, founder of Standard Oil, obtained a near monopoly on American refined products, and a substantial interest in American oil fields, he was able to set the price to some extent. Independent producers could always offer their product on the market at more competitive prices, but Rockefeller's oil empire was so big in the late nineteenth century that he was known to lower the price that his oil company charged in order to drive competitors out of that market. Once he achieved those goals, he would raise the price once again (Tarbell 2011).

After Standard Oil was dismantled in 1911 for being a monopoly, a number of smaller companies were created that competed aggressively against each other. That competition led the major oil companies to become better organized, and there were attempts to set up cartels and monopolies to set the price in their favour. Up until the 1960s, the largest oil companies, known as the Seven Sisters, used a system of having a 'posted price' at the well. That price was set by the oil companies themselves, and although it should have reflected the cost of producing a barrel from a particular well, it tended to be set low, since that was the price on which they paid the taxes and royalties that were due to the host country where their oil fields were located. The oil companies made their real profits from the price of refined products since they also owned the refineries that processed the oil, and also the retail outlets for selling the product to customers. In times of competition between the companies, the posted price would be lowered arbitrarily, depriving host countries of further taxes and revenues.

It was the constant reduction of posted prices in the 1950s that finally led to the creation of the Organization of Petroleum Exporting Countries (OPEC) in 1960 and the establishment of national control over oil fields in the OPEC states (Yergin 1991, pp. 391–412). Yet although OPEC was setting the price of its oil by the 1970s, it was not able to maintain the ability to determine that price because independent oil producers could always offer their petroleum on the spot market. When there was a glut of oil coming on the market, as happened in the early 1980s, that made OPEC's oil uncompetitive and it made refineries reluctant to sign long-term contracts with OPEC, preferring to buy on the spot market instead. Eventually that eroded OPEC's ability to set the oil price. Instead, OPEC's only way of influencing the price was through imposing quotas on its members to ensure that there was no glut of oil on the market, but the market and its demand became the actual force determining the price of oil (Learsy 2007, pp. 105–106).

2 The Introduction of Futures Trading in Oil

The opening of oil futures trading at the New York Mercantile Exchange (NYMEX) in 1983 formally heralded an era when the price of oil would be directly dictated by market forces, rather than oil producers. The oil exchange at NYMEX was based on the principles of futures trading in other commodities that began with the opening of the Chicago Board of Trade in 1848. That was the first attempt to stabilize prices on commodities by free trading. Later futures exchanges opened in other cities and countries. It was not until 1983, however, that oil futures began being traded at the NYMEX, well after gold and other metals had begun to be traded, as well as currencies (WTRG). The move to trade oil transpired because of a glut of oil on the market that led more and more refineries to buy their oil on spot markets rather than through contracts with OPEC, so that a futures market in oil actually made more sense as a means of setting the price than a contract with a producer. Those contracts could ultimately be broken by invoking force majeure if the contract price was too far above the spot price as had been happening in the early 1980s. Once that happened, OPEC lost much of the power it had to control the price of oil, as traders poured over energy production and consumption forecasts, bidding the price up or down depending on their analysis. Traders based their predictions on which way the price would go based on a number of factors, including looking at the spot price for oil traded at places such as the Rotterdam Exchange or New York, where it was immediately delivered to the buyer.

The crude traded at NYMEX was West Texas Intermediate (WTI), a light, Texas oil with an American Petroleum Institute (API) gravity of 39.6° that was slated for delivery at the refinery in Cushing, Oklahoma. That had been the world's most heavily traded oil by volume. There was also an exchange in London, the International Petroleum Exchange, which was renamed the Intercontinental Exchange in 2005, that traded the North Sea's Brent crude (also a sweet, light oil with an API of 38°), which was delivered to Europe's largest refinery—the Sullom Voe refinery in Scotland. While oil prices were in the $20s region at the start of the twenty-first century, WTI tended to be about $1 more expensive than Brent. With the growth in oil prices, the spread between the two continents widened and Brent became the more expensive oil. One explanation for the gap between WTI and Brent—both of which were relatively high-quality light and sweet crudes—was that the supplies of oil on which Europe depended were less stable than US supplies. The main supplier for the USA was Canada—a country most considered to be very stable, with a common border that allowed pipelines to carry supplies. Europe had relatively small reserves of its own oil and had to import a much larger proportion of its crude than the USA. By 2011, when oil and gas released from hydraulic fracturing, or fracking, in the USA was decreasing American demand for imported energy, the spread between WTI and Brent illustrated that trend by making the American oil cheaper in relation to its European counterpart. Europe was more dependent on Middle East oil than the USA, and during the Arab Revolutions that began in late 2010, when political instability in Libya and other oil-producing Middle East states threatened the supply of oil, Europe's futures exchanges saw the price of their oil spike, while American oil began trading several dollars below Brent prices. At one point in 2013, that difference was in the region of $20 less per barrel for WTI (EIA 2013).

Other traded crudes included the Omani barrel, traded on the Dubai Mercantile Exchange, which opened in 2008, and was used as a benchmark in the Asia-Pacific region for Middle East oil (Dubaimerc). The very light and sweet Tapis (API 43°–45°) from Malaysia was traded in Singapore as a reference for light Far East oil and because of its relatively high API, it is traded at a premium against both Brent and WTI. Minas from Indonesia sets the price of heavy Far East oil, although it had a relatively light API of 35.3°. Russian crude was based on the price of Urals oil, which was a mixture of several crudes with varying APIs from Western Siberia, the Urals, and the Volga region. All of that oil passed through the Druzhba pipeline to Europe for export and was traded at NYMEX under the name Russian Export Blend Crude Oil. OPEC used a whole basket of crudes to determine the real value of oil at any given time. The crudes included in the basket changed in 2005, but as of June of that year they consisted of 12 different crude oils produced by OPEC states, including Arab Light from Saudi Arabia, Saharan Blend from Algeria, Bony Light from Nigeria, Qatar Light, Angola Girassol, Ecuador Oriente, Iran Heavy, Iraq Basrah, Kuwait Export, United Arab Emirates Murban, Venezuelan Merey, and Libyan Ess Sieder. The OPEC basket was not an actual barrel slated for delivery, but a reflection of global oil prices based on the main export oils produced by OPEC.

WTI and Brent are the most often referenced benchmark crudes, with US prices usually quoted in terms of WTI while European prices are cited on the basis of Brent. Both prices are quoted in dollars as that was the primary currency accepted by oil companies for shipments of their oil when the futures exchanges were introduced. Crudes that are not traded at exchanges set their prices against the going rates of Brent or WTI to reflect their value in relation to the traded crudes. Since the price of a barrel of oil depended on both its API gravity and sulphur content, a medium crude could trade at a 10–15% discount against Brent, while a particularly sweet light crude could trade at a premium of 5% or more above WTI's current price. The pricing agency Platts cites oil prices by the name of the particular crude and its value in relation to Brent crude, for example, 'Siberian Light equals Brent minus US$2.10/barrel.'

What should be noted is that the traded price of crude has nothing to do with how much it actually costs to get that barrel out of the ground. Historically crudes from different regions had their own values assigned to them which were supposed to reflect their production costs. Once the price of oil began being set by futures exchanges, production costs became irrelevant since the exchanges were setting the price based on global demand and at what rate the oil industry could supply that demand, rather than any individual field's production costs. Thus, while Saudi oil reportedly costs as little as $2 or less to extract per barrel, it will sell for whatever the market price is at the moment, just as North Sea oil, which costs around $15 or more to extract, or Canada's oil sands, which could run over $30 to produce. The market price itself is more responsive to supply and demand than to any correlation between production costs and supply. Thus when supplies were tight and there was no real spare capacity for production from 2003 to 2008 the price of oil was high. Conversely, after the introduction of fracking for commercial production and the discovery of new oil fields which began coming online as a result of the high oil prices, the price of oil fell drastically in 2014 reaching a low of $44.88 for WTI on 13 March 2015, from $107.20 less than a year before on 12 June 2014, and $54.67 for Brent on those same days, from $113.03 (Y charts).

There are several actors active in futures trading on the oil market. Since contract agreements cover most oil that actually changes hands, futures trading at exchanges is largely used to hedge contract transactions in case a producer or receiver (often an oil company or refinery) signs a contract and finds the price of oil has swung against them between the signing of the contract and the actual delivery of the crude. Speculators are the other major participants of futures trading accounting for 90% of contracts traded. Speculators do not intend to deliver or receive oil, but just make money on the change in the price over time. Oil is also sold on spot markets, which means immediate delivery of the cargo. Spot market prices are followed closely, as they give a precise indication of what the market is willing to pay and the state of supply, but only 5–10% of oil is actually sold on spot markets (CRS 2005; Platts 2010).

3 Oil Price Fluctuations

The past decades have demonstrated how volatile oil prices are and how responsive the trading market is to those prices. In January 1999, after Iraq was allowed to sell oil under the UN's Oil-for-Food programme, its 300% increased production coincided with the Asian financial crisis, which reduced demand, resulting in the price of oil dropping to just above $10 per barrel. Oil prices began increasing in 2000, reaching over $20 per barrel by September then falling back again, before they started their upward climb in 2003. That ascent saw crude rise to over $40 per barrel by September 2004 and reach $70 per barrel in September 2005. By the end of 2007, the price was in the $90s and analysts were predicting it would pass the psychological benchmark of $100. In January 2008, it did so, and even topped $140 in July that year (CNN 2006, The Economist 2008). Despite its meteoric rise, oil began slipping in the second half of 2008 and by December it had dropped below $40. Over 2009 and 2010, the price settled between $65 and $85 per barrel. Some analysts predicted that was an appropriate range to keep production at levels preventing a shortfall, but not high enough to exacerbate the global recession that had begun in 2008. The Arab Revolutions that began in December 2010, along with threats of sanctioning Iranian oil, drove up oil prices that year so that the average price in 2011 was $111—an all-time high annual average (Fig. 9.1).

While consumers react negatively to high oil prices, there are benefits for producers that accompany high prices. After 2011 Venezuela's extra heavy oil (which had previously been too expensive to be considered commercially viable) came under contracts increasing Venezuela's proven reserves from 100 billion barrels in 2007 to almost 300 billion in 2012. At the same time, oil that would have been too expensive to produce at $50 per barrels was coming on line in the Gulf of Mexico, Canada and the North Sea. The high price also spurred exploration and Brazil, which had 11.2 billion barrels of proven reserves in 2006, saw them rise to 13 billion in 2014, making Brazil the world's ninth largest producer of petroleum and other liquids that year (EIA, *Brazil*, 2006; EIA, *Total Petroleum…*, 2014).[1] West Africa experienced similar rises in reserves owing to exploration in the Gulf of Guinea. On top of it all, fracking technology became commercially viable bringing American oil and natural gas online. Ultimately, that meant more oil and gas was becoming available which brought about the 2014 price collapse.

[1] EIA, 'Country Analysis Brief. Brazil,' August 2006; 'Total Petroleum and Other Liquids production 2014,' available at: http://www.eia.gov/beta/international/?fips=br.

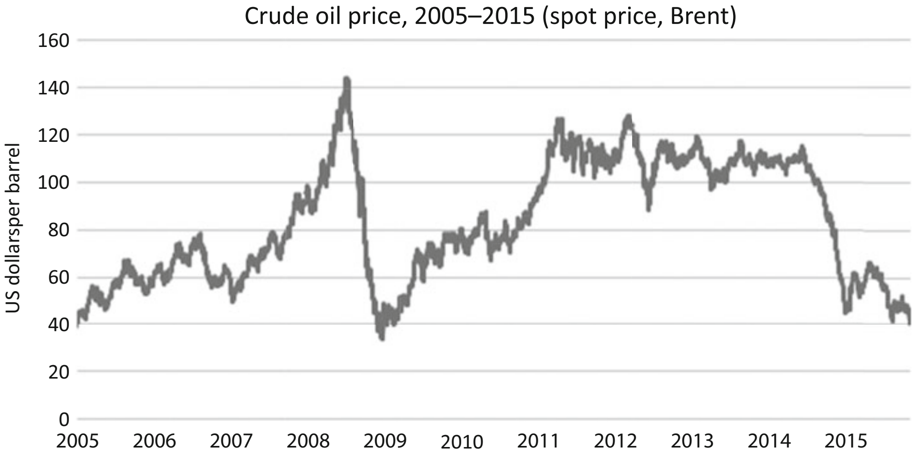

Fig. 9.1 Crude oil price, 2015–2015 (*Source*: US Energy Information Administration, https://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm (accessed 26 November 2015))

Oil prices are affected by a number of factors from the strength or weakness of the US dollar, to political instability, natural disasters, and speculation on the part of traders. Historically, prices have been very volatile, with gluts causing the price to plummet and shortages leading to steep rises. In the nineteenth century, the Standard Oil monopoly would sometimes flood the market with oil to force competing companies out of business and then readjust the price once the market was cleared of its competition. In the 1980s, as new independent producers appeared on the scene the price of a barrel nosedived by 70% in just a few months, from $31.75 per barrel of WTI in November 1985 to just $10 per barrel in 1986. That led Saudi Arabia to adopt Standard Oil type tactics and let the price keep falling by relying on net-backing deals. Such deals guaranteed a fee to refiners per barrel and allowed the Saudis and refiners to split the profits, so they could get something per barrel even if the price was rock bottom. The Saudis knew—just as John D. Rockefeller of Standard Oil had—that they could afford to take a cut in profits if it forced some producers out of the market. In November 2014, the Saudis again refused to cut back on their production at the regular OPEC meeting in Vienna, preferring to retain their market share and figuring that eventually oil that was more expensive to produce would be forced out of the market while they preserved their market share (EIA, *Markets and Finance…*, 2015).[2]

[2] EIA, 'Markets and Finance: Year in Review: Crude Oil Price 2014,' 28 April 2015, available at: http://www.eia.gov/finance/review/annual.

The 2005–2008 spike in the price of crude had less to do with any one event than a convergence of factors. The war in Iraq was often touted as a reason, but the fact was that Iraq's production had been offline for much of the 1990s owing to the UN embargo imposed on Baghdad after its invasion of Kuwait in 1990. Thus, consumers all had alternative suppliers by the time the UN allowed for some production under its Oil-for-Food programme. The actual forces most often cited as working behind the high oil prices from 2003 were the relatively rapid growth rates of Gross Domestic Product (GDP) in some developing countries, especially China and India, which led them to greatly increase their oil consumption. It had also been noted that the US dollar declined in value around that time, and as oil prices were set in US dollars on the exchanges, the higher prices were a way of offsetting the weak dollar. By one account, the weak dollar in 2007 was adding as much as $12–15 per barrel of oil (*Oil & Gas Journal*, 2007). Other factors included the changing structure of the oil industry, with many mega-mergers between companies having taken place over the 1990s; OPEC policies of rationing how much oil members put on the market; the rise in gasoline prices independently of oil because of tight refining capacity; the low levels of crude oil stocks; and the shortage of industry equipment, including rigs. Those factors all combined with the usual concerns over political instability in the Middle East as well as Venezuela and Nigeria. There were also concerns about the Russian oil industry, as the Russian oil company Yukos was essentially renationalized in 2006. In addition, as financial markets were weak, investment portfolios turned to commodities and real estate for profits, and that trading was leading to a speculative drive in its own right. Overall, oil responded to a complex set of circumstances that could not have easily been predicted (CRS, *Gasoline Prices* 2005, CRS, *World Oil Demand* 2005).

Apart from the financial and demand factors that led to the steep rise in the price of oil after 2002, there were others that were regularly at work. Those included seasonal swings, as well as natural disasters. Generally, crude oil prices tend to be higher in the winter when demand is larger because of cold weather, and surge again in August when people take to the roads in their cars for vacations and air conditioners are on all day. Prices tend to weaken in the spring with warmer weather. Other factors influencing the price of crude include stockpiling, which occurs in different places at different times. Ultimately, however, oil prices cannot exceed what people can pay. When prices rise dramatically, a sudden drop in demand is often seen, reflecting an inability to pay the new premiums. Historically that has worked to force the price down again. What was surprising in the first decade of the twenty-first century was that developed countries were able to sustain oil at over $70 per barrel, and it was only after oil topped \$100 per barrel that many countries descended into recessions. The recessions were blamed on other factors apart from just oil, including poor lending practices on the part of banks and real estate bubbles worldwide. Although the price of oil dropped precipitously in the second half of 2008, it rebounded over 2009 to the \$70s range. Most oil executives felt that was an appropriate level to maintain global production in the region of 85–86 million barrels a day which was the consumption rate at that time, and that the price was in the affordable range for consumers.

The argument that the adjusted post-2008 price was a more accurate reflection of what the true price of oil should be was demonstrated by the attitude of Saudi Arabia towards the price fluctuations. During the period of rising prices from 2003 to 2008, the Saudis—who tend to be conservative over oil prices since their dependency on oil revenues makes them vulnerable to any drop in demand during recessions—were initially wary of the upward climb in the price of oil and increased their own production to keep the price down. But by 2005, as there were no signs of a global recession and Organization for Economic Cooperation and Development (OECD) countries were coping with the new prices, the Saudis stepped back from their earlier attempts to keep the price lower and decided it was time to recalibrate their price band (Learsy 2007, p. 46). That said, many less developed countries had been unable to cope with the high price of oil and had seen their economies negatively affected even before the price hit \$50. When prices finally went past an affordable level for the developed states, a drop in demand was noted in the OECD that was naturally accompanied by a drop in price. The USA, the world's single largest consumer, saw its demand fall from around 22 million barrels a day in 2005 to less that 18.9 million in 2013. By the end of 2009, the price appeared to have been corrected to what was perceived as a realistic level, but political instability in the Middle East in 2011 once again drove prices up.

4 The OPEC Factor

The price of oil had been on an upward trend for over a decade, with the exception of a temporary price collapse in 2008. That changed in 2014 when oil from American fracking created a surplus on the market and OPEC did not reduce its output to buoy the price. The move demonstrated the extent of influence OPEC has over the price of oil. OPEC itself cannot set the price of oil. It had wrested control of the posted price from the international oil companies over the 1960s by demanding it have a say over that price. In the

1970s, it was able to set the price for its oil, which set a benchmark for what companies then charged for oil from other regions from where they extracted oil. Once futures trading in oil was introduced, however, OPEC was unable to simply set a price itself anymore, and reluctantly had to accept that the market would dictate the price of oil. The only mechanism it had at its disposal to influence the price of oil was regulating its output by setting quotas for its members. That had been the concept on which OPEC was based when it was created by the Venezuelan Minister of Hydrocarbons Juan Pablo Perez Alfonso. In reality, however, in its first decade OPEC did not enforce those quotas (Rabe 1982, p. 160). It was only when the price of oil collapsed in the early 1980s and futures trading was introduced that the organization began to take those quotas seriously. With most members disregarding their allocated quotas and producing more oil to make up for the low price, thereby driving the price further down, all the while expecting Saudi Arabia as the largest producer to cut its production to keep prices higher, the Middle East kingdom reacted by refusing to curb its output if its fellow OPEC members would not restrict theirs. It reasoned that with its low production costs per barrel, it could still make a profit even if it sold oil for just $2 to refineries and split the profit on the refined product with them. Few other countries could produce oil at such a low cost and the more expensive oil that was being produced would eventually be forced out of the market. That gambit eventually paid off and also shocked Saudi Arabia's fellow OPEC members into curbing their errant behaviour.

In 2014, it appeared there would be a re-enactment of the 1980s unrestrained production although the reasons behind it were somewhat different. Just as in the 1980s, new oil from Norway, Mexico, and the Soviet Union was coming on the market creating a surplus and driving the price down, so too by 2014 new oil from American fracking, Russia, Kazakhstan, Brazil, Canada, and the coast of west Africa was making itself felt on the market. North African and Middle East countries affected by the Arab Spring revolutions a couple of years earlier had recovered and were producing oil at the same levels as before the revolutions. Once again, OPEC members looked to Saudi Arabia and the wealthier members to curb their production to keep the price up, but the Saudis, Kuwaitis, and Emiratis were unwilling to give up their market share for the benefit of Venezuela and other poorer members. Within OPEC itself, there is no real mechanism for setting quotas (Griffin and Xiong 1997). It is not based on a country's proven reserves, or Venezuela would have the lion's share of the quota. It is also not based on population or on GDP. Production capacity is one of the factors influencing a county's quota, and by 2014, with Venezuela being recognized as the world's largest holder of proven reserves, talks with Iran over its nuclear weapons programme intensifying, raising the spectre that sanctions could be lifted against Tehran, making it easier for that country to increase production, and the dropping price leading other OPEC states to want to increase their own production, the three wealthier states realized if they cut their own production they would have a very difficult time getting that share back in the future. Thus, at the November 2014 OPEC meeting in Vienna, they dug in their heels and refused to cut their share. Other OPEC states did not offer to cut back on their own production so OPEC maintained its level of production from the previous year. As OPEC was producing approximately 40% of the world's oil, any decision to cut or increase production would have an impact on global supplies. Once the word came out that OPEC was not going to cut production, the price of oil began falling. At the same time, a number of rigs in the USA stopped pumping because they could not produce oil profitably if the price fell below $60. Projects to develop Venezuela's extra heavy oil were also put on hold, and there were questions as to whether Brazil's Lula field could produce at a profit if oil were in the $50s range, as well as fields in the Gulf of Mexico. Despite the drop in the price of oil, OPEC's wealthier members held firm in the succeeding biannual meetings and continued to maintain their production. Kuwait was believed to be best placed to weather the low oil price for several years, but the Saudis also reportedly could still meet their annual budget for four years owing to their sovereign wealth fund, currency reserves, and other assets. It was even reported that they were looking at trimming their budget so they could continue running with oil priced at $50 a barrel for eight years (EIA, *Saudi Arabia Budget…,* 2015).[3]

5 The Price of Gasoline

Gasoline is the single largest petroleum product consumed. Some 30–40% of crude consumption is in the form of gasoline in most countries (CRS, *World Oil Demand*, 2005). As gasoline is derived from crude oil, it is expected that the price of crude will have a large effect on the price of gasoline. To some extent this is true, but the degree to which it affects prices is not constant throughout the globe. In some countries, taxes on gasoline are equivalent to the value of the oil or even more, meaning that over half of what consumers pay for their gasoline is tax to their own government. According to OPEC, in

[3] EIA, 'Saudi Arabia Budget Insulated from Effects of Lower Oil Prices,' 12 February 2015, available at http://www.eia.gov/todayinenergy/detail.cfm?id=19971.

2014 tax on the price for a litre of gasoline in the UK amounted to 60.1% of the total price, while the cost of the oil in the gasoline made up just 29.7%. In the USA, tax made up just 14.8% of the cost, while the price of oil accounted for 60.6%. In Japan, the numbers were 33.4% and 47.9% respectively, and in Canada they were 29.7% and 53.5% (OPEC, *Who Gets What…*). Other factors that made up the rest of the cost of gasoline are refining costs, distribution and marketing costs, and station mark-ups. While in the USA taxes on gasoline are relatively low, that is not true for the rest of the developed world. Both the European Union (EU) and Japan have higher rates of taxation on crude. Thus, while the market price paid by OECD states for imported crude was roughly the same, the difference in the cost consumers paid for gasoline between them was huge. At the other end of the scale, there are countries that do not tax, but actually subsidized gasoline.

In August 2015, the most expensive countries for gasoline were Norway, Hong Kong, the Netherlands, the UK, and Denmark, where price ranged from $1.75 per litre in Norway to $1.64 in Denmark. On the opposite end of the spectrum, the least expensive countries for gasoline were Venezuela (which had been noted for having the world's cheapest gasoline for years), Saudi Arabia, Kuwait, Qatar, and Bahrain. Price there ranged from 0.01 cents per litre in Venezuela to 25 cents in Bahrain. Other major consuming countries in Asia often fell somewhere in the middle, but those had been increasing the taxes on gasoline at home to bring it in line with world oil prices, especially as they found themselves importing more and more oil. In India, the price of a litre of gasoline in March 2015 was 34 cents, while in China it was 42 cents. Since the price of oil had dropped considerably from the previous year, it would be expected that the cost of gasoline would have followed, but in fact, it had gone up from 21 cents in India and 31 cents in China from the previous year. Those hikes were due to a reduction in subsidies in those countries over that period. Thus, while oil generally trailed futures prices in international sales, gasoline prices in countries were often far off of that mark (MyTravelCosts 2015; Subramanian 2013).

6 The Price of Natural Gas

The different nature of gas makes its pricing system differ from that of oil. Natural gas is not only priced differently but the nature of the commodity almost separated natural gas that was delivered via pipelines from liquid natural gas (LNG) into separate commodities, although both are ultimately gas. As natural gas is exactly that—gas—it cannot simply be put in a barrel and brought to a spot auction. It can only be transported in tightly sealed pipelines that were built to a specific destination. Because of the costs involved in bringing gas from its source to its markets by building pipelines and the accompanying infrastructure, that investment had to be guaranteed when pipeline projects were contemplated so that natural gas tends to be delivered under long-term contracts to ensure that the projects are commercially viable. As gas is associated with oil, the price of gas shadows the price of oil in most contracts. There are some exceptions such as Yemen's LNG contracts with the companies GDF Suez (now Engie) and Total. Those exports were initially meant to go to the USA and so were indexed to American prices based on Henry Hub gas trading. The US pricing system for natural gas is unique as it is based on futures trading. The other main regional markets are Europe and Asia. Indexing natural gas to the price of oil originated in Europe in the 1960s and was the system adopted by Asia to price its natural gas imports. Since the two systems are completely different ways of pricing the commodity, the prices for American gas and European or Asian gas are often different. Owing to the increased supply of US natural gas from fracking, by 2014 it cost about a quarter of what Russian gas cost and was spurring Europeans to push for a new pricing formula for their gas which would take spot market prices into account more (Melling 2010).

Since the USA is no longer importing as much LNG as was expected in the early years of the twenty-first century, much of the gas Yemen had earmarked for the USA gets exported to Asia with Yemen sharing in the profits (Darbouche 2012). The pricing structure tying the price of gas to oil limits the gas markets to regions accessible by pipelines or LNG ports and their associated pipelines. The European region is largely supplied by Russia in Central Europe and Algeria in the Iberian Peninsula, while the North American region saw exchanges of gas between the USA, Canada, and Mexico. Starting in the 1960s, LNG exports expanded that trade with Algeria supplying Europe and the USA supplying Japan with Alaskan gas.

Although those natural gas exports were being shipped under contracts, there were still occasions when there were energy surpluses, which would be sold on spot markets, and also shortfalls when distributors who had more demand than they contracted for wanted to buy additional gas. Western Europe has a number of gas trading hubs, the largest of which is the UK National Balancing Point, developed in the mid-1990s when spot prices for natural gas were as much as 30% below long-term contract prices, giving the same impetus to setting up a natural gas futures exchange as the early 1980s had experienced in the oil markets (Heather 2010). In 2010, some 25% of natural gas sales in Europe were done through spot markets along those hubs, yet that volume was not sufficient to turn the hubs into price-setting mechanisms, and most gas was still delivered based on contracts that linked the price of gas to oil, even though the Europeans were expressing a preference for seeing the market set prices over long-term contracts (Svoboda 2011).

Asia consumes about 60% of the world's LNG trade, and Japan, Korea, and Taiwan all based their prices on the Japan Crude Cocktail oil-indexed price mechanism, which took the top crudes imported by Japan as the benchmark for pricing gas and LNG. In China, the government announced plans in 2011 to reform the price of natural gas to consumers by pegging the price of natural gas to alternative forms of energy. As gas was subsidized, despite the decline of the price of oil, consumers have not seen natural gas prices decrease (Platts 2014). India has multiple regional pricing regimes. The price of domestically produced natural gas brought online by state companies is set by the government, while imported gas is determined by the market (Ernst and Young 2014).

Although Europe and Asia continued to use long-term contracts tied to the price of oil as the primary price-setting mechanism, things worked differently in the USA. In 1989, natural gas futures began being traded on the floor at NYMEX and in April 1990 they became a formally traded commodity on the exchange. The contracts were pegged to the spot price for gas at the Henry Hub distribution centre in Louisiana, where 13 pipelines intersected to supply the USA with some 5 billion cubic feet (1.8 billion cubic metres) of gas each day. The futures trading differentiated how gas was priced in the US when compared to Europe or Asia. With the advent of fracking towards the end of the first decade of the twenty-first century and the release of enormous deposits of gas from shale, the US market found it was well supplied with gas, and that was reflected in the price, which dropped to half of what it had been in 2008 (NYMEX). Countries in the EU have been seeking a formula, which would take the futures price of gas, as well as the spot market price, into account in pricing the commodity. But as of 2015, the contract price for gas sold to the EU was still tied to long-term deals that include infrastructure costs.

7 LNG Pricing

LNG differs from piped gas as it can be transported across oceans in tankers so that it is not limited to regional markets. Work on turning gas to liquids for storage had begun as early as the 1820s, but it was not until the 1960s that any form of LNG market began to take form. The delay in developing a global natural gas industry was due to the costs and technology involved in transferring the commodity from one region of the globe to another. In gas form, natural gas was limited to transport by pipelines. But as a liquid, natural gas takes up just one six-hundredth of the volume of the commodity in its gaseous form, making it a real possibility to transport larger volumes by tanker. The key was to have LNG facilities to liquefy the gas and then re-gasify it at the other end. Those facilities had to have the capability of keeping the gas at the extremely low temperature of −260 °F (−162 °C), and pipelines to transport it from its point of entry facility and point of exit at the other end. In the 1960s, LNG was transported for the first time from Algeria to Europe. Because of the costs involved in putting the infrastructure in place, the contracts for natural gas supplies were all long-term contracts. For Japan, the development of the LNG industry proved to be a boon. There was no possibility of pipelines reaching Japan from gas fields, and the country was searching for cleaner forms of energy when its first LNG shipment arrived from the USA in 1969 (Yergin, *The Quest…*, 2011, pp. 315–317).[4] China and India both began receiving LNG shipments later in the twenty-first century, and had signed long-term contracts with Qatar as they saw their increasing energy consumptions growing.

Despite the advantages of using gas in producing energy, LNG shipped by tankers could not compete with gas transported by pipelines in the twentieth century. It was not until the twenty-first century that the costs of transporting LNG were brought down to levels that made it competitive with piped gas. The force behind those innovations was Qatar, which had made discoveries of natural gas starting in 1971 that made it the world's third largest holder of gas reserves with 871.59 billion cubic feet (24.66 billion cubic metres) of natural gas in 2014. Unlike Russia and Iran—the largest and second largest depositories of gas—Qatar is not located in a region where it can construct pipelines to the lucrative markets of Europe and Asia. Thus, it focused on making the transport of LNG cost-efficient. It bought tankers twice the size of those previously used to transport more gas at a lower cost. With ExxonMobil funding research into the transport of LNG, the problem of making LNG competitive with other forms of energy was ultimately solved by expanding the transport operation at every level, making the volumes transported competitive with piped gas because of the scale on which the operation was done. By 2007, Qatar had become the world's largest exporter of LNG, which gave the small kingdom the world's highest per capita GNP (BBC, 'Has Wealth…,' 2014).

[4] Yergin, Daniel, *The Quest: Energy, Security, and the Remaking of the Modern World,* (The Penguin Press, New York, NY; 2011), pp. 315–317.

The LNG revolution opened other possibilities. Gas could also be stored at freezing temperatures and sold on spot markets so that its price was more reflective of supply and demand than the natural gas sold under long-term contracts that were tied to the price of oil.

8 Alternative Pricing Regimes: Energy Barter

While futures trading and spot markets are the mechanisms most commonly used to price energy, a substantial amount of oil is traded through barter and that trade does not always translate into market prices. Venezuela's 1980 San Jose Accord and the 2005 PetroCaribe deal with other Latin American states and the Caribbean are examples of petro-barter, wherein Venezuela offered those countries oil at discounted prices or in exchange for products those countries produced such as sugar, and also offered lenient credit terms (Petrocaribe.org). In the case of Russia, it too has engaged in petro-barter. The early warning radar station in Baranovichi, Belarus, was leased to Russia as a means of offsetting Belarus's energy debt to Moscow. In Ukraine, the Russian Black Sea Fleet base in Sevastopol, Crimea, was also a way of offsetting Ukraine's energy debt before Russia annexed Crimea. During the Cold War, the Soviet Union used barter in providing energy to its former satellites in east and central Europe, as well as other Soviet republics. It was not until the 1970s and 1980s that it came to rely on its oil exports for cash from its western customers, while some 60% of its trade with east European states was based on barter, as well as much of its trade with its client states in Africa and the developing world (Rogers 2014).

Prior to the July 2015 nuclear deal between Iran, the USA, and other countries, Iran proposed petro-barter deals with both China and India as a means of bypassing international sanctions, which were an obstacle to large bank transfers for Tehran. China's investment in Africa is also seen as a form of petro-barter. The loans given for constructing infrastructure are often seen as deal sweeteners to win energy contracts and are essentially portrayed as bribes, although technically they are a form of development aid (French 2014, pp. 186–192).

Apart from countries engaging in petro-barter, there have been instances where oil companies themselves have used barter in paying employees. An example cited by Douglas Roger in his article on petro-barter described how Lukoil employees in Perm, Russia, were paid with clothing produced in China as there was no cash available in the early 1990s. The workers then sold the clothing at markets for cash (Rogers 2014).

Apart from petro-barter, some countries also engage in swap deals. Iran imports energy from Kazakhstan and Turkmenistan in its northern regions on the Caspian Sea and gives the equivalent in value back to those governments from its southern provinces on the Indian Ocean which those countries can then export abroad. In August 2015, it was reported that the USA and Mexico were considering oil swap deals ('US Will Reportedly…' *Oil and Gas Journal*, 14 August 2015).[5]

One other form of barter is substituting transit fees from pipelines delivering energy for partial payment of energy. Tunisia received gas in exchange for its transit fees from Algeria. In the former Soviet Union, Ukraine offset part of its payments for energy for transit fees from its pipelines, including the Druzhba oil pipeline which stretched from Siberia to the EU. Georgia offset its energy payments to Azerbaijan through transit fees from the Baku–Tbilisi–Ceyhan pipeline.

There have been a number of criticisms made over petro-barter. The first is that since it deprives the provider of cash, it may well short change the exporter. It is actually difficult to assess the true value of barter since it is often aimed at making it easier for the importer to import that energy. Although Venezuela may or may not have received appropriate compensation through Cuban doctors working in Venezuela in exchange for its energy, it may have benefited in other ways, such as having more economically stable neighbours.

Another criticism levied against petro-barter trade has been that it creates a new type of corruption. Petro-barter promotes economies of favours since cash is not forthcoming in those transactions. Thus, those with access to people who can grant favours puts them ahead of those who do not have that access, often creating socio-economic inequalities (Rogers 2014).

9 Energy Subsidies

Another feature of petroleum and natural gas sales, which makes it difficult to assess the true value of trade in those commodities, is the issue of subsidies. Many energy-rich countries subsidize oil and natural gas on their domestic markets. That is largely because energy exporters tend to have nationalized energy resources and, therefore, as property of the state citizens in those countries often feel they are entitled to the energy themselves. All of OPEC's mem-

[5] 'US Reportedly will Begin Limited Oil Swaps with Mexico,' *Oil and Gas Journal*, 14 August 2015. On-line article available at: http://www.ogj.com/articles/2015/08/us-reportedly-will-begin-limited-crude-oil-swaps-with-mexico.html/.

bers have nationalized their energy resources, as have other exporters such as Mexico and Norway. The price charged for energy varies between different countries. Venezuela is noted as having the world's cheapest oil at around five cents a litre (19 cents for a gallon) of gasoline, while in Iran it stands at 11 cents for a litre (less than 50 cents a gallon), in Saudi Arabia it is 12 cents per litre (78 cents per gallon), in Kuwait 21 cents per litre (88 cents a gallon), and in Qatar 22 cents per litre (92 cents a gallon) ('The World's Cheapest Gas,' *Christian Science Monitor*, 29 February 2012).

Subsidized energy prices are not only applied in energy-exporting countries. Importers such as India and China have also subsidized energy costs. The reasons behind the seemingly illogical policy in energy-importing states are an attempt to help the poor cope with the costs of energy. In India, kerosene is often used by the poorest sectors in cooking, and removing subsidies is seen as hurting that sector. China has been attempting to remove subsidies, and with the drop in price for oil and natural gas subsidies have slowly been reduced, although the cost of that energy has not dropped because it had been below market rates (Ghosh and Ganesan 2015).

While subsidized, or underpriced, energy costs are generally popular with the citizens of states that provide that energy, there are many who criticize that practice. The main condemnations are that subsidies deprive governments of potential revenue and discourage energy conservation. In Iraq and other Persian Gulf states, air conditioners blow full blast in every room of homes even if no one is at home. In Russia, natural gas is used in heating apartment buildings, but often there is no thermostat to regulate the gas so it is simply on or off. When it is off, apartments are as cold as freezers, but when it is on they become sweltering saunas. To remedy the problem and regulate the temperature, muscovites turn on the gas and then open the windows to cool the apartments. While that works well in getting the temperature to a comfortable level, it represents an enormous waste of energy.

The problem for countries with subsidized or underpriced energy is that once that benefit has been introduced, it is often difficult to roll back. Nigeria experienced protests when former President Goodluck Jonathan attempted to raise the price of oil, so that he backed down from his original plans and implemented only marginal increases in January 2012. In Venezuela, President Nicolas Maduro first proposed raising the price of gasoline in December 2013 and has repeatedly stated the underpriced commodity was costing the country some $12.5 billion a year, but to date he has been unable to enforce any price increase for fear of protests. The issue was so sensitive in the country that not even the popular late President Hugo Chavez dared propose such a measure, and the last time an announcement was made in favour of raising oil prices in 1989, by President Carlos Andres Perez, protests erupted in which around 300 people were killed ('The Debt Crisis…' *The New York Times*, 1989).

The problem of cheap domestic energy has been felt acutely by the Middle East and North African (MENA) countries. Demand for natural gas in MENA grew almost 90% between 2000 and 2010 leading some of those countries to become net importers of natural gas even though the region holds half of the world's proven gas reserves (Darbouche 2012). The cheap price of energy, especially natural gas, led Kuwait to begin importing LNG in 2009. As demand for natural gas has been growing within the MENA region, governments have announced plans to tackle the problem of underpriced domestic supplies, but to date only Iran appears to have made any progress since it began a five-year programme to remove subsidies in December 2010.

Iran had a unique set of incentives to reduce energy subsidies. It was under economic sanctions by many members of the international community over its alleged nuclear weapons programme which substantially curbed foreign investment in the country. In addition, it offered the highest energy subsidies of all MENA states at some $60–70 billion per year. Its subsidies had made it the world's second largest importer of gasoline in 2005 as it did not have the refining capacity to supply domestic demand. That demand was high not only because of domestic consumption but people found that filling up gasoline tanks and selling them in neighbouring Turkey for profit provided additional income so they were selling the country's cheap energy outside of Iran. The cheap energy also made Iran the world's third largest consumer of natural gas after the USA and Russia. President Mahmoud Ahmadinejad instituted a programme in 2010 raising the price of oil over five years, and natural gas over five to ten years (Darbouche 2012).

Opponents of the removal of energy subsidies have argued that cheap energy helps domestic industries develop and makes them more competitive in the global market. Since energy-exporting states sometimes have an unhealthy dependence on energy revenues, diversifying their economies by developing other sectors is seen as a highly desirable development, and any government plans that could undermine such efforts are seen as detrimental to the state's interest. Nonetheless, many countries which subsidize or underprice their energy can ill-afford such policies. In Egypt between 2010 and 2011, the government spent $16 billion on energy subsidies, which was more than the $4 billion spent on health in that period, or the $9 billion spent on education (Darbouche 2012). The costs of subsidizing and underpricing energy are seen as unsustainable in the long term in most countries engaged in such practices, but raising prices has not proved easy and is unlikely to happen quickly.

10 Conclusion

Looking at the price of a barrel of oil or unit of natural gas traded at futures exchanges and spot markets gives a precise idea of what importers can expect to pay for a barrel of oil or how much natural gas is worth on spot markets at a particular time. Yet that does not provide a full picture of the value of the energy market because oil- and gas-producing states sometimes subsidize that energy on their domestic markets, and also engage in petro-barter, with the goods and services that are being exchanged for energy not being the exact equivalents of the trading price. The mechanisms for setting energy prices are also subject to change. Today the price of oil is generally set by futures trading, but with the exception of the USA, the price of natural gas is often not set by exchanges, but tied to the price of oil. That may change in time as Europeans want a formula for their gas imports that takes spot market prices into account. That could lead Asia—the world's largest energy consuming region—to recalibrate its pricing mechanism and also look at spot market prices rather than oil prices in setting its natural gas prices, or even develop a new formula for setting prices for its gas imports. Thus, although there are mechanisms for determining the price of energy, since they are not applied uniformly in every energy transaction they cannot be used in setting a value to the business of energy. Yet for average consumers and companies paying the market price for energy, they are an indicator of supply and demand, and confidence in the markets for those commodities.

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10

The Political Economy of Carbon Markets

Richard Lane and Peter Newell

In late 2014, the *World Bank Group*, *World Economic Forum,* and *We Mean Business Coalition* announced that they would be convening a carbon pricing leadership coalition with business and government leaders. The coalition includes 1000+ companies and investors with more than $24 trillion in assets, along with 74 countries and 23 states, provinces, and cities representing 54% of global greenhouse gas (GHG) emissions, 52% of global GDP, and almost half the global population (World Bank 2014). As then World Bank Vice President and Special Envoy for Climate Change, Rachel Kyte stated at the time of the announcement:

> The science is clear. The economics are compelling. We are seeing a shift toward the economic architecture that will be necessary to avoid a 2-degree-warmer world, an architecture that supports green growth, jobs and competitiveness. (World Bank 2014)

Carbon markets are at the core of this architecture. At the United Nations (UN) level, ongoing negotiations around the international community's attempt to manage and govern climate change are focused on the construction of new market mechanisms. Since 2013, new emissions markets have been introduced in places as diverse as California, Kazakhstan, Mexico, Quebec, South Korea, and China, while interest in both 'green' carbon through REDD

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and REDD+ projects and increasingly 'blue' carbon associated with marine ecosystems continues to grow. Ultimately, the ambition of many advocates of carbon markets is the creation of a fully integrated, globe spanning set of markets. On one level then carbon markets, as a key means of pricing carbon, are evidently flourishing.

Yet at the same time, carbon markets are in crisis. In recent years, repeated and well-publicised scandals have engulfed the UN's Clean Development Mechanism (CDM) and Joint Implementation (JI) schemes (Schneider and Kollmuss 2015), as well as the flagship EU Emissions Trading Scheme (ETS). Australia's carbon trading scheme, inaugurated in 2012, was promptly discontinued in 2014 with the arrival of Tony Abbott's conservative administration. Globally, carbon prices continue to be low, with early 2015 rates for emissions reduction credits ranging from around $12/tonne to $2/tonne across a variety of regional and national systems, clearly too low to incentivise investment in low-carbon technologies (Fioramonti 2014, p. 91).

How can we make sense of these flourishing yet failing markets? There appears to be a growing gulf, on the one hand, between the lack of traction carbon markets have with investors, the alleged target and beneficiary of such mechanisms (Spash 2010), and on the other, the scale of political commitment to market mechanisms and the speed of roll-out of new markets and emissions trading systems. In a dynamic with obvious similarities to responses to the global financial crisis which began in 2008, public actors such as states and international institutions are increasingly at the forefront of efforts to (re)construct, bailout, stimulate, and develop new carbon markets, in spite of their questionable impact upon reductions in GHG emissions which continue to rise exponentially. For some commentators, 'market readiness' programmes, proposals for an online 'UN Climate Credit Store', and the World Bank's carbon pricing leadership coalition provide clear evidence of the zombie status of the carbon markets. Like other uses of the zombie metaphor in the social sciences (such as zombie capitalism, zombie economics, and zombie neoliberalism), carbon markets appear effectively dead, yet still politically unstoppable (Reyes 2011; Lipow 2014), staggering ever onwards from crisis to crisis.

In this chapter, we begin to explain the zombie-like existence of the carbon markets. We ask who and what are carbon markets for (Paterson 2012), and how, why, and when they came to take the form they do. This requires that we take seriously the political economy of carbon markets, within which they have both developed and continue to change. We identify the ways in which they are a product of, and help to constitute, a particular type of contemporary neoliberalism—climate capitalism (Newell and Paterson 2010). In the next section, we provide further detail on the 'zombie' state of carbon markets before developing in Sect. 3 an account of the (neoliberal) political economy of carbon markets. In Sect. 4, we then look at who the markets are developed by and what are they developed for, and in Sect. 5, at how and when carbon markets came to take the form they do.

1 Decarbonisation of the Dead: The State of the Zombie Markets

Emissions trading has been part of the climate policy landscape for nearly 20 years now. A mechanism for a global carbon market was first established with the CDM as one of the pioneering 'flexible' mechanisms under the Kyoto Protocol concluded in 1997. The UN's CDM market took off rapidly after its introduction, and the global value of primary offset transactions grew to US$7.2 billion in 2008, more than a tenfold growth from 2004, largely due to this market. Under the CDM, Certified Emissions Reductions (CERs) amounting to more than 1.8 billion tonnes of carbon dioxide (CO_2) equivalent were produced in the first commitment period of the Kyoto Protocol (2008–2012) (UNFCCC 2012a). Looking forward, and despite the manifest uncertainty over the future of the CDM and future carbon prices, the United Nations Environment Program Technical University of Denmark Partnership (UNEP DTU) UNEP DTU has projected a tripling of the number of reductions issued, to 4.46 trillion CERS over the 2012–2020 commitment period (CDM Pipeline 2015).

Outside of the UN system, at a regional and national level a swathe of new carbon markets and emission trading schemes are coming online in places like China, South Korea, Vietnam, Thailand, California, Kazakhstan, Mexico, and Quebec, bringing the total number of emissions trading systems up to 17 in 2015, with China's national system already scheduled and a further 15 systems under consideration (ICAP 2014; see also Engels et al. 2014; Lederer 2014; Betsill and Hoffman 2011). In China alone, seven pilot projects were launched in 2014 ostensibly covering 700 million tonnes of CO_2 emissions (worth $135 million in deals last year), and when a national system emerges in 2020, there are estimates of a $3.5 trillion market being created (Bond 2015). Before this in 2012, India had put in place a Perform, Achieve and Trade (PAT) scheme for energy efficiency targets and trading among its largest industrial sectors. By the end of 2015, the share of global emissions covered by emissions trading is expected to have increased by 70% since 2005 (ICAP 2014). Moreover, while only one of the markets currently incorporates credits derived from reducing deforestation, there are many advocates for an integration of REDD+, a global mechanism to reduce emissions from deforestation, into the carbon market representing a vast potential for further expansion.

In spite of these developments, European and UN emission schemes saw their turnover plummet from a peak of $140 billion in 2008 to $130 billion in 2011, $84 billion in 2012, and $53 billion in 2013 even as new carbon markets were being developed and implemented. Indeed, while the European Union Emissions Trading System (EU ETS) lost a third of its value in 2012 alone, the December 2012 sale of 5.58 million permits by the EU netted only €6.45 million, a cost that was too low to incentivise meaningful investment in low-carbon technologies among the regulated industries (Fioramonti 2014, p. 91). In the wake of a persistent over allocation within the EU ETS and the EU parliament's vote against a 'back-loading' plan to temporarily remove 900 million tonnes of carbon allowances from the market, on 16 April 2013, the price of European Emission Allowances (EUAs) fell 50% in only ten minutes, from an already moribund €5 to €2.63 (Fioramonti 2014, p. 91).

In the CDM, meanwhile, where primary and secondary transactions were estimated at $33 billion in 2007, a 90% year-on-year decrease in the price of CERs was witnessed to 2012, with CERs trading at this point at around US$0.40/tonne. This price was roughly 10 cents less than 'what analysts say it costs developers in fees to get issued with credits and well below costs involved in investing in carbon-cutting equipment' (Fioramonti 2014, pp. 93–94), and since 2012 the market for CDMs has collapsed almost entirely to US$0.20/tonne (Bond 2015). Not only have carbon markets been hit by low prices that are failing to drive necessary investment in low-carbon technology they have also been rocked by a series of scandals about their integrity, including instances of fraud and gaming by market actors as well as evidence of collusion and corruption (Transparency International 2011).

We can see then both the spectacular growth in new emissions trading systems, with the backing of politicians, industries, and economists, at the very same time as a process of continual failure on their own terms. That is, the carbon markets have repeatedly failed to adequately price carbon either effectively or efficiently. In spite of bailouts through back-stopping and voluntary cancellation schemes, the EU ETS remains Europe's 'flagship tool to fight climate change' (European Commission 2015). Similarly, collapsing prices, wild market fluctuations, and widely reported corruption have not prevented continued faith being placed in the ability of the markets to deliver meaningful reductions in GHG emissions after the end of the first commitment period of the Kyoto Protocol in 2012 (CDM UNFCCC 2012a, b). And governments continue to construct mechanisms and streams of finance to support the growth and interconnection, or linkage, of carbon markets under the second commitment period (2012–2020).

This is precisely the troubling zombie condition of the carbon markets that we alluded to above. With such a poor track record to date, what drives these market developments ever onwards? With carbon prices too low to effectively spur low-carbon technology development on the part of big polluters, and too volatile, with too great a requirement for market intervention by public actors to be considered efficient in any realm other than economic theory, we need to turn to the broader political economy of carbon markets for explanations.

2 The Neoliberal Political Economy of Carbon Markets

The power of capital and the development of neoliberalism have been invoked by various scholars in an attempt to understand the development of carbon markets within the broader global political economy (Parr 2012; Koch 2012; Schreuder 2009). Indeed, in the critical literature, carbon markets are often taken as a straightforwardly neoliberal, largely free-market answer to climate change (Böhm and Dabhi 2009; Bachram 2004) that powerful actors regard as a preferable solution to either regulation or taxation. Taxation, albeit offering a market-based solution aimed at 'internalising' externalities by making the 'polluter pay', has often lost out to carbon trading because it offers less flexibility in compliance and allows potentially greater scope for free-riding by firms not subject to the tax, raising the sceptre of both carbon leakage and capital flight, threats frequently invoked by organised capital to resist carbon taxes (Newell and Paterson 1998).

One issue with these approaches to explaining carbon markets is a general lack of specificity regarding the role and interaction of the actors, institutions, techniques, and technologies that comprise both the specific organisation of the market in question and the global political economy within which they develop. This is made clear in Parr's call to 'return to Marx's Capital' as the means through which to understand the development of environmental governance. For Parr, neoliberalism has its roots in the thought of Adam Smith, and can be thought of simply as a 'virulent strain' of liberal capitalism (2012, p. 6), leaving us with few tools to comprehend the contemporary organisation, the patterns and politics, and the means and materials involved in the creation and ordering of carbon markets.

Neoliberalism is often understood as taking form during the 1970s and reflecting a rebalancing of class power away from labour towards an increasingly mobile and structurally powerful capital (Harvey 2005). Many such accounts focus on the inner dynamics and internal contradictions that characterise contemporary capitalism, in particular the impulse of globalising capital to bring new areas of the commons into private hands by removing barriers to capital and to privatise and commodify resources in ways amenable to accumulation and exchange (Goldman 1998). Other accounts of the history and evolution of neoliberalism focus more on the specific processes which have given rise to neoliberalism and contributed to its spread throughout large parts of the world (Power 1999; MacKenzie 2006). For example, Jamie Peck's notion of the 'roll-back, roll-out' spatio-temporal dynamics of the process of neoliberalisation (2010, p. 22) appears at first blush to be particularly applicable to the explanation of the zombie-like nature of the carbon markets. For Peck, initial attempts focused on regulatory dismantling, deregulating, and disciplining—the roll-back phase of neoliberalisation—rapidly encounter social, economic, and technical limits, resulting in the development of a roll-out phase, associated with an:

> explosion of "market conforming" regulatory incursions … these are simultaneously, examples of neoliberal policy failure and neoliberal policy adaptation, again underlying the sense in which neoliberal restructuring resembles not so much a triumphal, forward march as a series of prosaic "forward failures". (2010, p. 23)

Here, the roll-out phase of neoliberalisation represents more than simply an attempt to remake the world in the image of markets. Instead, the ongoing mongrelisation implicit in the process of neoliberalisation represents a series of attempts to deal with the challenges and contradictions of governance in a 'malmarketized world' (2010, p. 24). However, for Peck, neoliberalisation appears to assume an imminent 'forward-leaning dynamic by virtue of the very unattainability of its idealised destination' (Peck 2010, pp. 6–7). This momentum apparently derives from neoliberal ideology itself and the endless frustrations borne of the failure to arrive at the preferred neoliberal destination. In simply taking neoliberal ideology at face value here, a problematic definition of neoliberalism is replaced with an equally problematic definition of the process of neoliberalisation. This overlooks the 'hidden hands' and the 'connective tissues' involved, replacing these with an overly structural 'forward-leaning dynamic'. There is a focus here on process, but without a clear identification of practices.

In contrast, others have approached the specificity of the carbon markets and their development by considering them as another aspect of the commodification and neoliberalisation of nature (Castree 2008). There is a vast literature on neoliberalism and increasingly 'neoliberal natures' (Mansfield 2004; Smith 2006), which provide useful points of departure for understanding the development and current state of the carbon markets. Neoliberalised nature here is posited variously as 'political doctrine, as economic project, as regulatory practice, or as process of governmentalization—and also of nature—as primary commodity, as resource, as ecosystem service, or as socio-natural assemblage' (Bakker 2010, p. 715). Attentive to the complex geographies of carbon markets, Castree (2008) explains the neoliberalisation of nature in terms of a series of environmental 'fixes' to capital's contradictions vis-à-vis nature. The commodification of carbon in offset markets provides a spatial fix (and a temporal one by discounting the future) by displacing carbon reduction efforts to areas of the world where it can be achieved more cost-effectively (Harvey 1981).

What the literature makes clear is the fissures and tensions indicative of a lack of a coherent overarching neoliberal programme (Nelson 2015, p. 3), or as Jamie Peck put it, the fact there is no single neoliberal 'replicating machine'. However, while focusing on a series of 'fixes' partially captures the idea of continual failure and reform, it can be seen as operating according to the same logic of 'forward failures', and therefore guilty of a similar structural reification: the neoliberalisation of nature is seen as driven by structural contradictions rather than situated historical conflicts (Nelson 2015, p. 4). This, again, makes it difficult to specify what was and is unique about the ongoing, zombie development of the carbon markets, and why these forms of market governance were developed in response to climate change in the mid-1990s, but were not applied to the Montreal Protocol to address the issue of ozone depletion in 1987, for example, the Convention on Biological Diversity in 1992, or the 1994 UN Convention to Combat Desertification. In other words, the particular form and process by which carbon markets emerged as the preferred means of addressing climate change cannot be reduced to a general reference to neoliberalism given that other environmental regimes in issues areas such as ozone depletion or desertification that developed during a similar historical moment did not place such primacy on trading.

In the next two sections, we will seek to identify practices at play in the ongoing development of the carbon markets as a component of the contemporary neoliberal political economy by looking in Sect. 4 at who the markets are developed by and what are they developed for, and in Sect. 5 at how and when they came to take the form they do.

3 The Carbon Markets and Climate Capitalism

Drawing broadly on the commodification and neoliberalisation of nature literatures, one way of making sense of the ongoing development of the carbon markets, in spite of their failings, is to view them as representing part of what can be referred to as a 'regime of accumulation' under neoliberalism. At a macro level, this is focused around the need to harness the heightened power of finance capital in a finance-led regime of accumulation that has come to dominate the global economy, and is central to the development of contemporary 'climate capitalism' (Newell and Paterson 2010). The modes of regulation required to stabilise these regimes include the law, state policy, corporate governance, and cultures of consumption (Aglietta 2000), where the power of financial capital is used to discipline social and political forces through the imposition of neoliberal governance practices. In particular, Paterson notes:

> The interests of finance in both deregulated "solutions" to problems like environmental ones, and the fetishisation of "markets" as solutions to all sorts of problems which is associated with the rise of finance, produce the ideological context within which environmental governance has developed since the late 1980s. (Paterson 2009, p. 107)

Here, the idea of emissions trading became so popular so rapidly from its 1996 introduction to climate mitigation discussions in the UNFCCC, precisely because of the creation of markets and accumulation possibilities: 'Emissions trading as a project has been and continues to be propelled by the realisation by powerful financial actors that here was a new commodity to be sold, new profits to be made' (Paterson 2009, p. 112). It is in this context that it has been argued that the development of climate governance mechanisms, and specifically carbon trading, represents an attempt to stabilise the contemporary, post-Fordist, financially led regime of accumulation while simultaneously providing a new basis for this accumulation through the further commodification of nature and natural processes associated with atmospheric carbon release and sequestration, resulting in an emergent form of 'climate capitalism' (Newell and Paterson 2010).

While also recognising the power of finance capital at this historical conjuncture as central to the analysis of carbon markets, Patrick Bond has recently taken a different approach in interpreting carbon market development as part of a series of interconnected projects to manage multiple capitalist crises. He sees it as an effort 'to subsidize the bankers' solution to climate crisis:

> The attraction of carbon trading in the new markets, no matter its failure in the old, is logical when seen within a triple context: a longer-term capitalist crisis which has raised financial sector power within an ever-more frenetic and geographically ambitious system; the financial markets' sophistication in establishing new routes for capital across space, through time, and into non-market spheres; and the mainstream ideological orientation to solving every market-related problem with a market solution. (Bond 2015)

For Romain Felli meanwhile, the zombie nature of the carbon markets and the role of finance are to be understood in a slightly different way. He argues that, contrary to many critical political economy and political ecology accounts, carbon markets do not represent the 'privatisation' of the atmosphere or the commodification of nature. Rather they are about the creation of a form of public property over the right to emit GHGs, one which is unequally distributed among and within states (Felli 2014). Hence, while tradeable carbon permits may look like commodities (they have exchange value and use value), in fact they represent pseudo-commodities or 'fictitious commodities', like land or labour, and do not have that self-expanding value that defines capital.

The distribution of these rights at the domestic level, he suggests, amounts to the distribution of rights to climate rent and cannot constitute accumulation strategies aligned with the existing regime of accumulation. Instead, Felli (2015) locates the development of market-based instruments of environmental governance directly with respect to the neoliberal thought of Friedrich Von Hayek and Ronald Coase. These he views as means to depoliticise the implementation of environmental limits to growth in response to their politicisation during the 1960s and 1970s. For Felli, this depoliticisation sees emissions trading markets as neoliberal, not in the sense that they commodify or privatise nature, but in the sense that they entrench the power of financial capital (Felli 2015).

This establishment of new routes for capital accumulation or rent extraction involves the movement of finance from the global North to the global South and the return flow of carbon credits, what Bumpus and Liverman (2008) refer to as 'accumulation by de-carbonisation'. They view the construction of the markets as developing an 'unequal' geography linking Global North and South, following the general principles of market environmentalism and 'neoliberal governance' (Bumpus and Liverman 2008, p. 148). For Bumpus and Liverman, the perceived dynamism and regulatory development of these markets, following the logic of a Polanyian double movement

(Polanyi 1980[1944]), means that the potential efficacy and environmental impact of carbon trading are not predetermined. They maintain that:

> The carbon markets and the CDM show that with strong state interventions and the internalization of harmful environmental externalities, capital can continue to accumulate from reducing levels of carbon in the atmosphere. (Bumpus and Liverman 2008, p. 144)

Indeed, the materiality of the different forms of 'carbon' that are said to be commensurated and commodified through credits and offsets in carbon markets are less cooperative than they appear, or indeed can be made to appear, even with strong state intervention, on industry and national balance sheets and registries. For example, drawing on Bakker's work on 'un-cooperative commodities' (Bakker 2004), Newell and Bumpus (2012) analysed the role of 'un-cooperative methane' in shaping the rent that can be generated from CDM landfill gas projects because of the struggle to control and capture its generation and movement (Newell and Bumpus 2012). More broadly, a series of abstractions are required to construct both 'carbon' and the markets upon which to trade it in what Larry Lohmann refers to as the 'endless algebra of carbon markets' (2006, 2011). For Lohmann, the measurement, accountancy practices, and techniques involved in this endless algebra of commensuration are not being undertaken simply by an international financial cadre of 'carbon cowboys' or hucksters (Lohmann 2009), or what the financial press likes to refer to as the 'shenanigans' of a few bad apples. Instead, their (necessary) failure to adequately price a truculent environment is hardwired into their institutional functioning.

This issue can be seen to play itself out with particular reference to the determination of project additionality, and issues of counterfactual baseline determination which are, similarly to the evaluation of risk in the sub-prime housing market, evidently not simply amenable to a technical solution. For example, doubts have been raised about the additionality of many CDM projects. Recent estimates suggest that between 20% and 70% of all CDM projects are non-additional (Carbon Market Watch 2015), while around 75% of the Emissions Reductions Units produced by JI projects are unlikely to represent additional emissions reductions, suggesting in the latter case that the use of JI has resulted in global GHG emissions being 600 million $t\mathrm{CO_2e}$ higher than they would have been otherwise (Kolmuss et al. 2015). Similarly, revelations contained in the WikiLeaks cables showed government officials claiming that none of the CDM projects from countries, such as India (the world's second largest host of CDM projects), could be considered genuinely additional give further cause for concern about the integrity of the claimed emissions savings (Yan 2011).

Whether focusing on rent extraction or commodification, these accounts qualify more traditional political economy analyses (e.g. Parr 2012; Koch 2012) by emphasising contingency, and the specific role of finance in the development of the carbon markets. However, while this form of zombie environmental governance may seemingly stumble upon the 'endless algebra' of neoliberal natures, this still requires that we explain the historical development of the conceptual and technical context that supports its ongoing momentum. What this suggests is the need to place both the current crises in carbon markets, and their broader development trajectory, in a wider historical and material context, part of the shifting and non-linear dynamics of neoliberalism of which they are part and which they continue to shape, despite their failings to date. In order to investigate this, in the next section, we look at both the role played by the environment with respect to the development of neoliberalism, and the need, even of powerful actors, to secure legitimacy and approval.

4 The Nature(s) of Neoliberalism

Matthew Paterson has argued that the development of the carbon markets involves a recurrent tension within capitalism between accumulation and legitimation (Paterson 2010). Here, '[t]he principal tension is that while the pursuit in general of climate governance is brought about by the search for legitimacy, the specific mechanisms developed as private climate governance strategies are informed primarily by the search for accumulation' (Paterson 2010, p. 359). Put differently, 'The key tension for policy makers lies between the need to create cycles of growth for particular sectors of the economy in order to sustain climate policy, and the pursuit of the environmental integrity on which the stability of the political coalition that carbon markets have enabled depends' (Paterson 2012, pp. 83–84).

This tension between accumulation and legitimation is itself both produced and productive however. It has a specific history, one written into contemporary understandings of the environment and environmental pollution, and one that enables the continual legitimation of failing carbon markets precisely on the basis of the need to reconcile continual economic growth with environmental protection. To illuminate this more clearly requires that we look more closely at the way the markets are legitimated.

The ongoing development of the carbon markets is justified and ultimately legitimated on a twofold basis that they are simply the most *effective* and *efficient* means of reducing GHG emissions. The World Bank Group squarely states that carbon pricing is 'considered one of the most effective ways to bring down greenhouse gas emissions' (World Bank 2014). The reason for this was further elucidated by Willie Walsh, CEO of British Airways' parent company International Airlines Group: 'An effective system will increase incentives for the aviation industry to accelerate the introduction of low-carbon technology and lock in the great potential to decarbonize air transport' (World Bank 2014). Efficiency meanwhile refers to the cost-effectiveness of the markets with respect to the industries whose emissions are to be governed. Connie Hedegaard (then the EU's Climate Commissioner) made the overriding importance of this clear in 2011 when she stated that European climate policies need to work 'in a way that will not hamper economic growth in Europe but which leaves companies maximum flexibility to cut emissions at least cost' (Hedegaard 2011).

Underlying the claims of carbon market effectiveness and efficiency is a specifically welfare economic notion of pollution understood as market failure (Lane 2014). Here both environmental pollution, in general, and climate change, in particular, are understood as negative external effects or externalities of markets, as first described by the British economist Arthur Cecil Pigou in the 1920s. According to the famed logics of Garrett Hardin's *Tragedy of the commons* (1968), and Ronald Coase's (1960) *The problem of social cost* (the latter of which specifically targeted Pigou's own preferred method of taxation), environmental pollution markets are the optimal way of addressing this market failure. These markets undertake the internalisation of environmental externalities, their pricing and subsequent incorporation within production, and market decision-making through the assignment of property rights.

Within the post-war welfare economics discipline, environmental externalities were understood as merely exceptional cases, but by the end of the 1960s and start of the 1970s, the development of the popular environmental movement had highlighted the seemingly pervasive nature of pollution under modern capitalism. Recent accounts have sought to make sense of the apparently 'ironic' (Smith 2006; Robertson 2012) development of the new environmental commodities of the 1980s onwards precisely out of the successes of the environmental movement of the 1960s and 1970s. For example, Sara Holiday Nelson has recently argued that 'neoliberal environmentalism emerged as a solution to a set of interlocked socio-ecological disturbances to the Fordist mode of production' (Nelson 2015, p. 5).

For Steven Bernstein, the answer lies in the transition to what he calls 'liberal environmentalism' between the 1972 *Limits to Growth* report released during the Stockholm conference on the Human Environment that same year, and the 1992 UN Conference on Environment and Development in Rio. As Bernstein notes, the 'norm-complex' governing global environmental practices shifted from one focused on environmental protection at the beginning of the 1970s to the acceptance of 'the liberalization of trade and finance as consistent with, and even necessary for, international environmental protection' by the early 1990s. This 'liberal environmentalism' promoted 'market and other economic mechanisms (such as tradeable pollution permit schemes or the privatization of commons) over "command-and-control" methods (standards, bans, quotas, and so on) as the preferred method of environmental management' (2000, p. 7).

Bernstein's constructivist account views the shifting of environmental norms from 'limits to growth' notions to 'liberal environmentalism' as due to the failure of the early 1970s focus to fit with the prevailing international norms of economic growth. What this takes precisely for granted, however, is how this focus on growth came about, and the way in which the conceptual parameters of the contemporary carbon markets are also the conceptual parameters of the environment, as it was constructed during the development of the neoliberal consensus on growth in the late 1960s to mid-1970s in order to resolve this tension (Lane 2014).

First, while for Bernstein, the dominating international preoccupation with economic growth is simply assumed (Paterson 2009, p. 103), this preoccupation is in fact a mid-twentieth-century development (Arndt 1978, p. 13), and one that coincides with the 'great acceleration'; the sudden post-war speeding up of economic growth, oil consumption, and environmental despoliation (Steffen et al. 2007). A series of technical developments within the nascent environmental economics discipline in the USA was key here.

The work of the post-war Paley Commission helped shift measurements of material reserves from geologically based volumetric measures, to economically based notions of working inventory. This novel shift, as undertaken in the commission's 1952 report (Landsberg 1987), would begin the process of undermining a concern with the absolute scarcity of natural resources which was prevalent at the time (Lane 2014, pp. 32–34), and would, for example, form the basis of early oil industry rebuttals to M. King Hubbert's 1956 'Peak Oil' thesis. The Paley approach was continued through the 1960s with the publication of highly influential empirical studies by economists working for the think tank that developed from the Paley Commission, Resources for the Future (RFF). These reports, most crucially Barnett and Morse's 1963 *Scarcity and Growth*, contributed to the development of an economic and political mainstream during the Kennedy and then Johnson Presidencies focused on economic growth above all else, a focus even Richard Nixon derided as 'Growthmanship' in his 1960 presidential debates with Kennedy.

Second, after the environmental movement of the 1960s and firebrand heterodox economist Kenneth Boulding brought the impact of this growth, in the form of pervasive pollution within the 'spaceship earth' to public and political attention, RFF economists in the late 1960s further secured the political primacy of economic growth by rehabilitating the notion of external effects within the 'Materials Balance' approach. By late 1970, this approach had already become what Nobel laureate Robert Solow referred to as 'the economist's approach to pollution' in his vice-presidential address to the annual meeting of the American Association for the Advancement of Science (Solow 1971). This then had the effect of undermining environmentalist concerns with the impact of infinite economic growth on a finite planet by reconstructing pollution fully in line with economist's theory of externalities:

> *Materials balance* took the concerns highlighted by Boulding and the anti-growth movement and yet translated them into a form that removed, once again, economic growth from material constraints. This defused the conflict between the environment and the economy by undertaking a timely volte face on the environment and market failure. No longer is environmental pollution the clear indicator of the failure of markets and of a focus on economic growth, rather, it is due to market failure—pollution results when markets are not implemented in order to adequately price the environment. (Lane 2014, pp. 41–42)

The carbon markets should, therefore, be seen as part and parcel of the neoliberal restructuring of the environment and pollution exclusively as external effects, with the latter caused by market failure. This underpins the zombie-like and relentless logic of the market in the face of the failures of specific markets. This process had already been 'rehearsed' in Michel Callon's (2009) terms with respect to the US Clean Air Act in 1970 and its 1990 Amendments. Here, a series of highly influential environmental economics studies (Bohm and Russell 1985; Tietenberg 1985) were key in transforming the US Environmental Protection Agency's (EPA) early trading programmes into merely an ad hoc implementation of economic theory. After this point, any ultimate assessment of the viability of emissions markets could be infinitely deferred on the grounds of the apparently poor design of any specific market. This reconstruction of the EPA programmes as ad hoc allowed the efficiency of the market in general to be retained, while the actual programmes themselves, and their apparent divergence from the efficiency claims projected by economic theory, could be explained precisely in terms of inadequate design. That is, environmental economists were able to have their policy and critique it (Lane 2012, p. 598).

The persistence and yet persistent failure of the carbon markets can be seen then as derived in part from the political economic framing of climate change as an environmental issue, admittedly, the environmental issue of the age, but one whose divorce from the specificities of economic growth at the dawning of the contemporary neoliberal age requires the continual maintenance of the tension and resolution between accumulation and legitimation through economic, technical innovations around externalities and market failure.

The specific historical trajectory of this tension between accumulation and legitimation, economic growth and environmental protection, and the management of this tension through the development of the neoliberal technology of carbon markets, explains why this form of governance was undertaken as a means to address climate change in the mid-1990s, but was not applied to the Convention on Biological Diversity, or the UN's Convention to Combat Desertification or the Montreal Protocol concluded ten years before the Kyoto Protocol. Climate change goes to the heart of the relationship between energy growth and environment, and potentially implies 'dissipating' rather than just 'different' business (Rowlands 1995, p. 137). That is, it differs significantly from the case of ozone depletion where this tension is largely absent as alternative sites of accumulation and market-ready technologies were available to the leading industrial players (ICI and DuPont) and where the presence of complex North–South politics was greatly reduced. Likewise, the issue of desertification, while of great significance to those, largely poorer, countries afflicted by it, does not pose a threat to the organisation of the contemporary global economy or the most powerful states that oversee it. Only climate change appears to present as an existential threat to global capital accumulation. No lesser critic of the carbon markets than Nicholas Stern made this point clear in his famous review: 'Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen' (Stern 2006, p. i).

5 Conclusion

Overall, we maintain in this chapter that an explanation of the zombie status of carbon markets requires an attentiveness to the historical contingency, specificity, and indeterminacy of the development of the nature(s) of neoliberalism under climate capitalism. We have sought to draw attention to the dynamics between the markets, the political contexts in which they emerge, and the development of neoliberalism. This includes the dynamic of regulation and deregulation; questioning whether commodification is an apt and accurate description of what carbon markets seek to achieve; and introducing non-human agency into the everyday practices of carbon markets where it determines what can be 'commodified' and by whom.

The evolution and entrenchment of carbon markets are not, therefore, a process of straightforward 'roll-out' neoliberalism. Difficult political work is implied in the translation of ideas and markets in particular settings, producing different varieties of carbon governance in their wake (Fuhr and Lederer 2009). The role of the state, the extent to which national and international capital and labour are party to decision-making, the distinct ways in which markets and finance are organised, and the variable role of social mobilisation in contesting marketisation in settings as diverse as China, Europe, India, and Mexico inevitably lead to uneven, non-uniform, and distinct expressions of climate capitalism. There is also a cross-fertilisation of practices and actors between markets. For example, in assembling carbon markets 'carbon market actors borrow from existing financial practices to make the emerging market readily intelligible, to enable it to operate as a matter of financial routine'. Part of this is about the 'selling of desire' involved in assembling finance and the environment in carbon markets (Deschenau and Paterson 2011) whereby what is being sold is 'not the tonne per se but rather the financial or discursive representations of it'. In addition to mobilising capital and investor interest, there are also the intermediaries, brokers, and 'market-makers' that actually facilitate the operation of the markets and ensure that rents are created (Newell 2009; Lovell and MacKenzie 2011). The tension inherent between the construction of a financialised regime of accumulation or form of rent extraction that these developments help to construct, and the need for their legitimation needs to be seen not simply as driven by the neoliberalisation of nature, but as part of the means through which the nature(s) of neoliberalism were developed and maintained.

In sum, the contemporary characteristics and historical development of carbon markets require a richer, more textured, and nuanced account than afforded by notions of 'zombie' capitalism or either by ascribing to carbon markets the same properties as other processes of commodification or assuming we can 'read off' their complex development from the requirement to create the conditions to (re)produce capital accumulation. In addition to emphasising the complexity and contingency of carbon markets, such an account also draws attention to the vulnerabilities, contradictions, and fragilities that characterise the practices of making markets and of accounts which expound their benefits. For critics, this should give grounds for hope that an alternative climate politics remains possible.

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11

The Politics and Governance of Energy Subsidies

Harro van Asselt and Jakob Skovgaard

Subsidies for the production and consumption of various forms of energy are an important part of the policymaker's toolbox. Energy subsidies can serve a variety of policy objectives, such as lowering energy prices, protecting or creating jobs, promoting low-carbon energy technologies, and securing energy supply. At the same time, depending on their scope, design, and application, such subsidies may have a range of unintended adverse socio-economic and environmental effects.

Energy subsidies have come to the forefront of international debates in recent years in several respects. Fossil fuel subsidies have captured the global political agenda ever since the leaders of the G20 pledged to phase out 'inefficient' subsidies in 2009. Renewable energy subsidies, for example, for the deployment of wind or solar technologies, or for the production of biofuels, have similarly moved to the centre of attention of international debate, with several disputes emerging in the context of the World Trade Organization (WTO) and beyond (see Chap. 7).

Notwithstanding the mounting attention for energy subsidies, fundamental questions about their size and scope, the political conditions under which they emerge, and their effectiveness remain unanswered. Moreover, while new research is shedding light on energy subsidy reform at the national level,

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the roles of different international institutions in governing energy subsidies require further scrutiny.

This chapter offers a bird's-eye view of the politics and governance of energy subsidies. It begins by outlining the challenge of defining subsidies, resulting in varying—and at times conflicting—estimates of the size of energy subsidies. It moves on to discuss the reasons why energy subsidies are adopted and maintained, before explaining their possible social, economic, and environmental effects. Next, the chapter highlights options for the reform of energy subsidies at the national level. The chapter then discusses the (prospective) role of different international institutions in governing energy subsidies. It ends with some concluding remarks and identifies areas for further inquiry.

1 Defining Energy Subsidies

Energy subsidies can be divided into three types according to the source of energy: fossil fuel, renewable energy (including biofuels and hydropower), and nuclear (Kitson et al. 2011). Some subsidies, particularly electricity subsidies, may effectively cover fossil fuels, renewable, and/or nuclear energy. Importantly, there is no agreement on how to define energy subsidies (OECD 2010; Gerasimchuk 2014). This disagreement has far-reaching consequences for the measurement of the size of global and national energy subsidies, and for determining which countries hand out subsidies. Few would dispute that policies that set prices paid by consumers below the market price (e.g. fixing the price of gasoline at $0.23 dollar/litre in Egypt; Cheon et al. 2013) constitute an energy subsidy. Yet this determination may be less straightforward for other types of policies.

Two important distinctions are used in the classification of energy subsidies. First, there are definitions that consider energy subsidies in terms of the *benefits conferred on a specific group*, whereas other definitions define energy subsidies in terms of a *price-gap* between the actual price and a benchmark price (Koplow 2009; OECD 2010; Beaton et al. 2013). An example of the former kind of definition is that of the Organisation for Economic Cooperation and Development (OECD), arguably the most commonly used one today: 'A result of a government action that confers an advantage on consumers or producers [of energy], in order to supplement their income or lower their costs' (OECD 2005, p. 191). This definition is based on—though more extensive than—the most recognised definition from the WTO's Agreement on Subsidies and Countervailing Measures (SCM

Agreement), which defines subsidies as 'direct transfers, fiscal incentives and provision of goods and services'. To classify a given policy as a subsidy, it is necessary to study policies individually and to identify whether they confer a benefit, such as direct financial transfers or tax rebates to energy producers (Steenblik 2003; Koplow 2009). Different kinds of benefits have been classified as constituting energy subsidies. Whereas initial studies of subsidies only addressed direct government payments to producers, analysts expanded the scope to also include reduced tax rates and later also non-monetary support such as loan guarantees, insurance liabilities, provision of goods and services (e.g. infrastructure), purchase of goods, and research and development (Steenblik 2003).

The price-gap approach, instead, identifies energy subsidies through their impact on the prices paid by consumers, and more precisely whether the prices are below a given benchmark price. The benchmark price may be the international price of a given fuel, or it may include the international price as well as the national value-added tax (VAT),[1] and possibly (and very importantly) also taxes corresponding to the externalities of using the fuel (Steenblik 2003; Koplow 2009; Clements et al. 2013; Gerasimchuk 2014; Coady et al. 2015). When it comes to energy products which are not subject to much international trade (e.g. electricity), the benchmark price may be calculated on the basis of the domestic cost of production (correcting possible 'artificially' low prices if the production has been subsidised; see Coady et al. 2015, p. 8). Thus, only if consumers pay a price for energy below the benchmark price, a subsidy exists. Importantly, the conferred-benefits approach focuses on individual policies, while the price-gap approach focuses on energy prices as the unit of analysis.

A second distinction can be made between *producer* subsidies directed at the production of energy (e.g. coal mining or oil field exploration) and *consumer* subsidies directed at the energy use by households or companies (Steenblik 1995). Consumer subsidies include free or reduced-price electricity, cooking fuels such as kerosene sold at below-market prices at state shops, and gasoline prices which are fixed nationally at levels as low as $0.10 cents/litre. Producer subsidies include, among others, tax rebates and loans, financial and technical support for exploring potential energy resources such as new oil or gas fields, direct financial transfers, and feed-in tariffs for renewable energy. Generally speaking, producer subsidies can only be measured by price-gap approaches in case producers receive a price for their products above a benchmark price, while a conferred-benefits approach will include

[1] Since the VAT on energy or fuels may be reduced or non-existing.

more policies as producer subsidies in their analysis. A far larger proportion of consumer subsidies will be included in a price-gap analysis. As it is the case with price-gap versus conferred-benefits approaches, emphasising consumer or producer subsidies makes a significant difference, as consumer subsidies are concentrated in developing countries while producer subsidies are more common in industrialised countries.

As a result of these important methodological choices, the estimates of the size of global energy subsidies vary tremendously: the two most well-established estimates are, respectively, $670 billion (IEA 2014) and $5300 billion (Coady et al. 2015). These differences primarily pertain to fossil fuel subsidies rather than renewable energy subsidies. The main difference for fossil fuel subsidies concerns whether the externalities of fossil fuels are being included in the calculation. Estimates also differ due to developments over time (particularly fluctuations in fossil fuel prices) and differences in data collection, making it difficult to compare estimates directly (Bárány and Grigonytė 2015). Similar methodological challenges plague estimates—and cross-country comparisons—of renewable energy subsidies (Ghosh and Gangania 2012).

The International Monetary Fund (IMF) arrived at its $5300 billion estimate in 2015 (not counting renewable energy subsidies) using a price-gap approach including both producer and consumer subsidies, the latter calculated on the basis of the externalities of traffic congestion, climate change, and local air pollution (Coady et al. 2015, p. 30). Local air pollution accounted for about three-quarters of the externality and climate change for about one-quarter. The International Energy Agency (IEA) used a price-gap approach, and did not include externalities. As a result, it estimated global fossil fuel subsidies at $548 billion and renewable energy subsidies at $121 billion, both in 2013 (IEA 2014).[2] Aside from the IEA reports, renewable energy subsidies are only rarely included in estimates of global energy subsidies (Fig. 11.1).

2 Explaining Energy Subsidies

The widespread use and the scale of energy subsidies would suggest that policymakers are convinced that such subsidies can play an important role in achieving their policy objectives. But what are the factors underlying the

[2] Producer subsidies are notoriously hard to measure, although first analyses offer insights into their scale. For instance, Bast et al. (2014) estimate subsidies in support of exploring fossil fuels at $88 billion/year.

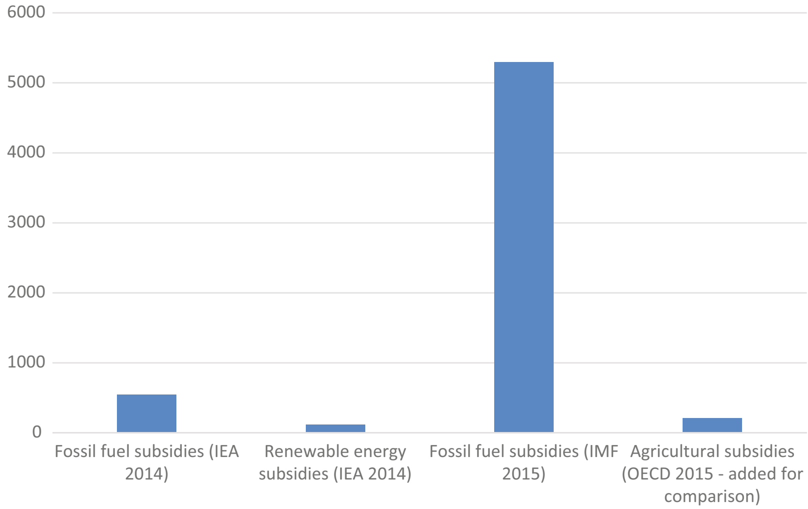

Fig. 11.1 Energy subsidy estimates (billion US$)

adoption and maintenance of energy subsidies? Surprisingly, this question has received scant attention in the literature.

Oosterhuis and Umpfenbach (2014) distinguish four broad types of rationales underpinning energy subsidies. The first three types of explanations are functional: subsidies can help achieve economic, social, and/or environmental objectives. From an economic perspective, subsidies can help reduce dependence on energy imports, or help countries achieve first-mover advantage with respect to the development—and possible export—of new and emerging energy technologies (Ghosh and Gangania 2012). This has, for instance, been an important rationale for renewable energy support in countries such as the USA and China. Social objectives served by subsidies can include the provision of energy at affordable prices (a major concern particularly in developing countries), but may also relate to the creation or protection of local and national industries and jobs (e.g. the protection of coal miners in Germany). Energy subsidies, particularly for renewable energy, may further be motivated by the pursuit of environmental objectives, such as climate change mitigation and improving air quality.

The final explanation offered by Oosterhuis and Umpfenbach (2014) is concerned with the political economy of energy subsidies. Energy subsidies can be seen as a rent provided by the politicians to secure the support of interest groups (e.g. energy producers or consumers). Referring to the example of how biofuel subsidies in the USA were adopted and maintained, Victor

(2009) suggests that when energy producers are concentrated and well organised, and the costs are distributed across the general population, there will be a strong 'demand' for subsidies. He adds, however, that the 'supply' side of subsidies is at least as important. Subsidies appeal to governments not only because they can help garner political support but also because they are a relatively straightforward tool to achieve such objectives, for instance, compared to cash transfer schemes. This 'supply-side' explanation goes some way in explaining why certain autocratic governments (e.g. in the Middle East) hand out sizable fossil fuel consumer subsidies (Commander 2012; Cheon et al. 2013).

However, this explanation is still partial at best, as it is focused primarily at energy producers and exporters. Complementary explanations have been put forward. Cheon et al. (2015), for example, analyse the role of national oil companies in countries providing petroleum subsidies. They suggest that such companies allow governments to respond to oil price fluctuations through subsidies and that in countries such as Iran, Argentina, and India, national oil companies allow governments to hide the fiscal burden of subsidies. Using the example of Indonesia, Lockwood suggests that energy subsidies are particularly prevalent in countries with weak central control, meaning that 'power is too decentralised to coordinate corruption' (Lockwood 2014, p. 487).

Studies on the political economy of renewable energy support are also scarce. Szarka (2010) examines the emergence of policies in support of wind power in the European Union (EU), concluding that it is insufficient to focus on so-termed advocacy coalitions, and arguing that the interests of industries (both incumbents and newcomers) as well as the public interest should be taken into account in the analysis.

Ultimately, it is likely that in any given context, multiple rationales are simultaneously at play, and explanations will need to account for specificities of the countries or regions adopting and maintaining the energy subsidies. Studying the rationales will remain of high importance, as they shed light not only on why subsidies were adopted in the first place but also on why it can be challenging to reform them.

3 Effects of Energy Subsidies

Energy subsidies may thus be adopted to meet a range of goals. Yet it remains unclear to which extent subsidies actually achieve those aims. Moreover, subsidies may lead to other (unintended) adverse effects.

In terms of economic effects, a first-order impact of subsidies is the burden they pose on the public purse. With respect to fossil fuel subsidies, the IMF suggests that eliminating post-tax subsidies could free up $2.9 trillion in government revenues (Coady et al. 2015). Again, there is variation between countries. For instance, fuel subsidies took up 13.7% of the government budget in India in the 2012–2013 fiscal year (IISD 2014); this number is higher in some countries in the Middle East and North Africa region, where subsidies have taken up to 35% of the government budget (El-Katiri and Fattouh 2015; UNEP 2015). This not only matters from the perspective of government revenues; in developing countries, it also matters as the money could have been spent on other issues for which there is social demand, such as health, education, or public infrastructure (Jakob et al. 2015; Merrill and Chung 2015).

This ties in to the social impacts of fossil fuel subsidies. While expanding energy access for the poor may be a rationale for fuel subsidies, such subsidies tend to be highly regressive, meaning that they mainly benefit the richer part of the population. For instance, in India, $8 billion of fuel subsidies for liquefied petroleum gas largely failed to reach the rural poor (Ghosh and Ganesan 2015). Based on a review of fuel subsidies in 20 developing countries, Arze del Granado and Coady (2012, p. 2241) conclude that 'the richest 20% of households capture on average six times more in fuel subsidies than the poorest 20%'. For gasoline, the effects are strongest, with 'over 97 out of every 100 dollars of gasoline subsidy [leaking] to the top four quintiles' (Arze del Granado and Coady 2012, p. 2239). One of the underlying reasons is that the wealthy generally consume more energy; however, politically informed handouts may also play a part (Koplow 2014).

In terms of environmental impacts, Stefanski (2014) suggests that 36% of global carbon emissions between 1980 and 2010 were driven by fossil fuel subsidies. Conversely, there are various estimates of the climate change mitigation benefits of fossil fuel subsidy removal. Burniaux and Chateau (2014) estimate that if the 37 countries covered by IEA analyses remove consumer subsidies between 2013 and 2020, this would lead to a reduction of global greenhouse gas emissions by 8%. The IMF—whose definition, it should be remembered, is wider—estimates that eliminating post-tax subsidies could result in carbon dioxide emission reductions of over 20% (Coady et al. 2015). Country-specific analyses have also emerged. For example, Lin and Ouyang (2014) estimate that the removal of consumer subsidies in China in 2006–2010 led to emissions savings of 3.72% of total emissions during that period. There are also indirect impacts of fossil fuel subsidies (and their reform) on emissions: such subsidies lower the relative costs of fossil fuels vis-à-vis renewable energy technologies, strengthen the power of fossil fuel industries as incumbents, and distort investment decisions against renewable energy (Bridle and Kitson 2014; Bridle et al. 2014). Vice versa, however, if the savings of fossil fuel subsidy reform are invested in renewables or energy efficiency, this may bring about additional mitigation benefits (Merrill et al. 2015b).

The effects of renewable energy subsidies are difficult to estimate, as much will depend on the interaction with policies to promote renewable energy and other climate policies, notably carbon pricing. Kalkuhl et al. (2013) suggest that, on their own, renewable energy subsidies constitute an expensive way of reducing emissions. Nevertheless, such subsidies have helped kick-start local and national renewable energy industries—notably wind—in some countries, such as Denmark and Germany (Lewis and Wiser 2005; GWEC and IRENA 2012), and may help other countries, such as China (Ouyang and Lin 2014), achieve a range of economic, social, and environmental goals. However, whether renewable energy subsidies are able to simultaneously achieve various goals remains unclear: in India, support for wind and solar photovoltaic helped to achieve energy security and environmental goals, but was less successful in creating new jobs and establishing an internationally competitive industry (Ganesan et al. 2014). Moreover, not all renewable energy subsidies will have positive environmental impacts: subsidies for some types of renewable energy—for example, bioenergy and (large) hydro—may also lead to adverse environmental impacts.

4 Energy Subsidy Reform

The adverse impacts of energy subsidies, and notably fossil fuel subsidies, have led to calls for their reform at the national level (e.g. Whitley 2013). These calls have been strengthened by concerted analytical efforts by international organisations (see Sect. 6), as well as the work of non-governmental organisations (NGOs) such as the Global Subsidies Initiative. Through its role as a knowledge broker, and working with stakeholders in various countries, the latter has added pressure and helped influence countries to implement fossil fuel subsidy reform. Other policy advocacy and research organisations, such as Oil Change International and the Overseas Development Institute, have also entered the fray, leading not only to further pressure on governments to undertake subsidy reform but also to an increasing knowledge base on experiences with energy subsidy reform.

Successful and less successful efforts to reform energy subsidies have already taken place in a host of countries (Clements et al. 2013; World Economic

Forum 2013; Whitley and van der Burg 2015).[3] Most of these efforts have focused on reforming consumer fuel subsidies.

The broader energy sector reforms in Chile and Mexico are generally viewed as (modest) successes (e.g. Vagliasindi 2013; Whitley and van der Burg 2015); Mexico has even moved from a subsidy to a tax for gasoline. Another example considered to be a success case are the 2005 reforms in Ghana (Laan et al. 2010). After several failed earlier attempts, the Ghanaian government implemented a campaign to communicate the reforms and their impacts, and put in place a new, non-political body to set fuel prices. Although the reforms stayed in place for several years initially, subsequent developments have led to increased fuel subsidies in the country again (Whitley and van der Burg 2015), highlighting the challenge of maintaining energy subsidy reform.

In other countries, such as Bolivia, Nigeria, and Yemen, attempts to reform fuel subsidies have been thwarted by public protests (Clements et al. 2013). In Nigeria, such protests were fed by suspicions that the government revenues resulting from a price increase would be misused by corrupt politicians. Reforms in Indonesia have also sparked public outcry in recent years. However, through social assistance—in the form of cash transfer programmes—and careful communication to the public, the subsidies have now received some public backing (Lindebjerg et al. 2015). A form of cash transfer has also been introduced in India, with the Direct Benefit Transfer for Liquefied Petroleum Gas scheme (which has enrolled 144 million consumers within six months), under which households can receive an amount equivalent to the existing subsidy (with expected government savings of $1–2 billion). In the short term, however, some have questioned whether this reform measure will actually lead to significant savings (Clarke et al. 2015).

The main message emerging from the various experiences is that energy subsidy reform is not easy. Nevertheless, some basic lessons for how to undertake reform have been learned thus far (Beaton et al. 2013; Whitley and van der Burg 2015). First, the potential adverse impacts of subsidy reform should be fully understood, which includes the need to identify winners and losers. Second, understanding the potential impacts of reform allows for the adoption of strategies and measures to mitigate those impacts, such as using the increased revenues to soften the impacts, adjusting the timing of the subsidy phaseout, or implementing social assistance programmes targeted at affected households and businesses. However, reformers need to remember that the

[3] Further case studies can be found at: http://www.iisd.org/gsi/fossil-fuel-subsidies/case-studies-lessons-learned-attempts-reform-fossil-fuel-subsidies, date accessed 20 October 2010.

financial benefits from reform may only materialise over time; this means that reform requires the upfront mobilisation of finance. Third, to build support—or to avoid protests—the reasons for reform, its implications, as well as mitigation measures should be clearly communicated to stakeholders and the wider public. Building support further requires a 'whole-of-government' approach, involving economic, financial, energy, social, and environmental ministries, which all have a stake in the reform process.

Insights have also been generated into the conditions under which subsidy reform may be easier or more difficult. First, if the costs of subsidies become unbearably high, subsidy reform is possible. For example, high oil prices mean that subsidies pose a greater fiscal burden to governments, providing an impetus for reform. Interestingly, however, falling oil prices reduce the political sensitivity of subsidy removal as the impact on consumer prices becomes less apparent, meaning that they also offer conditions amenable for subsidy reform (IEA 2015). This happened, for instance, in India, where Prime Minister Narendra Modi ended diesel subsidies in the wake of plummeting oil (and diesel) prices. Similarly, improvements in macroeconomic conditions (e.g. rising income) may also enable reform. Second, the longer the period over which subsidies have been handed out, the more difficult it will be to overcome entrenchment (Victor 2009). For instance, energy subsidies in oil-producing countries in the Middle East have been around for decades, meaning it will be challenging to reform them. Third, energy subsidy reform is likely to be easier for countries with good governance records (Koplow 2014) and more difficult for countries where corruption is rife (Lockwood 2014).

5 Energy Subsidies and Global Governance

Having discussed energy subsidies at the national level, this section examines the various international institutions governing energy subsidies, primarily fossil fuel subsidies. The international governance of renewable energy subsidies—and in particular the role of the WTO—is further discussed in Chap. 7.

The G20

Central to the global governance of fossil fuel subsidies has been the G20 state leaders' 2009 Pittsburgh commitment '[t]o phase out and rationalize over the medium term inefficient fossil fuel subsidies while providing targeted support for the poorest' (G20 2009). This commitment transformed fossil fuel subsidies into a high-priority issue on the international plane. Although arguably not a direct cause of fossil fuel subsidy reform, the G20 commitment is important for understanding the increasing attention to fossil fuel subsidies and the cases of fossil fuel subsidy reform since 2009. The G20 is a forum for 19 of the largest national economies, the EU and the Bretton Woods institutions (the IMF and the World Bank) to discuss important issues with an emphasis on economic issues (Van de Graaf and Westphal 2011). The G20 does not have its own secretariat but relies on the state hosting the G20 meeting, and only produces non-legally binding outputs (i.e. joint statements and reports).

While the G20 commitment referred to the OECD and IEA estimates that phasing out fossil fuel subsidies could reduce emissions by 10% by 2050, it neither provided a definition of fossil fuel subsidies nor specified what the terms 'rationalise', 'medium term', and 'inefficient' meant. Thus, the G20 commitment did not specify which policies were targeted. Importantly, fossil fuel subsidies were primarily addressed in terms of their impact on climate change, while the importance of maintaining support for poverty reduction was also stressed. The idea of a G20 commitment on fossil fuel subsidies had been around before 2009, but only in 2009 did member states previously opposed to such a commitment accept it. Their acceptance should be seen in light of the political attention to climate change in the run-up to the Copenhagen climate conference and the emphasis placed on the subject by the new Obama Administration (which as summit hosts chaired the drafting process).

Besides the impact on the international political agenda, the Pittsburgh commitment resulted in two different processes: one in which the members report their subsidy reform strategies and timetables to a G20 expert group, which subsequently reviews them (Aldy 2015, forthcoming); and one in which the OECD, IEA, World Bank, and Organization of the Petroleum Exporting Countries (OPEC) provide an analysis of the scope of energy subsidies, and offer suggestions for implementation of the commitment. Regarding the reporting, it is up to the members to identify which subsidies exist in their country and how to phase them out. The G20 members have used different definitions of fossil subsidies. Seven countries (Australia, Brazil, France, Japan, Saudi Arabia, South Africa, and the UK) have claimed, at times questionably, to have no fossil fuel subsidies, whereas other countries have submitted plans for phasing out subsidies with varying degrees of ambition (Kirton et al. 2012, pp. 62–69). These reports may be subject to voluntary peer reviews by other G20 members and representatives of international organisations such as the OECD.

Besides the G20, the Friends of Fossil Fuel Subsidy Reform—a forum of smaller, non-G20 industrialised and developing countries—have also called for fossil fuel subsidy reform and financed reports on the issue.

International Economic Institutions

While the G20 has been important as initiator of the international effort to reform fossil fuel subsidies, five international institutions (OECD, IEA, World Bank, IMF, and OPEC) have provided analysis of fossil fuel subsidies and recommendations for their reform. The main impact from these organisations has been their cognitive influence exerted by advancing knowledge about fossil fuel subsidies; this knowledge, in turn, helps shape the action of states and other actors on fossil fuel subsidy reform. Importantly, the involvement of these five institutions extended the scope of addressing fossil fuel subsidies beyond the G20 countries.

The OECD, the IEA, the World Bank, and OPEC—but not the IMF—were specifically tasked by the G20 with providing analysis of the scope of energy subsidies and suggestions for the implementation of the commitment. Thus, their engagement with fossil fuel subsidies was to a large degree caused by the G20 tasking them, but their increasing focus on climate change in the lead-up to the Copenhagen summit has also been an important contributing factor. The institutions have provided joint reports to the G20 (e.g. IEA et al. 2010; World Bank et al. 2014) as well as individual ones (e.g. OECD 2013, 2015). The joint reports used the IEA's price-gap approach, but OPEC explicitly distanced itself from the use of a benchmark price based on international market prices in the case of producer countries, arguing instead that the benchmark price should be based on production costs (IEA et al. 2010).

The IMF decided to address fossil fuel subsidies at its own initiative, and promoted its own—rather radical—definition of fossil fuel subsidies, which includes non-taxed externalities (see Sect. 2). As a result, the IMF arrived at very high estimates of global fossil fuel subsidies, drawing much political and media attention. Both the World Bank and the IMF had addressed such subsidies as part of their general policies on subsidies of all kinds, which they consider undesirable due to subsidies distorting markets and constituting ineffective state expenditure (IMF 2000, 2008; World Bank 2013). These policies also included the bilateral interaction with states, including policy recommendations and Structural Adjustment Programmes for countries with fiscal problems. Over the last ten years, energy and fossil fuel subsidies have been addressed in an increasing number of IMF recommendations to individual countries and increasingly been treated as an issue distinct from other kinds of subsidies such as food subsidies (e.g. IMF 2008, 2015). Including fossil fuel subsidy reform in Structural Adjustment Programmes has always been controversial (e.g. the IMF-backed subsidy reform in Nigeria, which was reversed following widespread riots), due to the factors outlined in Sect. 5 and resentment of foreign interference (Lockwood 2014). Arguably, the increasing global awareness of fossil fuel subsidies contributes to the domestic acceptance of fossil fuel subsidy reform being highlighted in Structural Adjustment Programmes.

Furthermore, the OECD and the IEA had already provided analysis of energy subsidies before the Pittsburgh summit, and continued to publish analyses and reports on energy subsidies independently of the G20 commitment. The IEA's annual World Energy Outlook, which is the single most influential publication within energy policy, has paid increasing attention to energy subsidies. While energy subsidies have been equated with fossil fuel subsidies by most of the institutions, the IEA has also considered subsidies to renewable and nuclear energy (IEA 2014).

An important impact of the efforts of the five institutions is that it has become clearer that fossil fuel subsidies are also widespread in industrialised countries. While fossil fuel subsidies were initially seen as a developing country phenomenon (due to direct expenditure on fossil fuel consumption being prevalent in developing countries), the reports of the institutions directed attention towards production subsidies, tax expenditure, and untaxed externalities—the kinds of subsidies that were also widespread in industrialised countries. The OECD, which was tasked with estimating fossil fuel subsidies in its member countries, estimated these subsidies to be in the range of $55–90 billion (OECD 2013).

The World Trade Organization

There is a fuzzy relationship between the WTO and energy: the complex characteristics of energy and energy markets make it unlike other goods regulated by the international trading system, and energy can be seen as both a good and a service, meaning that it is governed by different WTO rules (Ghosh 2011).

The discussions of relevance for energy subsidies in the context of the WTO have revolved around the notion of 'dual pricing', which refers to practices by fossil fuel exporters that set a lower domestic price for fuels than the price charged internationally. Such practices have been criticised by fossil fuel importers, who argue that dual pricing violates provisions in both the General Agreement on Tariffs and Trade and the SCM Agreement (Marhold 2013). Given that this issue remains unresolved, it is not surprising that fossil fuel subsidies have hardly been discussed.

Nevertheless, WTO rules on subsidies, in particular the SCM Agreement, govern energy subsidies. Although trade disputes have largely focused on renewable energy subsidies (see Chap. 7), such rules in theory also apply to fossil fuel subsidies. Subsidies which are contingent upon export performance or upon the use of domestic over imported goods are prohibited under WTO law, whereas other subsidies that are deemed to be 'specific' (i.e. aimed at certain enterprises or industries) and lead to 'adverse effects' on the interests of other members are 'actionable', meaning they are subject to a challenge. Furthermore, the SCM Agreement specifies that WTO members should notify their subsidies, providing sufficient details to allow other members to assess the impacts on trade.

Applying these rules in practice, however, has proven difficult. In contrast to renewable energy support, no fossil fuel subsidy has been challenged by a WTO member. For consumer subsidies, a key challenge is to prove that such subsidies are 'specific', given that the benefits of such subsidies generally accrue to a broad group of producers and/or consumers (Lang et al. 2010). More importantly, however, notification rates of subsidies have generally been low, due to a lack of commitment (possibly due to fear of starting a trade dispute), a lack of clarity about which subsidies need to be reported, and the inherent difficulties of estimating them (Casier et al. 2014). Even if WTO members do report subsidies, the surveillance mechanism rarely leads to the questioning of the subsidies (Steenblik and Simón 2011).

Suggestions have been made on how the WTO could help enhance the transparency of fossil fuel subsidies, for instance, by adopting a new notification template providing further details on subsidies in a standardised fashion (Steenblik and Simón 2011) or allowing NGOs to report on the level of subsidies (Casier et al. 2014). However, any progress on this front will likely depend on overall progress in the overarching trade discussions, which have largely stalled in recent years.

The Climate Change Regime

Notwithstanding the clear relevance of energy subsidies for achieving climate change objectives, the climate treaties offer very little guidance. Neither the United Nations Framework Convention on Climate Change (UNFCCC) nor the Kyoto Protocol mentions fossil fuel subsidies or their reform. The Kyoto Protocol does include an illustrative list of policies and measures, including '[p]rogressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and application of market instruments' (Article 2(1)(a)(v)), but it remains up to parties to decide which policies to implement.

The new institutional architecture emerging in the climate negotiations may offer further opportunities for addressing fossil fuel subsidies (Merrill et al. 2015a). In the emerging architecture, parties are free to choose the mitigation policies and actions they desire as part of their 'nationally determined contributions', and some countries (e.g. Ethiopia and Morocco) have already referred to fossil fuel subsidy reform in this context.

Whether fossil fuel subsidy reform will be taken up as an agenda item in the UNFCCC in the future remains to be seen, however: fossil fuel-producing countries would likely oppose multilateral measures aimed at fossil fuel subsidy reform, as they stand to lose the most. Combined with the consensus rule of the UNFCCC, this may make far-reaching options (e.g. concrete phaseout targets for fossil fuel subsidies) difficult to achieve (Lang et al. 2010). Still, other options—such as voluntary reporting of subsidies and their reform—may be within the range of the possible (Benninghoff 2013).

6 Conclusions

This chapter has provided an overview of the politics and governance of energy subsidies. It highlights, first of all, that the political challenges related to energy subsidies start at the most basic level: their very definition. Given the lack of clarity and agreement about the size and scope of energy subsidies, it is also hard to estimate their impacts, and come to fully fledged theories about why they emerge and persist. Notwithstanding this lack of clarity, however, a concerted research effort by a range of international organisations and NGOs have led to deeper insights into the economic, social, and environmental effects of fossil fuel subsidies. As a result, a strong case has been built for their reform and phasing out. However, as the mixed experiences with national-level subsidy reforms illustrate, it is essential to fully understand the political economy of why such subsidies were adopted and maintained in the first place. Finally, the chapter shows that energy subsidies are governed by a mix of international (economic) institutions, working increasingly in tandem. What is interesting, however, is that two of the international institutions that seemingly should be engaged in the governance of energy subsidies—the WTO and the international climate regime—have so far stayed largely on the sidelines.

The chapter points to several avenues for further inquiry. First, the definition of subsidies—a seemingly technical exercise—has great ramifications for their study and identification of options for reform. The wide-ranging estimates by different international organisations of the size of fossil fuel subsidies point to different assumptions about such subsidies, leading to questions about which countries should take the lead in phasing them out. Similarly, while there is mounting understanding of consumer subsidies, producer subsidies have largely stayed out of the spotlight. Future research could thus explore how and why different international organisations choose to define subsidies, and the political implications of focusing on consumer versus producer subsidies.

A second area for future research concerns the theorisation of why energy subsidies are adopted and maintained over time. What conditions drive governments to adopt such subsidies, and how can variation between similar countries (e.g. autocracies and democracies) be explained? As a corollary, such theories could provide insights under which conditions energy subsidy reform can succeed, drawing on the slowly expanding number of case studies of successful and unsuccessful subsidy reform. Another line of inquiry could aim to shed light on how energy subsidy reform fares compared to other types of subsidies (e.g. fisheries and agricultural subsidies).

Lastly, our chapter has underscored the growing number of international institutions that has become active in the field of energy subsidies. Yet questions remain about the underlying motivations for these institutions to address energy subsidies and their reform, as well as their effectiveness. Moreover, while international institutions may play an important role in the governance of energy subsidies, the role of NGOs such as the Global Subsidies Initiative merits further attention as well.

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Part IV

Energy Transitions

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Analysing Energy Transitions: Combining Insights from Transition Studies and International Political Economy

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1 Introduction

The energy sector is currently changing in very fundamental ways. New technologies such as wind turbines, solar PV modules, smart grids, energy storage technologies or electric vehicles are diffusing rapidly, next to substantial improvements in energy efficiency (GEA 2012; IEA 2014). These developments complement and partly even substitute the use of fossil and nuclear fuels. Also, existing institutional structures and organizations are in turmoil, including major changes in business models, value chains, ownership structures, social practices, markets and regulations. Such far-reaching changes of entire sectors, in which new technologies, institutional structures and organizations emerge and existing ones change or decline, are typically referred to as *socio-technical transitions* (Geels 2010; Markard et al. 2012). The energy sector has seen major transitions in the past (e.g. Solomon and Krishna 2011; Grubler 2012), and also current developments can be conceptualized as a socio-technical transition. While past transitions in energy—such as the shift from wood to coal or from coal to oil for heating and transportation—have often been fuelled by new (technological) opportunities to produce cheaper or

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better energy services (Fouquet 2010), the ongoing energy transition[1] is different: It is a *purposive transition*, which is driven, among others, by concerns about greenhouse gas emissions, nuclear risks, energy prices or energy import dependence (Grubler 2012; Strunz 2014). As such, it is highly dependent on public policies that shape both speed and direction of the transition (Van den Bergh 2013). Consequently, also politics, interests of incumbent actors and conditions for policy change are of central importance for studying energy transitions, although these issues have initially been neglected in research on transitions (Meadowcroft 2009; Kern 2010; Stirling 2014; Markard et al. 2015).

The energy transition is a complex, multifaceted phenomenon that poses great challenges for innovation and energy scholars alike, and the debate about which conceptual frameworks are suitable to study transitions or how existing ones have to be adapted is still under way (Fuchs et al. 2012; Markard et al. 2015; Strunz 2014). The aim of this chapter is to present central insights from two so far largely unconnected streams of literature: transition studies and international political economy (IPE). We explore how they can potentially cross-fertilize each other in studying energy transitions. The argument is that a better mutual understanding could lead to novel avenues for research on the IPE of energy transitions. Transition scholars are just beginning to pay more attention to politics and political economy concerns, and the interplay of the local, national and supranational levels, which is why we believe there is much to gain from connecting to intellectual traditions in IPE. As argued in Chap. 1, IPE, on the other hand, has not only neglected energy issues for some time but has also not dealt much with highly dynamic empirical contexts, in which technological change is central and a broad range of different types of actors are involved. Therefore, both strands of work may equally benefit from the theoretical and empirical insights the other field has to offer.

In the remainder of this chapter, we introduce both transition studies and IPE and elaborate on the key characteristics of energy transitions. Then we make suggestions of how the literature on socio-technical transitions and IPE can complement each other for the purpose of studying energy transitions. We end with a collection of research topics that may inspire further research at the intersection of both fields and briefly introduce the other chapters in this section of the handbook.

[1] Here and elsewhere, we use the singular ('energy transition') as a catchword to point to general characteristics of energy transitions. At the same time, we acknowledge that there is not *one* energy transition but that actual transition processes and pathways may vary substantially, for example, across different countries or regions.

2 Transition Studies and Sustainability Transitions

Transition studies is an emerging research field concerned with radical innovation and fundamental transformation of sectors like energy, transportation, healthcare, agriculture or water (Geels 2010; Markard et al. 2012). It involves scholars from a variety of disciplines such as innovation studies, science and technology studies, history, sociology, geography, economics, management and political science. The field has developed very rapidly over the past 15 years: As of 2015, the academic network of transition scholars (transitionsnetwork.org) comprises more than 1000 researchers from all over the world and about 200-plus new publications per year can be associated with the topic of transitions. Sustainability transitions, in fact, represent a topical focus in the broader field of transition studies, and the energy sector is one of the main domains of empirical inquiry (Grin et al. 2010; Verbong and Loorbach 2012).

Key Terms and Concepts

In transition studies, sectors such as energy or transportation have been conceptualized as socio-technical systems. *Socio-technical systems* can be viewed as networks of *actors* (organizations but also individuals) and *institutions*[2] such as societal and technical norms, standards, regulations or user practices, as well as *material artefacts and knowledge* (Geels 2004; Markard 2011). The different elements of the system interact, and together they provide specific services for society (e.g. energy supply). The systems concept emphasizes that its elements are closely connected, which means that changes in one element typically affect others and the system as a whole.

A socio-technical transition is a set of processes that lead to fundamental changes in a socio-technical system (Grin et al. 2010; Verbong and Geels 2007). Transitions are multidimensional as they entail changes in organizational, institutional and technological structures. Transitions unfold over long time spans (several decades), and they are open-ended processes in the sense that—along the way—the outcome is unclear and uncertainty is high. Transitions typically involve and affect a broad range of actors, including those with entrenched interests in the existing system (Kern and Smith 2008; Stirling 2014).

[2] Note that in transition studies, institutions are mostly viewed as formal and informal rules and/or patterns of behaviour, not as organizations that create and implement policies.

Transitions have occurred in many areas in the past. The transportation sector, for example, saw major transformations due to the development and later decline of railway systems (e.g. Salsbury 1988), or through the development and widespread diffusion of the car (Geels 2005). Aviation changed fundamentally when turbines were developed and used for jet airplanes that were able to travel at much greater speeds and distances (Geels 2006). More recently, many industries have been deeply affected by digitalization, new information technology and the spread of the Internet (Dolata 2013).

While transitions are often emerging, for example, due to technological progress, they may also be purposive, or goal-oriented (Smith et al. 2005). In the transitions literature, there is a particular focus on so-called *sustainability transitions*, which are large-scale sectoral transformation processes associated with the promise to bring about more sustainable modes of production and consumption (Markard et al. 2012). Sustainability transitions are purposive transitions, guided by political goals and—at least partially—governed by public policies. This is what makes them particularly interesting from an IPE perspective.

Major Frameworks

Transition scholars have not only provided numerous empirical accounts of historical and ongoing transitions but also developed different conceptual frameworks to grapple with the complexity of transitions. Here we introduce and briefly discuss the four most influential approaches: the multilevel perspective (MLP), technological innovation systems (TIS), strategic niche management (SNM) and transition management (TM).

The goal of the MLP is to explain the dynamics of transitions. Building on earlier work on socio-technical regimes (Rip and Kemp 1998), it explains transitions through the interplay of dynamics on three different levels: niches, regimes and landscape (Geels 2002). *Socio-technical regimes* are established engineering practices, problem definitions, process technologies and dominant designs in a specific sector (e.g. electricity) that are socially embedded into the expectations and daily routines of technology users or consumers and supported by formal norms, regulations and broader infrastructures (Kemp et al. 1998). The core idea behind a regime is that it is very resistant to change and imposes a direction for incremental socio-technical development along established pathways. *Niches*, in contrast, are protected spaces, that is, specific markets or application domains, in which radical innovations can develop without being subject to the selection pressure of the prevailing regime (Kemp et al. 1998). The *landscape* encompasses external factors and developments such as significant changes in commodity prices, major accidents and disasters or long-term macroeconomic or societal trends. According to the MLP, transitions occur if the landscape exerts pressure on the established regime and thus opens up opportunities for alternative niches to break through to the regime level and eventually to replace existing technologies and regime structures.

The goal of the TIS framework is to study the emergence of novel technologies together with the associated institutional and organizational changes (Bergek et al. 2008a; Carlsson and Stankiewicz 1991). The framework has strong conceptual linkages to other innovation systems approaches such as national or sectoral innovation systems (Freeman 1988; Malerba 2002; Nelson 1988). A TIS has been defined as a network of actors and institutions that jointly interact in a specific technological field and contribute to the generation, diffusion and utilization of variants of a new technology and/or a new product (Markard and Truffer 2008). The concept emphasizes the strong interplay of actors and institutions and suggests a set of seven key processes, so-called functions, for successful technology development (Bergek et al. 2008a; Hekkert et al. 2007). The TIS framework received quite some attention for the study of emerging energy technologies in different countries (Truffer et al. 2012) but has also been criticized for not paying enough attention to the politics of regime change (Kern 2015).

SNM is concerned with the protection and nurturing of radical innovations in niches. At the same time, it is also a policy-oriented approach to deliberately create and support niches in order to bring about regime shifts (Hoogma et al. 2002; Kemp et al. 1998). SNM highlights social learning across multiple experiments, the formulation of collective expectations and networking as key processes for technologies in niches to prosper (Geels and Raven 2006). Recent work has also looked at the political agency of technology advocates trying to obtain protective public policy measures, and the effects this has had on niche developments (Smith and Raven 2012; Boon et al. 2014).

Similar to SNM, *transition management* is an intervention-oriented concept with the goal to trigger sustainability transitions (Kemp and Loorbach 2006; Loorbach 2010). It combines the work on technological transitions with insights from complex systems theory (e.g. Kauffman 1995) and governance approaches (Rotmans et al. 2001). Guiding principles for TM are derived from conceptualizing societal systems as complex, adaptive societal systems and understanding management as a reflexive and evolutionary governance process (Nill and Kemp 2009; Voß et al. 2009). TM involves several elements or steps, including problem structuring and envisioning in multi-stakeholder arenas, developing new coalitions, implementing transition experiments and evaluating and monitoring the process (Loorbach and Rotmans 2010). Interestingly, the approach has been adopted and implemented by the Dutch Ministry of Economic Affairs to manage their energy transition, but faced a variety of setbacks, many of which were related to issues of power and politics (Kern and Smith 2008; Kern and Howlett 2009; Hendriks 2008).

The Dutch example illustrates that sustainability transitions are highly political: They are normatively motivated, policy-driven and entail potentially large economic drawbacks for incumbent industries. This is one of the reasons that make transitions an interesting topic for IPE scholars. The next subsection will therefore specifically focus on issues of politics.

The Politics of Transitions

Earlier work in transition studies has been criticized for neglecting politics and power (Shove and Walker 2007; Meadowcroft 2009; Scrase and Smith 2009; Kern 2010) but meanwhile, there is a growing interest in the politics of transitions.

One line of research focuses on power since transitions involve shifts in power but also require political power by proponents to affect change in the direction they consider desirable (Smith et al. 2005; Avelino and Rotmans 2009; Stirling 2014). In this context, transition scholars have analysed the sociopolitical work of technology advocates directed at creating niches for sustainable energy innovations (Smith and Raven 2012; Raven et al. 2015). Scholars have also explored how legitimacy of new technologies is achieved or undermined (Bergek et al. 2008b; Markard et al. 2016). Most contributions have focused on (domestic) politics and on how domestic institutional contexts and legacies shape such processes (Kern 2011; Fuenfschilling and Truffer 2014) but there is limited attention to international political processes and how they influence transitions. Moreover, scholars have looked into the political dimensions of niche–regime interactions (Hess 2015) and the strategies of incumbents responding to pressure for change (Stenzel and Frenzel 2008; Penna and Geels 2012; Smink et al. 2015).

Another central issue are the political difficulties governments will encounter in attempts to steer transitions (Jänicke and Jacob 2005; Meadowcroft

2005). In a study on energy transition policies in Switzerland, Markard et al. (2015) have shown that established coalitions are very stable, although meanwhile renewable energy pathways can be more easily associated with economic benefits and conservative political views. A related example is the implementation of the transition management approach through the Dutch government which encountered political challenges, not least with regard to political representation (Hendriks 2009) and the dominance of regime incumbents within the process (Kern and Smith 2008).

Lastly, there is already some emerging work on the political economy of transitions. Newell, for example, draws on transitions scholarship and combines it with his interest in the global politics of the environment and climate capitalism (Newell and Paterson 2010; Baker et al. 2014), while Schmitz (2014) analyses how the global power shift from West to East affects the low-carbon transformation.

The emergence of studies on the political aspects of sustainability transitions is very encouraging but there is still some way to go. In Sect. 5, we will argue that insights from IPE may contribute to further develop this work. However, before we turn to IPE, the next section discusses some of the key characteristics of energy transitions.

3 Energy Transitions

Past Transitions in the Energy Sector

The energy sector has seen many major transformations, at different times and different places (Araújo 2014; Solomon and Krishna 2011). In the past, many of these were driven by the discovery and exploitation of new primary energy sources such as coal, oil and gas, and by the development of novel energy conversion technologies including steam engines, internal combustion engines, steam turbines or nuclear reactors. The indicative overview in Fig. 12.1 shows that, until the mid of last century, there were two major shifts in energy sources, from wood/biomass to coal and from coal to oil. More recently, several new sources and technologies were added (see Sect. 3.2). Many of these changes varied across subsectors (heating, transport and electricity) and also across countries.

The development of the steam engine and the beginning of the industrial revolution in the mid-nineteenth century, together with a massive increase in the use of coal, marked the starting point of the first major socio-technical

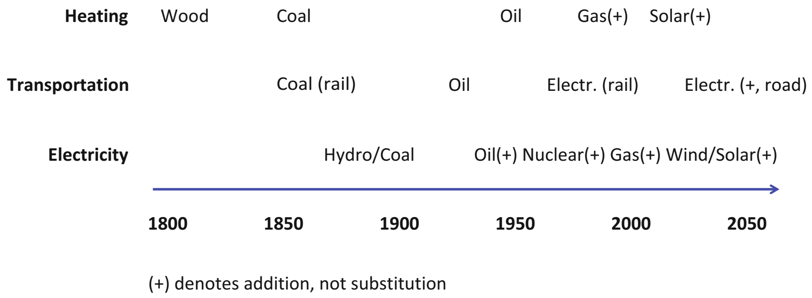

Fig. 12.1 Major changes in energy carriers over time globally

transition in modern history (Grubler 2012; Solomon and Krishna 2011). A second major transition began in the early twentieth century, when oil entered the scene—first as a fuel for lighting, later as a fuel for locomotives and automobiles (e.g. Geels 2005). However, it was not until around 30 years later that coal lost its importance for railway transport, and it took another 20 years to also be replaced by oil on a larger scale for heating purposes (e.g. Turnheim and Geels 2012). Interestingly though, this did not mean the end of the coal era: The decline of coal was just relative, confined to certain regions and subsectors. Because of an ever growing energy demand mainly in emerging economies, coal is still the second most important energy carrier with a current 25% share of worldwide energy supply, mostly for generating electricity (IEA 2014).

These examples of past transformations in the energy sector generate some important insights. First, they were all accompanied by major changes in technologies, infrastructure, regulation, industry structures, consumer practices and so on. Second, they did not occur overnight but took decades to fully unfold. Third, they substantially varied across subsectors and regions (Bridge et al. 2013). Fourth, they were accompanied by a substantial expansion in energy demand (esp. transportation and electricity), both locally and globally. It is especially the latter that constitutes a particularity of past energy transitions: Substitution and decline of established fuels and technologies have often been confined to specific regions but not globally.

Based on the transition concepts in Sect. 2 and the above insights, we define energy transition as follows. An *energy transition* is a long-term, multi-dimensional and fundamental transformation of the energy sector in a specific techno-institutional context (e.g. country). It includes and affects a broad range of technologies, organizational and institutional structures.

Ongoing Energy Transitions

The ongoing energy transition is characterized by a shift towards renewable energy sources and increased energy efficiency, away from fossil and nuclear fuels. It is certainly most advanced in the electricity subsector, but has seen some progress in heating and just initial developments in transportation (see Chap. 16). The current transition is similar to past transitions: It also entails shifts in primary energy carriers and energy technologies (wind turbines, solar PV modules, biogas plants, smart grids, fuel cells, electric vehicles, etc.), and it also goes along with new products, services, business models and regulations.

However, in contrast to many past transformations which have emerged as a consequence of new technologies and/or resource discoveries, the ongoing energy transition is a *purposive transition* towards sustainability: It is targeted at carbon emission reductions and more sustainable modes of energy production and consumption more generally (Strunz 2014). As a consequence, public policies play a central role as a driver of the energy transition (Grubler 2012; van den Bergh 2013). At the same time, the overall goals of the transition are very much contested (Stirling 2014), with different actor groups pursuing different, often conflicting interests and visions (e.g. small-scale decentralized electricity systems based on renewables vs. large-scale centralized electricity production from nuclear, gas and coal-fired power stations with carbon capture and storage [CCS]).

In the ongoing transition of the electricity subsector, two countries are often seen as front runners: Denmark and Germany (see Table 12.1). Over the past 30 years, Denmark has ramped up its use of wind power for electricity generation to more than 30% and a further expansion up to 50% is foreseen until 2020. In the German electricity market, which is 20 times larger than the Danish, the share of renewables has grown from 3.5% in the 1980s to 25% in 2013. A remarkable issue for the German energy transition is also the (meanwhile broad) political consensus to phase out nuclear power until 2022 (Strunz 2014).[3]

The following table depicts four examples of purposive energy transitions in different energy subsectors at a national level. They are all geared towards low-carbon technologies, although they were triggered by different events at different times.

The comparison highlights that transition pathways can vary substantially as countries come with different institutional, social, political and techni-

[3] The contribution of nuclear to electricity production was 15% in 2013 (down from almost 30% in earlier years). Denmark has never used nuclear power.

Table 12.1 Examples of purposive national transitions in the energy sector

Case	Scope	Time frame	Key developments	Key events and drivers	Sources
Nuclear France	Electricity sector, national level	1970–2000	Rapid increase of nuclear for electricity generation (from 0% to 75%)	Oil price shock, strong political support and subsidies	Hadjilambrinos (2000) and Solomon and Krishna (2011)
Ethanol Brazil	Transport sector, national level	1975 till today	Massive increase of sugarcane ethanol as a fuel (from 0 up to 27 billion litres in 2009)	Oil price shock, strong political support and subsidies	Solomon and Krishna (2011)
Wind power, CHP and biogas Denmark	Electricity and heat supply, national level	1970s till today	Wind power up to 33% of electricity production	Oil price shock, political support and subsidies	Hadjilambrinos (2000)
Renewables and nuclear phase out Germany	Primarily electricity supply, national level	1990s till today	Renewables up from 3% to 25% of electricity production, nuclear down from 28% to 15% (2013)	Climate change and nuclear accidents, continued and strong regulatory support, broad political consensus	Strunz (2014) and Laes et al. (2014)

cal legacies. The different national or regional transitions, however, may also affect each other. They are interconnected, among others, by international knowledge flows, collaboration, value chains, trade, technology transfer and even ideas or visions. In Switzerland, for example, policymakers, societal movement groups as well as industry actors repeatedly point to neighbouring Germany when there is a discussion of the pros and cons of an energy transition (Markard et al. 2015). Especially the argument that Swiss firms can benefit as technology suppliers for energy transitions in Germany, Switzerland and elsewhere received quite some attention in recent political debates. Whether and in what regard such international relationships matter and will lead to some kind of convergence of national energy transition pathways remains to be seen and is an interesting topic for comparative political economy research.

Challenges for Theory Development

To summarize, energy transitions are highly complex processes which pose major challenges for scholars seeking to analyse them. Here we highlight five key characteristics of purposive sustainable energy transitions, which in our view are central for theory development.

First, they are multidimensional. Compared to recent changes in the energy sector as a consequence of market liberalization and privatization (e.g. Markard and Truffer 2006; Sioshansi 2006), current energy transitions are even more fundamental and encompassing: They entail not only institutional and organizational changes but also major technological changes across entire value chains. At the same time, there is a broad range of technologies involved with new ones (e.g. solar, wind, fuel cells) emerging and established ones (e.g. nuclear, coal) potentially declining.

Second, energy transitions are associated with a high degree of *uncertainty and complexity*. Due to the large number of actors, institutions and technologies affected by the ongoing changes, the outcome of the transition is very much open: Will renewable and/or distributed energy production dominate in the future? Will the incumbent players (utilities, technology developers, oil majors) of today prevail? Will electricity supply and transportation become more intertwined (e.g. through electric vehicles)? Will the key role of national policymaking give room to local and/or supranational regulation? Given this uncertainty, strategy making at the firm level as well as policymaking at national and international levels is beyond 'business-as-usual,' requiring novel and more flexible tools, collaboration and goal formulation.

Third, purposive transitions require a close involvement of *public policies*: We expect energy transitions to be driven or strongly affected by policy interventions, for example, innovation policies targeted at renewable energies or environmental taxes (Meadowcroft 2005). In this regard, it is different from sectoral changes that are primarily driven by technological advances and user demand such as the emergence and continuous transformation of the information and communication technology sector (Dolata 2013).[4]

[4] However, as renewable energy and efficiency technologies become more and more mature and economically attractive, policies might lose some of their importance as drivers of sustainable energy transitions.

Fourth, there are strong *vested interests* and *conflicts* over transition goals (Stirling 2014). Existing energy infrastructure (such as power plants, pipelines, power lines) is both highly capital intensive and long lasting (Markard 2011), which sets high incentives for maintaining the status quo and using existing assets as long as possible to avoid sunk costs. Incumbent actors control access to resources as well as key assets in generation or transmission; they possess technological competences and hold strong market positions. Moreover, they often have close ties to policymakers both nationally and internationally (e.g. Kungl 2014; Stenzel and Frenzel 2008).

Fifth, energy transitions exhibit a high level of *context dependency*: Countries and regions differ a lot in terms of the available resources, technologies that have been developed and applied, infrastructures, regulations and also consumption patterns. As a consequence, we can expect energy transitions to show different pathways of transformation in different contexts (Bergek et al. 2015; Bridge et al. 2013). At the same time, energy transitions span different scales, from local to national and international levels.

Having elaborated on the characteristics of energy transitions, we will now turn to discussing IPE perspectives and how they might enrich our understanding of such transformations.

4 International Political Economy Perspectives

As pointed out in the introductory chapter, it is notoriously difficult to precisely define what IPE is about. Cohen argues that IPE in the broadest terms 'is about the mutually endogenous and every-changing nexus of interactions between economics and politics beyond the confines of a single state' (Cohen 2014, p. 138). Given that transition processes are widely acknowledged to be driven by an interplay between economic and political factors and that many of the important underlying processes are international in nature (e.g. technology development, value chains), it seems obvious to explore potential synergies between the two fields. In the following, we will discuss what insights IPE can offer with regard to the governance of energy transitions. This strategy immediately runs into difficulties because of the diversity of the field of IPE: For this chapter, we will mainly draw on what Cohen calls the American and the British schools of IPE. This is useful for our purposes since they represent contrasts in terms of theoretical approach, methodologies and research questions but are both argued to be interesting avenues to consider in the analysis of energy transitions.

American School

Arguably the dominant school of thought within IPE is the American school. The American school has a state-centric realist ontology: National governments are the core actors and explaining state behaviour is central to the analysis. Key considerations are relative and absolute costs and gains. This does not mean that other types of actors are completely ignored but they are mainly of interest insofar they influence or constrain government policy. For scholars from the American school, formal theory is important and research is often designed for hypothesis testing, using quantitative methodologies focusing on rigour and replicability of the results following the natural sciences model (Cohen 2014). Attention focuses on many different issue areas including trade policy, monetary relations, foreign aid and environmental policy (Smith et al. 2014).

System governance is also an important part of the American school's research agenda which is studied as a collective action problem between sovereign governments. As part of this agenda, hegemonic stability theory, international regime theory, the role of international organizations and institutional theory have all informed the American school's analysis of system governance. This seems an area where much can be learned for the analysis of transition processes.

Research within the American school is very much focused on the nation state as the unit of analysis and how the international system impacts on national interests. Critics like Michael Zürn therefore speak of the 'shackles of methodological nationalism' (Cohen 2014, p. 31). Another critique of the American school is its narrow focus which misses out on the big questions. Theorizing instead focuses on the mid-level 'where broader structures are simply taken for granted. The Big Picture gets ignored, if not forgotten' (Cohen 2014, p. 31).

British School

In contrast, the British IPE school has been characterized as much more interdisciplinary, interpretive, normative and historical in nature (Cox 2009; Cohen 2014). In the British school, there is also a call for studying civil society actors in addition to states. Cox also argues for the adoption of longer time horizons to be able to analyse a system's origins and its development potential, claiming 'By and large the European mind is attuned like Vico's to the idea of transformations in societies and in power relations—in the problematic of rise, decline and creative revival … rather than to a fixation on maintenance of the status quo' (Cox 2009, p. 322). When Cohen (2014, p. 57) describes the research agenda of the British school as 'how systems came into being in the past, what changes are presently occurring within them, and how those changes might be shaped in the future,' this could be a verbatim statement of a transitions researcher. An example of the type of work scholars from the British school are conducting is the research of Baker et al. (2014) who undertook a critical political economy analysis of the South African minerals–energy complex: a regime of accumulation based on low-cost state-owned electricity production and cheap labour with a focus on understanding state–capital power relations. One of the weaknesses of the British school is that there is little shared conceptual or methodological ground across the school (Cohen 2014). Cox described the British school as characterized by a 'chaotic interplay of ideas and approaches' (2009, p. 323).

Rationalist or Post-positivist Approaches in Analysing Transitions?

As mentioned in Chap. 1, a significant debate in the discipline of IPE is about methodology and epistemology. The American school is essentially *rationalist*, positivist and empiricist. The British can be labelled *post-positivist*. The literature on transitions partly builds on insights from science and technology studies within which post-positivist approaches are very important in understanding processes of technological development (MacKenzie 1996; Bakker et al. 2012). For example, the development of shared positive expectations of actors around a niche is seen as a key process within the SNM literature (Geels and Raven 2006). Also the literature on TIS not only points to the importance of legitimacy as a form of social acceptance (Bergek et al. 2008b) but also influences expectations of technology managers and thereby affects their direction of search for technology development (Jacobsson and Bergek 2011). Also the emerging work on the politics of transitions builds on a range of cognitive approaches, including work on discourses and narratives (Späth and Rohracher 2010), advocacy coalitions (Markard et al. 2015) or policy paradigms (Kern et al. 2014).

We argue that this is no coincidence but is a consequence of one of the key features of transition processes: uncertainty. Since transitions are complex, lengthy and multi-actor processes, the outcomes of which are impossible to predict, cognitive analyses aiming to understand how actors come to see the world and act according to their 'perceived reality' are crucial.

This contrasts with the American school's IPE which is based on an understanding of politics in which actors use different forms of power to achieve outcomes which are in line with their material interests: 'For sceptics—variously realists, materialists, and often rationalists—ideas do not matter, as power and material interests ultimately drive politics' (Price 2006, p. 252). However, we argue that, for example, material interests of a large multinational oil company in the long term (e.g. being a successful business in a low-carbon world) may be very different from material interests in the short term (e.g. avoiding stranded assets). Following Blyth, in such situations of Knightian uncertainty it is not the direct material interests which shape actors' behaviour but their particular perceptions of their material interests, and so ideas render interests 'actionable' (Blyth 2002, p. 39). This might be especially important in transition processes where there is large uncertainty for actors about their future material interests and how to realize them.

Table 12.2 tries to summarize some of the key features of the American and the British schools of IPE as well as the transition studies literature.

At first sight, there seems to be a better fit between the British school of IPE and sustainability transitions scholarship, because of the shared interest in normative questions and qualitative, interpretative, historical explanations. However, we argue that the concerns with materiality on which much of clas-

Table 12.2 Key features of the IPE and sustainability transitions literatures

	Ontology	Agenda	Purpose	Openness	Epistemology
American School	State-centric	State behaviour, system governance, US perspective	Positive (explanation)	Mainly economics and political science	Rigorous empirical testing (hard science model)
British School	Individuals, states, social forces, historical structures	Very broad	Normative	Broadly inclusive	Qualitative, historical, interpretative
Sustainability transitions	State-centric, socio-technical systems, social forces	Public policy, mainly Europe/North America; some work on Asia	Positive (explanation) and normative	Broadly inclusive and diverse	Mainly qualitative, historical, interpretative

Source: based on Cohen (2014), row on sustainability transitions added by authors sic IPE is based are also important in transitions research. For example, the emerging work on the political economy of transitions takes the (current) material interests of incumbent firms and governments very seriously in analysing prospects for transitions to occur and in terms of their influence on the direction of travel (Baker et al. 2014; Smink et al. 2015). We therefore disagree with Geels' (2010) claim that there is limited potential in crossovers between transition theories and rational choice, precisely because realist/materialist explanations have much to say about current power structures and how the interactions between firm and state interests, both within states and transnationally, shape the development of energy systems. In the final section, we will therefore argue that both IPE schools can provide useful impetus for transitions scholarship and that IPE can also learn from transition studies.

5 Towards a Research Agenda on the International Political Economy of Energy Transitions

For studying energy transitions, scholars can use and possibly even combine insights from transition studies and IPE. Table 12.3 lists for each of the key characteristics of energy transitions, potential contributions as well as possibilities for improvement in both streams of literature.[5]

The comparison shows that both have strengths and weaknesses and that these are largely complementary: Transition studies has stronger conceptual foundations with regard to the first two aspects, while IPE contributes more to understanding the last two. Both literatures equally acknowledge the key role of public policies, although with different perspectives. Due to these complementarities, we think that it is highly promising to mobilize insights from both fields when studying specific aspects of energy transitions. Below, we provide first ideas of how both fields can enrich each other.

Lessons from IPE for Transition Studies

IPE offers a number of important insights for transition studies. *First*, it highlights the *relevance of politics* and strong *influence of established industry actors*. These include national and multinational companies (MNCs) (e.g.

[5] Note that table entries are indicative; among others they do not fully reflect the differences among frameworks within the two strands of literature.

Table 12.3 Contributions of IPE and sustainability transition studies to energy

Key characteristics of energy transitions	Transition studies	International political economy
Multidimensional, key role for technology	Strong contribution: frameworks acknowledge interplay of organizational, institutional and technological change	Potential for improvement: focus so far on organizational and institutional interplay, not on technology
Highly complex and uncertain	Strong contribution: evolutionary and cognitive/constructivist approaches incorporate uncertainty and strong focus on dynamics	Challenge: approaches not particularly adapted to highly dynamic environments; assumptions of rational interests and known payoffs do not hold
Key role for public policies	Widely acknowledged; rather seen as independent variable	Widely acknowledged; rather seen as dependent variable
Vested interests and conflicts	Potential for improvement: politics increasingly incorporated but still room for conceptual improvement	Strong contribution: politics and power acknowledged and incorporated in frameworks but focus on distributional rather than transformational issues
Context dependency, local, national and international levels	Potential for improvement: variation of contexts and local versus international economic and political relationships often not in focus	Mixed contribution: international relationships and multi-scalarity acknowledged; context dependency less so (apart from varieties of capitalism literature, see Chap. 1)

Shell, BP, Alstom, GE, etc.), associations (Eurelectric, World Energy Council, World Nuclear Association), international non-governmental organizations (Greenpeace, Friends of the Earth, etc.) and a variety of international organizations (World Bank, International Monetary Fund, Organisation of Economic Co-operation and Development, International Energy Agency, International Atomic Energy Agency, Organization of the Petroleum Exporting Countries, International Renewable Energy Agency, etc.). The associated actors control key resources and collaborate in international networks so that they have the ability to successfully advocate their interests in national and international policy systems. IPE has many relevant theoretical perspectives to offer in this regard, including work on the role of epistemic communities in international environmental politics (Haas 2016) or work on regulatory capture (e.g. Goldbach 2015).

Second, IPE highlights that there are *diverging national interests*, for example, with regard to the international trade of energy carriers, the use and exploitation of energy resources, the development of international energy infrastructures or trade or environmental regulations. National interests are often shaped by the abundance of energy resources, existing energy infrastructures, industries and the vested interests of national champions (see e.g. Eberlein and Doern 2009). National governments formulate different political objectives of how (or whether) to transform the energy sector and also set different priorities in terms of technology development, resource exploitation or models of infrastructure provision (Hughes and Lipscy 2013). Moreover, institutional settings and governance traditions differ across countries (Kern 2011). For energy transitions, these national differences have at least two implications: First, common objectives and strategies at the international level will be very difficult to achieve. Even if, for example, overarching international climate mitigation targets like in the United Nations Framework Convention on Climate Change 2015 Paris Agreement can be agreed upon, countries or regions are likely to pursue different energy transition pathways. This is partly the case because '[c]hoices over fuel types, efficiency policy, and international strategies have important distributive consequences within and between countries' (Hughes and Lipscy 2013, p. 451). Second, energy transition studies often depart from emphasizing the necessity and urgency of a reduction of greenhouse gas emissions and expect collaborative strategies directed at a global transition to low-carbon energy systems to emerge. However, scholars may equally want to consider that conflicts and intense struggles occur at the international level over the speed and direction of such transitions and that relative gains vis-à-vis competitors might be an important consideration for national policymakers.

A *third*, related aspect is the *interplay of local, national and international political developments* that is relevant for energy transitions, but is currently underresearched. IPE scholars have a long tradition to carry out studies that take these multiple levels into account. Transition scholars can learn from these experiences: It seems crucial to take the analysis beyond the national level, to better study international–political relationships and to take interactions between different political scales into consideration. One example of such interplays might be between national energy transition policies and international trade or environmental agreements. Scholars could draw on the work on two-level games (Putnam 1988; McLean and Stone 2012) or even three-level games (Hwang and Kim 2014).

Fourth, if transition scholars were to follow the lead of the British school as a normatively committed school of thought, more emphasis could be put on distributional consequences of transitions (Stirling 2014). For Susan Strange and colleagues, one of the key questions always has been: For whose good or who wins and who loses? Baker et al. already suggested that questions of justice, distribution and the role of labour 'must be addressed more systematically in transitions literature if the possibilities of a "just transition" are to be understood and acted upon' (2014, p. 23). Strangely even though the idea of overturning regimes and replacing them with new configurations is quite central in transitions thinking and scholar have talked about 'winners' and 'losers' of transitions (Meadowcroft 2011), no such analysis focusing on the distributional issues within or across societies exists so far.

Lessons from Transition Studies for IPE

Conversely, we argue that IPE analysis can also learn from transition studies. *First*, transition studies is interested in analysing *ongoing, fundamental changes*. This is very different from IPE, where scholars mostly concentrate on relatively stable situations (in the sense of the path-dependent development of regimes) and the actors, power relations and institutions therein. Energy transitions, in other words, represent an empirical phenomenon to which some of the core concepts of IPE might be difficult to apply. A related point is that—in situations of high uncertainty—rational choice assumptions of American IPE may not hold. Instead, cognitive and ideational approaches may be more adequate. For example, the MLP focuses on social enactment, sense-making and cognitive processes to explain regime change (Geels 2010). However, the work on historical or discursive institutionalism (Pierson 2000; Blyth 1997; Schmidt 2003) might be one way of combining attention to structures as well as change which has gained traction in political economy and which could be enriched with insights from transition studies, for example, in terms of different transition contexts (Smith et al. 2005).

Second, transition theories like the MLP or the TIS approach highlight the *relevance of (hard and soft) institutional structures and the co-development of institutional, organizational and technological changes*. IPE very much focuses on the former two but less so on the technological aspects of international energy systems. It is especially the interaction of the different political, economic and technical dimensions that is a strength of transition studies which can be informative for IPE. The technological perspective is also highly relevant at the international level, where diverging interests come together. The development of (international) technology standards is one of the issues that is central here (e.g. Funk and Methe 2001; Bakker et al. 2015). Experiences also show that technology developments might be much faster than national (policy) developments, thus acting as supranational forces creating tensions for and across national interests.

6 Introducing the Remaining Chapters in this Section

The subsequent chapters in this section will grapple with many of the issues highlighted above and contribute the respective authors' perspectives on selected aspects of the IPE of energy transitions.

Chapter 13, *Carbon Capture and Storage Demonstration and Low-Carbon Energy Transitions: Explaining Limited Progress*, by James Gaede and James Meadowcroft asks the question why, despite much international interest in CCS technologies as a key climate mitigation option, progress with demonstrating CCS has been much slower than anticipated. By reviewing the global progress with demonstration projects, they find that recent activity has been concentrated in just a few countries, including the USA, Canada, Brazil and Saudi Arabia—all of which are major fossil fuel producers. They attribute the slow progress to a number of IPE factors, including the faltering political interest in addressing climate change at the international level over the past decade, the economic recession in 2008–2009 and the following public austerity response in many OECD countries, as well as the rapid rise of shale oil and gas in the USA. Their most important finding is that CCS so far is more politically feasible in regions that derive substantial economic benefits from fossil fuel production. The authors argue that CCS progress is furthest advanced in countries where there is a strong commonality of interest between the private and public sector as investing in CCS is crucial for maintaining fossil fuel-based rents in an increasingly carbon-constrained world.

Chapter 14, *Democracy and Transitions: European Experiences of Policy Inclusiveness and Changes in the Electricity Industry*, by Mari Ratinen and Peter D. Lund analyses policy inclusiveness of Denmark, Germany, Finland and Spain with regard to changes in the electricity sector. Departing from the claim that inclusiveness is understudied in the transitions literature and drawing on private self-interest rather than public interest theory, they ask how policy inclusiveness (in terms of actors being both engaged in policy processes and benefitting from policy outcomes) influences transitions. They find that more inclusive governing traditions and looser ties between governments and incumbent firms have a positive impact on the emerging energy transitions, while a relatively low degree of inclusion appears to be linked to relatively close ties between the government and incumbent firms and seems to slow down transitions. The chapter also demonstrates the diversity of transition pathways across countries, with some countries aiming to increase the use of nuclear power (Finland), while others focus primarily on supporting renewables (Denmark, Germany).

Chapter 15, *Second Life or Half-life? The Contested Future of Nuclear Power and Its Potential Role in a Sustainable Energy Transition*, by M.V. Ramana critically examines the future global prospects of nuclear power and the main challenges that confront an expansion. The chapter argues that although nuclear power is going to remain part of the electricity generation portfolio in several countries where political elites remain strongly committed to nuclear power, its global prospects for significant growth are limited. Ramana discusses a variety of political, social and economic factors which contribute to this assessment which include construction and operating cost increases, construction time overruns, the limited progress with small modular reactor designs, safety and public acceptability concerns. The chapter also reflects on the strategies of various nuclear reactor vendors trying to obtain international orders beyond their 'home' markets and which are often strongly backed by their respective governments. Ramana argues that the limited potential for significant growth reduces the desirability of a nuclear solution to climate change, which requires a very rapid and drastic reduction in emissions, and therefore questions whether nuclear power can be a part of a sustainable energy future.

Chapter 16, *Decarbonizing Transport: What Role for Biofuels?*, by John Alic analyses the role of biofuels as a potential substitute for oil as a transport fuel. He investigates the various policy rationales put forward in support of biofuels and discusses policy developments in the EU, Brazil and the USA as the world's three biggest user and producer regions of biofuels. The chapter reflects on important political economy aspects of biofuels by pointing to the dominance of MNCs in downstream production, the limited prospects of local rural job creation as well as the uncertain net job effects across countries. The chapter also explores the importance of the interplay between national (interest group dominated) politics and the international economy and trade flows, including impacts on food prices. Alic concludes that although (some) biofuels have potential to cut greenhouse gas emissions, first-generation biofuels will not be able to replace petroleum in the near- to medium-term future and that cutting emissions from personal vehicle transport is therefore the most intractable issue of all major emission sources.

A general lesson learned from the chapters in this section is about the enormous difficulties that a global transition towards sustainable energy systems poses: Many of the key technologies which could potentially be part of this transformation (e.g. biofuels, nuclear, CCS, renewables) face a variety of political, social and economic challenges. IPE thinking offers useful lenses to explain why this is the case. However, an IPE lens seems to be less useful in thinking about potential remedies or, in other words, about possible proactive political strategies for purposive energy transitions. This is one of the strengths of the emerging field of transition studies and above we have outlined some ideas about how to combine transition studies' insights with scholarship from IPE.

The chapters also highlight the importance of understanding innovation and technological change as being part of wider economic and political processes rather than something that happens in public or private R&D facilities. This reinforces the argument that energy transitions need to be seen as transformations in socio-technical systems, which include supply-side and end-use technologies, their associated infrastructures, market arrangements, policies and rules, consumer preferences and behaviour, cultural expectations and so on. Explaining how and why such systems change and whether these processes can be actively steered in terms of their direction and speed is a key future challenge for the field of energy IPE and related scholarship.

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13

Carbon Capture and Storage Demonstration and Low-Carbon Energy Transitions: Explaining Limited Progress

James Gaede and James Meadowcroft

In 2009, the International Energy Agency (IEA) called for the establishment of 100 large-scale carbon capture and storage (CCS) demonstration projects by 2020, to prove the technology at scale, and to facilitate subsequent commercial deployment that could contribute to meeting the 2°C climate target. Four years later, the IEA radically scaled back its ambitions, reducing its goal to just 30 international CCS demonstration projects. By mid-2015, only 14 such facilities were operational, and half of these existed before the IEA established its original goal. The new projects are located in just four countries: Brazil, Canada, Saudi Arabia, and the USA.

In the years following the publication of the IPCC's *Special Report on Carbon Capture and Storage* (2005), there was considerable international interest in CCS as a mitigation approach that could ease the transition to climate-friendly energy systems. By trapping greenhouse gas (GHG) emissions associated with fossil fuel usage, CCS would allow a more gradual transition away from the fossil energy systems on which the world remains dependent. CCS could be understood as one element in a comprehensive and cost-effective tool kit of climate mitigation strategies in the energy sector—that would include fuel switching, new renewable deployment, energy efficiency, nuclear and big hydroelectricity generation, and so on. But CCS has not been without critics, with many arguing that it is an expensive and

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risky distraction that drains societal resources away from the urgent effort of completely kicking the fossil fuel habit.

In this chapter, we consider why progress with CCS demonstration has been much slower than many experts anticipated a decade ago, and why projects have so far been concentrated in just a handful of countries. We will review prospects for the future rollout of CCS and make some modest suggestions for measures proponents might take to facilitate wider uptake.

The discussion is organized in five parts. Section 1 presents a brief review of CCS, focusing on the readiness of the technology, its potential contribution to GHG mitigation, and the complexity it presents from a transitions perspective. Next comes an overview of progress with large-scale integrated demonstration projects. Section 3 considers factors typically cited as explanations for the slow progress in getting demonstration projects off the ground. Then we provide a broader political economy-based discussion of difficulties with CCS. The final part of the chapter presents our conclusions.

1 What Is Carbon Capture and Storage?

CCS is not one technology but an array of more-or-less well-established technologies, practices, and solutions to three distinct problems: capturing CO_2 emissions, transporting them to a suitable storage location, and storing them permanently underground.

Over the past 15 years, international political interest in CCS has above all been focused on the potential to reduce GHG emissions from coal-based electricity generation. The argument has been that coal remains abundant and cheap; many nations (including the USA, but especially large developing countries like China and India) have substantial coal reserves, and CCS could allow continued exploitation of these resources while addressing climate concerns. CCS could also be applied to gas-fired power plants which have approximately half the emissions of their coal-fired counterparts. Models suggest that the availability of CCS as a mitigation option would substantially reduce the overall cost of meeting climate targets (International Energy Agency 2009, 2013; Working Group III of the Intergovernmental Panel on Climate Change 2005). CCS could also be applied to manage other industrial emissions. This includes industries (such as gas processing and the production of hydrogen, ammonia, and methanol) that already generate relatively pure CO_2 streams, and others (such as cement or iron and steel production) where alternative GHG abatement options are limited. Finally, CCS might at some point in the future be linked with the combustion of biomass or with direct air capture in order to draw CO_2 out of the atmosphere and generate 'negative emissions' (Meadowcroft 2013). Such a vision of CSS equipped biomass energy production (BECCS) is increasingly being incorporated into climate modeling exercises that are struggling to define emissions pathways that remain within the 2°C target.

In its 2013 Roadmap report on CCS, the IEA argued that CCS will be an integral part of any 'lowest-cost' climate change mitigation scenario (International Energy Agency 2013). Based on modeling conducted for the 2012 Energy Technology Perspectives report on CCS, the IEA anticipated a massive increase in CCS by 2050—growing from approximately 25 megatonnes per annum (MtPA) of CO_2 captured today to about 8000 MtPA in 2050. Cumulatively, this would entail storage of nearly 120 gigatonnes (Gt) of CO_2, or roughly 14% of the cumulative global GHG reductions that the IEA believes are necessary to limit global warming to 2°C.[1]

Core practices in the transport and storage 'steps' of CCS are well established and have been in use for decades. Pipelines would provide the main transport vector. Techniques for underground injection are similar to those already deployed in the oil and gas industry for the disposal of wastes and enhanced oil recovery (EOR). Storage sites are available in depleted oil and gas reservoirs, but over the longer term, deep saline aquifers would provide the largest storage potential.

On the capture side, amine-based technologies have been deployed at scale in industrial settings. But they are expensive, and alternative capture strategies remain technologically immature. Capture is the most costly element of the CCS chain and currently imposes a severe energy penalty, in the range of perhaps 15–30% for a coal-fired power station. In developing its 'road map' for CCS, the IEA refers to 'first phase' capture technologies where a concentrated CO_2 stream is a by-product of existing production—for example, in natural gas processing, where CO_2 from the reservoir must be separated to make the gas salable, or in hydrogen production. Here, capture is 'inherent' to the industrial process. 'Second stage' capture technologies would be applied in other industrial contexts and are less mature. Sandwiched between the two is the power sector where some further technological development is required, and above all, the integration of processes and demonstration at scale. The three broad approaches to capture in the power sector are the

[1] The other components of global reductions in the 2012 ETP '2DS' scenario are: end-use efficiency (42%), fuel switching (12%), renewables (21%), power generation efficiency and fuel switching (3%), and nuclear (8%).

post-combustion separation of CO_2 from flue gases, syngas/hydrogen capture (sometimes dubbed 'pre-combustion'), and oxy-fuel combustion. A summary of the IEA's understanding of the technological maturity of capture solutions in different industrial applications processes is presented in Table 13.1.

While capture represents the main focus for technological innovation, CCS projects require a substantial site-specific effort to characterize the reservoir formation where storage will take place. More generally, work is required to improve measurement, monitoring, and verification technologies that can be used to track CO_2 movement in the subsurface and ensure the integrity of storage. Policy frameworks and legal and liability regimes also require development, although some jurisdictions have begun to make progress here.

From a sustainability transitions perspective, CCS presents a number of complexities. On the one hand, it is clearly an 'end of pipe' technology, a pollution control strategy that would allow continued exploitation of fossil fuels at large industrial facilities while preventing damaging CO_2 emission from reaching the atmosphere. To this extent, critics worry that CCS will

Table 13.1 Technological development of CCS capture technologies

		Syngas-hydrogen capture	Post-process capture	Oxy-fuel combustion	Inherent separation
First-phase	Gas processing	-	-	-	Sweetening
	Iron & Steel	Direct reduced iron (DRI), smelting	-	-	DRI
	Refining	-	-	-	Coal-to-liquids; synthetic natural gas from coal; Hydrogen production;
	Chemicals	-	-	-	Ammonia/methanol
	Biofuels	-	-	-	Ethanol fermentation
Power generation	Gas	Gas reforming and combined cycle	Natural gas combined cycle	Oxy-fuel combustion	Chemical looping combustion
	Coal	Integrated gasification combined cycle (IGCC)	Pulverised coal-fired boiler	Oxy-fuel combustion	Chemical looping combustion
	Biomass	IGCC	Biomass-fired boiler	Oxy-fuel combustion	Chemical looping combustion
Second-phase	Iron & Steel	Hydrogen reduction	Blast furnace capture	Oxy-fuel blast furnace	-
	Refining	Hydrogen fuel steam generation	Process heater and combined heat and power capture	Process heater and CHP oxy-fuel	-
	Chemicals	-	Process heater, CHP, steam cracker capture	Process heater and CHP oxy-fuel	-
	Biofuels	Biomass-to-liquids	-	-	Advanced biofuels
	Cement	-	Rotary kiln	Oxy-fuel kiln	Calcium looping
	Pulp & Paper	Black liquor gasification	Process heater and CHP capture	Process heater and CHP oxy-fuel	-

Lab or Concept   Pilot   Demonstration   Commercial

Source: adapted from IEA (2013)

encourage continued dependence on fossil resources, deepen carbon ‘lock-in’ (Unruh and Carrillo-Hermosilla 2006), and dilute efforts to break away from the existing energy trajectory by siphoning away investment that should be directed to renewable energy systems and changing patterns of energy consumption (Meadowcroft and Langhelle 2009). In the language of the multi-level perspective on socio-technical transitions (see Chap. 12 of this volume), CCS could be understood as a niche development that serves to prop up and extend the existing fossil energy regime and to weaken renewable energy niches that would have the potential to secure broader system change. Expenditure of huge sums of public money—to fund several generations of demonstration projects that could prove the technology at scale and drive down costs—can be seen as a massive subsidy for fossil energy production, which plows public resources into technologies which will ultimately allow fossil fuel incumbents to continue private accumulation, and constitutes a clear violation of the ‘polluter pays principle’. On the other hand, it can be argued that the challenge of climate change mitigation is to eliminate GHG emissions while making available energy resources to sustain continued human development. So if CCS can be shown to work at scale, and to work at a reasonable cost, then it is socially advantageous to develop the CCS option. For even if CCS is not applied to coal-fired power plants, it might prove useful in transition pathways that exploit natural gas. And it will be required to manage industrial process emissions. And at some point, we might need to apply it at scale with biomass or air capture to draw back from climate overshoot. This perspective suggests that CCS is not necessarily only a ‘one world’ technology that serves to extend the lifetime of the existing fossil-based regime but potentially a ‘two world’ technology that opens doors to a variety of more transformative pathways (Meadowcroft and Hellin 2010).

2 Demonstration Through Large-Scale, Integrated Projects

As noted above, it is widely agreed that even though the practices that are integrated into CCS are relatively well understood, they must be demonstrated at scale before commercial deployment. The policy focus has been therefore on getting a sufficient number of ‘large-scale, integrated projects’ (LSIPs) off the ground to demonstrate feasibility and drive down costs. These types of technological demonstration projects are intended to show not only that the technology in question works, and does so safely, but also that it *can work* in the context of existing social, political, and economic arrangements.

This entails resolving uncertainties about the specific technology, but also the generation of understanding and social acceptance of the technology, as well as its promotion by interested parties (Markusson et al. 2011; Markussson et al. 2012). Demonstration can thus be considered a process of social learning, without which the diffusion of new technology will likely be rocky, slow, or faced with concerted opposition (Rosental 2005; Shapin 1984).

To track progress on CCS demonstration, the Global CCS Institute (GCCSI) maintains an online database of LSIPs at various stages of development, with records running back to 2009 (the database is also published annually in the organization's *Global Status of CCS* report). The five stages of development used by the Institute are: identify, evaluate, define (potentially followed by a final investment decision, or FID), execute, and operate. Each year projects may be added, renamed, or re-characterized, or put on hold, delayed, or otherwise canceled.

For this chapter, we reviewed this listing as published in the Global Status reports between 2010 and 2014, and the list that is currently (September 2015) available online from the GCCSI's website. Reconciling the changes over this five-year period, we find a total of 118 separate active or planned LSIPs identified by the GCCSI since 2010. Of these, 63 projects (53%) have been delayed, put on hold, or otherwise canceled since 2010.

Of the remaining 56 projects, seven were already in operation prior to 2010. These include Snøvit (Norway, 2008), In Salah (Algeria, 2004), Weyburn-Midale (Canada, 2000), Sleipner (Norway, 1996), Shute Creek (USA, 1986), Enid Fertilizer (USA, 1982), and Val Verde (USA, 1972).[2] Based on the GCCSI's records, it seems only 24 of the other 49 projects made investment life cycle progress (ie, progressed from one investment decision stage to the next) over the past five years. Of these, 11 passed the FID: four are currently in execution, while the other seven have begun operations. Another four projects have remained at the 'Execute' stage for the past five years and therefore are not considered here to have made any progress.

Accordingly, there are presently 22 post-FID LSIPs (14 operating plants and 8 at the execute phase, highlighted in blue in Fig. 13.1), half of which were either operating before 2010 or did not make any further progress in the past five years. This means that of all the projects that were identified since 2010, only 22% made progress, 10% progressed past an FID, and about 6% actually managed to begin operations in the past five years. Appendix A contains a summary of the operating and 'execute' stage projects by whether or not they made progress, and also includes their industrial sector. Interestingly,

[2] In Salah suspended storage activities in 2013, and it remains to be seen whether or not they will resume in the future.

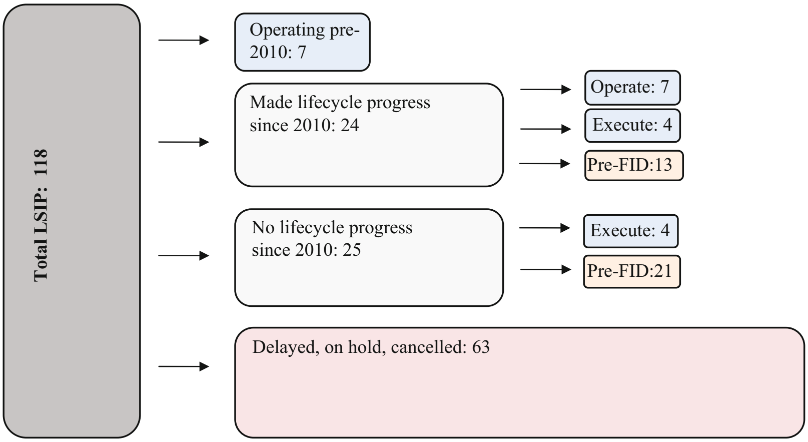

Fig. 13.1 Large-scale integrated projects investment life cycle progress (*Source*: based on data from GCCSI)

45% of this basket of demonstration projects were in the gas processing sector (where CO_2 must be removed to market the gas), with less than 10% in the power sector which was the key focus of political attention with respect to climate mitigation.

Another way to appreciate the uneven character of advance in CCS demonstration is to consider the countries and regions where these projects are located. According to the GCCSI database, a total of 24 countries had planned or operated CCS projects between 2010 and 2015, but only 12 countries still have projects considered 'on'.[3] Grouped into six regions, the bulk of active/planned ('on') projects are in North America (26, or 46% of the total) and of those 19 are in the USA. Excluding previously operating projects and those already at the 'execute' stage in 2010, Europe, Asia, and Australia/New Zealand have no new post-FID projects, meaning that *no country in these regions has managed to get a new large-scale, integrated CCS plant operational in the past five years, nor one past a final investment decision*.[4] Figure 13.2 summarizes project status ('progress', 'no progress', and 'off') by region.

[3] Countries without 'on' projects include Algeria, Australia, Brazil, Canada, China, South Korea, Netherlands, Norway, Saudi Arabia, United Arab Emirates, UK, and the USA. Countries with 'on' projects include Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Italy, Malaysia, New Zealand, Poland, Romania, and Spain.

[4] However, as the 2014 Global Status report discusses, a number of smaller or non-integrated pilot projects—mainly focused on capture and sponsored by the capture technology vendor—are active in these regions. Active projects are underway in the UK, Germany, France, Netherlands, Norway, Spain, Italy, Sweden, the USA, Canada, Japan, China, Korea, and Australia (Global CCS Institute 2014, pp. 59–60). This is discussed further in Sect. 3, 'Explaining Uneven Progress', below.

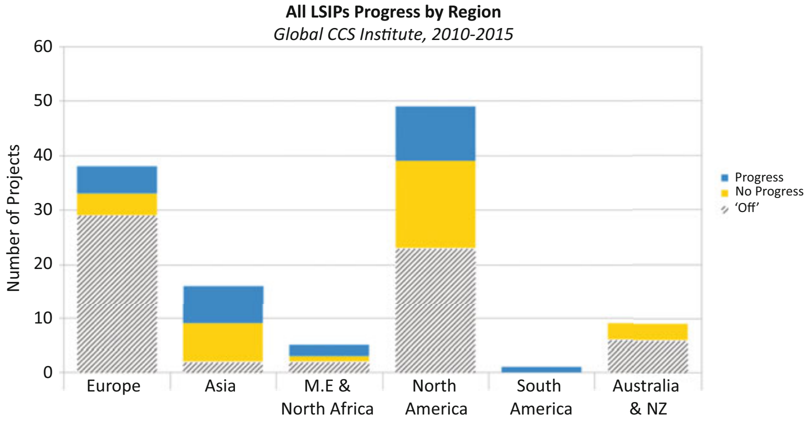

Fig. 13.2 All large-scale integrated projects, progress by region (*Source*: based on data from the GCCSI)

The only countries to get a new CCS project operational were Canada (Boundary Dam), Brazil (Petrobras' Lula Oil Field EOR project), Saudi Arabia (the Uthmaniyah CO_2-EOR Demonstration Project), and the USA (Air Products Steam Methane Reformer EOR Project in Texas, the Coffeyville Gasification Plant in Kansas, the Lost Cabin Gas Plant in Wyoming, and Century Plant, also in Texas). The Petrobras, Uthmaniyah, and Century Plant projects are deployed in natural gas processing, while the Air Products and Coffeyville projects are involved in hydrogen and fertilizer production, respectively. Boundary Dam is the only operating project, new or existing, in the power generation sector, and is using post-combustion capture technology on a pulverized coal-fired power station. All of these projects sell or use directly the captured CO_2 for EOR purposes.

At these rates of progress, what can we expect by 2020? Of all the 118 projects, 96 were added to the GCCSI list in either 2009 or 2010. This number includes the seven plants already then in operation. Another eight projects were added in each of 2011 and 2012, three more in 2013, two in 2014, and only one in 2015. Though many of the projects listed in 2009–2010 were in existence prior to the beginning of records, the decline in newly identified projects since 2011 suggests decreased interest in CCS over the past five years. Furthermore, of the seven projects that progressed to operation during this time period, only two were added to the GCCSI list post-2010, indicating that development timelines continue to exceed five years in most cases.

If the eight projects currently at the ‘execute’ stage manage to begin operations, and another eight of the pre-FID projects advance two or more stages (15 are currently at the ‘Define’ stage), the IEA’s target of 30 demonstration plants by 2020 remains just within reach. To date, more progress is being made in some regions rather than others—Europe in particular has so far not managed to get a single LSIP through a final investment decision, despite having 36 projects on the drawing board at one point or another between 2010 and 2015.

3 Explaining Limited Progress

While little progress has been made outside of the USA, Canada, Brazil, and Saudi Arabia in getting new large-scale, fully integrated CCS projects operational, a number of smaller, non-integrated pilot projects—primarily focused on capture and sponsored by the vendors of different capture technologies (with public support)—are underway elsewhere (see footnote 4 above for a list of countries). In some cases, these may eventually give rise to operational LSIPs. However, this should not detract from the clear lack of progress in getting new *demonstration plants* operational—the kind that most stakeholders agree are necessary to make CCS available as a commercially viable mitigation technology—outside of North America, and a handful in the Middle East and South America. What accounts for this difficulty in getting the CCS demonstration effort off the ground?

Existing literature suggests a number of factors, with the absence of a price on carbon sufficient to bridge the ‘financial gap’ generated by the construction and operation of these facilities being perhaps the most prominent. Other factors include: a lack of public and policy-maker awareness and understanding of the technology, and, in some cases, public and political opposition to CCS; a policy preference for alternative means of reducing carbon emissions (ie, renewables); policy uncertainty regarding emissions targets and carbon pricing; a lack of (public) financial support, especially in higher-cost industrial applications; the general complexity of the business case for most CCS projects; the lack of networked pipeline infrastructure for transport; insufficient or non-existent regulatory frameworks to address issues such as liability or ownership of stored emissions; and the lengthy timelines and lack of progress worldwide in characterizing sufficient storage locations (IEA 2013; GCCSI 2014; Markusson et al. 2011; Sawyer et al. 2008).

From this list, it is clear that while the immediate cause for the uneven progress of CCS demonstration may be economic in the sense of insufficient financial resources to bring projects to fruition, the proximate causes can be categorized as largely technical/economic *or* policy/regulatory in nature. Furthermore, we can also note a general distinction between factors affecting CCS development that are 'micro', in the sense they are associated with specific projects and/or sites, and those that are more 'macro', concerning broader institutional and structural trends and developments. Table 13.2 summarizes these explanations for uneven CCS progress.

Many of the factors listed in the policy/institutional quadrant in the bottom-right of Table 13.2 are actually intended to solve or remove barriers found in the other quadrants. Addressing these barriers is thus typically understood to be the responsibility of government, a view supported by recent literature on 'green' industrial policy (Mazzucato 2014; Rodrik 2004, 2014; Schwarzer 2013).

Given the emphasis on the role of government in overcoming policy and regulatory barriers to technological development, commercialization, and diffusion, it is perhaps not surprising that, beyond even the identification of proximate causes for the financial gap associated with CCS, most explanations of limited progress hinge on a lack of 'political will' to fix it (Sawyer et al. 2008; Scott et al. 2012; Williams 2006). But the role that *politics* plays

Table 13.2 Explaining uneven progress with CCS demonstration

	Project/site-specific factors	Structural/institutional context
Technical and economic factors	Project characteristics Capture technological maturity Characterization of storage locations Multiple partners, risk tolerance	Competitive pressures CO_2 utilization options (ie, EOR) Coordination problems Absence of business case Recession
Policy and regulatory issues	Permitting delays Public opposition Uncertain policy environment Absence of regulatory frameworks specifying liability/ownership	No carbon pricing Policy preference for alternatives Lack of awareness/understanding Availability of public funds Political opposition (eg, environmental non-governmental organizations) Strict regulatory frameworks (eg, no onshore storage)

(as distinct from policy and regulation) in facilitating or hindering CCS progress is not generally addressed by focusing on the economic potential of the technology. In the following section, we will explore some of the more political factors influencing CCS progress over the past decade from a political economy perspective.

4 The (International) Political Economy of CCS

Political economy, a field of study focused primarily on the interaction *between* states and markets, predates both economics and political science (Gamble et al. 1996). In the long history of the field, many different (and sometimes competing) perspectives have been advanced on this relationship—some tending more toward a focus on actors, others on structural factors (Pontusson 1995; Popkin 1979); some on institutions and yet others on the role 'ideas' play in determining outcomes (Campbell 1998; Thelen 1999). There is occasionally some tension associated with finding the proper balance between economic (ie, market) and political (ie, state) factors (R. Bates 2006; R. H. Bates 1988; Evans et al. 1985). In general, however, a political economy perspective can be distinguished from more policy-centric approaches, as it tends to focus more on more general institutional arrangements and 'paradigm' shifts (Esping-Andersen 1989; Hall 1993), as well as from more economically oriented perspectives, like that described in the previous section. Therefore, a political economic explanation for CCS progress would be, broadly speaking, situated somewhere toward the middle of the micro/macro, economic/policy characterizations noted above.

Recent literature on the political economy of CCS offers some insight into the complex interplay of political processes and the explanatory factors found in Table 13.2 above, and the effect this has had on CCS deployment in the past decade (Kern et al. 2015; Meadowcroft and Langhelle 2009; Torvanger and Meadowcroft 2011). In this context, it is important to note that while the financial gap may indeed play an important role in informing firm decision-making regarding investment in a project, the fact that CCS demonstration projects are expensive, technically and financially complex, have long lead times and often involve many partners means that they require substantial and sustained commitment from both government and industry actors to bring to fruition (Kern et al. 2015). Moreover, the decisions to design and implement the specific policies and support measures a government can implement to help overcome the barriers to CCS economic potential are themselves subject to political and economic considerations.

As a consequence, a political economy perspective rearranges the proximate explanatory factors noted above and adds some new, meso-level political considerations to the mix.

Although it was created to explain decisions regarding *specific* CCS demonstration projects, Fig. 13.3, adapted from Kern et al. (2015), presents just such an arrangement. It is important to note that the factors identified in this framework are not considered static, but are rather interacting with each other constantly to contribute to the outcome for any given CCS demonstration project.

Extrapolating outward from the focus on specific demonstration projects tends to bring to the fore factors in this framework that are more international and/or institutional in scope. In this respect, it is important to note that over the past decade international commitments to address climate change have remained comparatively weak. Moreover, the failure of the 2009 Copenhagen

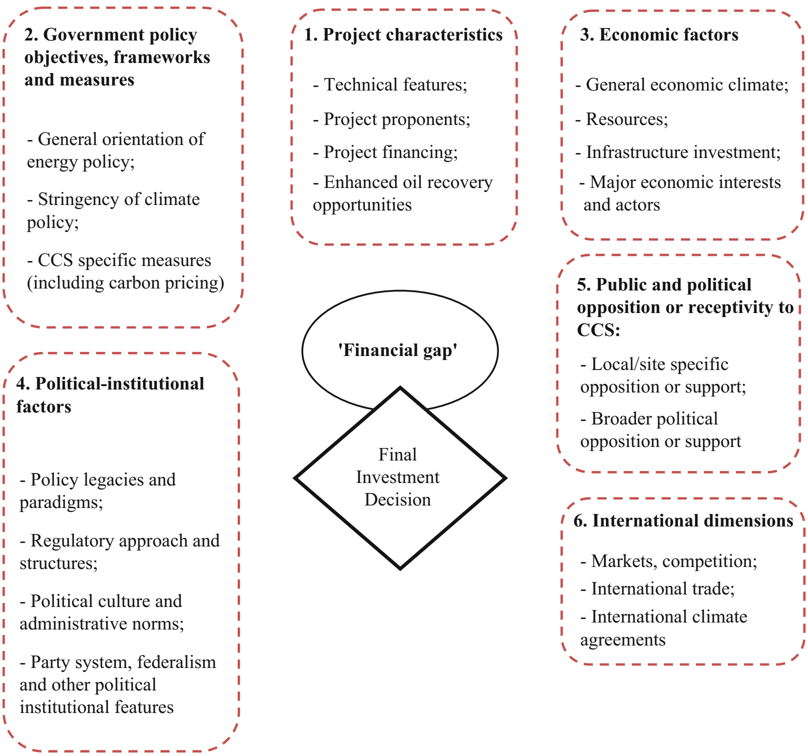

Fig. 13.3 Political economy factors influencing CCS demonstration projects (*Source*: adapted from Kern et al. 2015)

meeting to conclude a substantive follow-up agreement to the beleaguered Kyoto Protocol dashed short-term hopes for a more strenuous mitigation effort. And without a strong international commitment to GHG emission reduction, CCS was hardly likely to appear as a priority for governments or industry. So, at the most basic level, the failure of CCS to take off is a reflection of the lack of urgency major states accorded to climate change.

Clearly, governments were preoccupied by the 2008–2009 recession and the difficult economic situation which confronted many countries in subsequent years. This was the case for European Union (EU) states which experienced a prolonged period of slow growth and dislocation (OECD 2015). The explicit preference for 'austerity' as the policy response to the crisis made funding expensive CCS less appealing. And post Copenhagen, there was also a sense that the EU had already done its bit and that others should step up to show climate leadership.

In retrospect, the IEA's original goal of having 100 CCS demonstration facilities in place by 2020 was hopelessly ambitious, driven by technical considerations and largely divorced from the real politics playing out around international efforts to address climate change. This was true with respect to the overall level of effort the international community was ready to commit to climate change mitigation, but it applies also to the support which CCS was likely to achieve in comparison to alternative mitigation approaches such as the promotion of renewable energy. Although energy incumbents may have complained about renewable energy support policies, such as feed-in tariffs (FITs), in many countries, there has been substantial public support for developing renewable alternatives, especially wind and solar.

The fact is that the actors who might benefit the most from eventual CCS deployment face split incentives (Kern et al. 2015; Torvanger and Meadowcroft 2011). On the one hand, taking the initiative to develop and 'prove' CCS at scale would help to prepare the fossil energy sector for a carbon-constrained future. But, on the other hand, implementing CCS represents a serious short-term financial and administrative burden. CCS is a pollution control approach that adds nothing to the core functionality of the underlying energy technology (in fact, it degrades it by reducing overall efficiency and raising costs). Moreover, to the extent that CCS is proven to work, calls for its deployment will rise. So there is a powerful motivation for actors in the fossil sector to delay investment and/or to focus their attention on resisting the introduction of more stringent climate policy frameworks. Only when it is certain that carbon constraints are imminent, substantial, and growing (as transmitted through regulation or a robust carbon price) will this incentive structure tilt decisively. Contrast this with the situation of firms involved with carbon emission-free energy technologies (renewables, nuclear, etc.) who have motivation both to improve their technology to drive down their costs, and to support more stringent climate policy which will raise the costs of their fossil fuel competitors.

These factors seem especially clear in case of the coal industry which has for the most part displayed little enthusiasm for accelerating CCS demonstration and deployment. Power companies face a more complex situation: if they operate coal-fired assets, they might like to have CCS available in the future, but they are generally in no hurry to see it made mandatory for new plants. On the other hand, they may also be open to alternative generation technologies—such as gas with its lower carbon footprint, or new renewables which avoid the 'lumpy' investment profile of large CCS-equipped generation facilities. Oil industry players have been more actively involved with CCS. The separation, transport, injection, and reservoir management process are already familiar to the industry; incremental costs in gas processing and hydrogen production are lower than in the power sector; there are opportunities to exploit captured CO_2 for EOR, extending the commercial life of depleted fields; and the biggest firms (such as Shell, which is involved in a number of projects) are able to make strategic investments looking at anticipated business conditions decades in the future.

CCS was positioned early on as the technology that could reduce emissions in coal-fired generation plants (viz., 'clean coal'). And yet it is precisely in this sector that the demonstration record is weakest. At the moment, only 3 of the 22 operational or execute phase CCS projects are in the electricity sector, all three at coal power plants in North America. By the close of 2015, only the Boundary Dam facility had come on line. And this project presented a variety of favorable circumstances, having been developed by a provincially owned utility and providing a 'double fossil fuel dividend': preserving jobs at the local mine whose high sulfur coal would find no alternative market, and selling CO_2 to the Weyburn EOR operation (generating oil royalties for the province).

It is also interesting to note how the outlook for coal has somewhat darkened over the past few years. The market share of coal in the US power sector has fallen dramatically, with dozens of planned coal plants being canceled as the shale gas revolution (based on horizontal drilling and hydraulic fracturing) has driven down natural gas prices (Cusick 2015; Mathiesen 2015). There is now an open debate about when China will reach 'peak coal' as the industrial structure evolves and growth slows and the country struggles to deal with acute air quality issues (Gloystein 2015). Moreover, the recent rapid expansion of new renewables was not anticipated (at least by the IEA) a decade ago, and the dramatic fall in the price of wind and especially solar technologies is making them increasingly competitive in many markets (eg, compare International Energy Agency 2004 with International Energy Agency 2014).

All this has (at least for now) left CCS as something of an 'orphan' technology, lacking enthusiastic private or public sector proponents outside of a handful of states, fossil fuel-based industry associations, and international organizations. Indeed, the identification of CCS as the one technology able to 'clean up' the fossil fuel industry, coal power in particular, while on one level its strongest political asset, may now be working against it. Even with CCS, coal power remains a comparatively 'dirty' source of electricity, associated with the large-scale destruction of landscapes, leaking tailing ponds and contaminated drinking water supplies, and extreme air pollution particularly in the developing world (Nijhuis 2014; Pearce 2008). And in political terms, the forces that are most in favor of stringent climate policy tend to be those that are also most skeptical of the implications of supporting CCS.

As we have seen, opponents can characterize CCS as an end-of-pipe or 'bury and forget' technology, and one which will not lead to a decisive break with the carbon-intense energy systems which we need to leave behind. In addition to these concerns about 'carbon lock-in', opponents have also raised the issue of a 'political lock-in', where sinking large public investments into CCS creates a strong incentive for governments to continue open-ended subsidies of the fossil fuel industry. And this just at a time when the societal movement to 'divest' from the fossil energy sector is growing (Stephens 2014). In short, in many countries, it has become increasingly politically costly for politicians to be associated with CCS. Germany is a case in point where governments backed away from early support in the face of critical voices from the climate community and local opposition to transport and storage. In the Netherlands too, there has been substantial opposition, leaving many political leaders shy of supporting CCS. Elsewhere—for example, the UK—governments are in principle supportive, but have failed to come to grips with the scale of the required financial commitment and been unable to drive projects to realization. In the EU, the funding mechanism originally intended to support CCS projects (which was linked to revenues from its emissions trading system) was diluted by its opening to other technologies and diminished by the collapse of the ETS carbon price.

It is striking that most of the countries which so far have been at the forefront of CCS demonstration are major oil and gas producers, and especially oil and gas exporters. Of the $2.4 billion of direct public investments in CCS noted by the IEA, a large proportion of that has been in the USA and Canada—both major oil and gas producers. Of the seven projects that have recently become operational, five are in these two countries, with the other two located in Brazil and Saudi Arabia—also oil and gas hubs.

CCS progress thus appears furthest advanced in countries where there is a strong *commonality of interest* between the private and public sector in maintaining fossil fuel-based rents even in an increasingly carbon-constrained world. In other words, so far, CCS is not so much being pursued as a way to speed up the transition to a future low- or zero-carbon economy, but rather as a more-or-less implicit industrial policy by governments in countries with a well-entrenched, fossil fuel-based political–economic regime. That approximately 75% of post-FID CCS demonstration projects either sell or use the captured CO_2 directly for EOR purposes (so generating new emissions as that oil is consumed) only reinforces this conclusion. Of the six remaining projects designed for dedicated geological storage, two are in Norway and have been operating for some time; one is no longer sequestering (in Salah, Algeria), while Shell's Quest project (due to open in the fall of 2015) involves an Alberta hydrogen plant and is linked to efforts to retain US market access by reducing the carbon footprint of oil sands output to that of conventional crude (Kern et al. 2015).

5 Conclusion

CCS has made some progress over the past decade, and the IEA's radically downgraded 2020 target for demonstration facilities may just be achievable. However, most of that progress has been in regions where income from fossil fuel production means that the political feasibility of implementing CCS seems to outweigh the barriers to its economic potential. Taking a political–economic perspective on this suggests that the dynamic stems from the commonality of interest between private and public sectors in those oil- and gas-producing countries.

It would be a mistake to conclude that the modest pace of advance indicates that the technology is essentially unworkable or that high costs represent an insuperable obstacle to its ultimate deployment at scale. The fundamental reason for the lack of more significant progress remains the weakness of the international climate regime and of existing national policy frameworks. Should nations decide that climate change mitigation is necessary and urgent, it seems likely that more widespread interest in CCS will revive. And as fossil energy incumbents appreciate the implications of hard carbon caps, they will devote increased efforts in trying to make this option viable.

In the meantime, CCS proponents might get further by 're-branding' the technology, emphasizing its potential outside the context of coal-fired power generation—for example, its possible use with gas-fired power generation, in a variety of industrial processes or with biomass. Organizations such as the IEA or GCCSI could take the lead here. Private sector project proponents should also be prepared to bear more of the political costs associated with CCS, such as tolerating performance-based stipulations attached to public funds used to subsidize CCS development. Environmental organizations could do more to mediate public acceptance of this technology, while politicians and others try to engineer more adequate carbon pricing regimes.

In a volume published in 2009, Meadowcroft and Langhelle offered three radically different visions of the place CCS might occupy in a low-carbon emission future half a century from now. In one case, CCS had emerged as a core technology in a global energy system still heavily reliant on fossil energy resources. Here learning effects had dramatically reduced CCS costs while renewables had yet to live up to their promise. In the second case, CCS was a nationally or regionally significant technology in a mixed energy world where many countries had turned away from fossil energy systems. In the third future, CCS was largely a niche technology applied in industrial processes in a world dominated by renewables and other non-fossil energy sources. Yet even here, CCS might look toward a deployment horizon spanning a century or more were it to be linked to biomass or air capture in an attempt to partially roll back climate overshoot.

Based on our analysis above, it would seem that we may well be headed somewhere between the latter two scenarios. But it is still far too early to tell. Which option more closely resembles the future that actually materializes will depend on the trajectories of multiple rival technologies, and myriad economic and political choices and developments.

From a transitions perspective, however, CCS remains a hard case. It appears as a Janus-faced technological option which could both slow and accelerate the transition to a low-carbon emission world. Despite the relatively slow deployment over the past decade, it remains a technological option we are unlikely to eschew entirely.

6 Appendix A: Post-FID CCS Projects, Progress versus No Progress

Project			Country	Sector	Capture Tech
Previously operating		In Salah CO_2 Storage	DZ	Natural gas processing	Pre-combustion capture (natural gas processing)
		Petrobras Lula Oil Field CCS Project	BR	Natural gas processing	Pre-combustion capture (natural gas processing)
		Great Plains Synfuel Plant and Weyburn-Midale Project	CA	Synthetic natural gas	Pre-combustion capture (gasification)
		Sleipner CO_2 Storage Project	NO	Natural gas processing	Pre-combustion capture (natural gas processing)
		Snøhvit CO_2 Storage Project	NO	Natural gas processing	Pre-combustion capture (natural gas processing)
		Enid Fertilizer CO_2–EOR Project	USA	Fertilizer production	Industrial separation
		Shute Creek Gas Processing Facility	USA	Natural gas processing	Pre-combustion capture (natural gas processing)
		Val Verde Natural Gas Plants	USA	Natural gas processing	Pre-combustion capture (natural gas processing)
Progress	**Execute**	Quest CCS Project	CA	Hydrogen production	Industrial separation
		Abu Dhabi CCS Project	AE	Iron and steel production	Industrial separation
		Illinois Industrial Carbon Capture and Sequestration Project	USA	Chemical production	Industrial separation

(*Continued*)

Project			Country	Sector	Capture Tech
		Petra Nova Carbon Capture Project	USA	Power generation	Post-combustion capture
	Operate	Boundary Dam Integrated Carbon Capture and Sequestration Demonstration Project	CA	Power generation	Post-combustion capture
		Uthmaniyah CO_2–EOR Demonstration Project	SA	Natural gas processing	Pre-combustion capture (natural gas processing)
		Air Products Steam Methane Reformer EOR Project	USA	Hydrogen production	Industrial separation
		Century Plant	USA	Natural gas processing	Pre-combustion capture (natural gas processing)
		Coffeyville Gasification Plant	USA	Fertilizer production	Industrial separation
		Lost Cabin Gas Plant	USA	Natural Gas Processing	Pre-combustion capture (natural gas processing)
No Progress	**Execute**	Gorgon CO_2 Injection Project	AU	Natural gas processing	Pre-combustion capture (natural gas processing)
		Alberta Carbon Trunk Line (ACTL) with Agrium CO_2 Stream	CA	Fertilizer production	Industrial separation
		Alberta Carbon Trunk Line (ACTL) with North West Sturgeon Refinery CO_2 Stream	CA	Oil refining	Industrial separation
		Kemper County Energy Facility	USA	Power generation	Pre-combustion capture (gasification)

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14

Democracy and Transitions: European Experiences of Policy Inclusiveness and Changes in the Electricity Industry

Mari Ratinen and Peter D. Lund

1 Introduction

Sociotechnical transitions are wide-ranging, large-scale technical, social, and cultural changes to transform the current unsustainable practices and industries into more sustainable ones. In the electricity industry, sociotechnical transitions imply radical changes in technologies and actors.

Transition studies are a relatively new stream of research, which focuses on how to promote and govern transitions. Regardless of that, many theoretical and empirical advances have been made in understanding sociotechnical transitions (for a review, see Markard et al. 2012). However, as an emerging field of research, transition studies have received criticism. For example, though increasing democracy and citizen participation are among the goals of sustainable development, they are seldom discussed in the literature, as transition studies are more focused on technological changes (Stirling 2014). In addition, political structures and economic forces are seldom analysed. For example, policy inclusiveness is often perceived as being secondary (C. Hendriks 2008, 2009; Kern and Smith 2008; Smith and Kern 2009). Some commentators even argue that transition processes must be exclusive (Jhagroe and Loorbach 2015; Rotmans and Loorbach 2008; van de Kerkhof and Wieczorek 2005), and that they must be managed by the government (Kemp et al. 2001;

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Kemp 1994; Raven 2006; Rip and Kemp 1998; see eg Wiskerke 2003). The implicit or explicit perception of regulations and regulators in the transition literature appears to be rather normative, assuming that the regulators are objective and aiming at maximising the welfare of the entire society (Ogus 2004). Accordingly, the politics of transitions has not received the attention some critics claim it requires (see eg Kern 2015; Lawhon and Murphy 2012; Lovell 2007; Pesch 2015; Shove and Walker 2007; Smith et al. 2010; Walker and Shove 2007). Nevertheless, some advances have been made in integrating concepts such as inclusion and politics into transition theories (Avelino and Rotmans 2009; Grin et al. 2010; C. M. Hendriks and Grin 2007). However, more information is needed on how political structures and economic forces shape transition processes.

In this chapter, we focus on democracy and inclusiveness in particular. The focus is on policies, which are perceived as important tools for the development of radical innovations and creating regime changes in most transition theories (Markard et al. 2012). A regime consists of actors, knowledge, technologies, as well as various practices and procedures that hold them together (Geels 2002).

We analyse political inclusion, that is, inclusion in policy processes and outcomes, and transitions. Attention is paid to policies, which aim at introducing changes in technologies and in actors, that is, policies to increase generation of renewable electricity and to liberalise the industry. These kinds of policies are often interlinked but in order to analyse inclusion of actors in more detail, we perceive them separate. To gain new insights into how political structures and economic forces, that is, the government, the public, and large firms, influence transitions, the starting premise is thus that all actors, including regulators, are self-interested (Ogus 2004). The question that guides our research is how policy inclusiveness influences transitions.

We compare how governing traditions and the inclusion of the government, the public, and large firms influence the transition processes. In doing so, we wish to highlight the ambiguous and dynamic nature of terms such as liberalisation and sustainable development (Walker and Shove 2007). Pursuing these kinds of goals requires the ability to react and change to new demands set by increasing knowledge and information (Garud and Gehman 2012). Accordingly, we suggest that to achieve that kind of dynamism, different kinds of perceptions, actors, interests, and technologies must be included in the policy processes and outcomes.

We use the terms public, electorate, and consumers interchangeably as an opposite to utilities to juxtapose the changes in policy processes and outcomes. Case studies of Denmark, Germany, Finland, and Spain are presented. We start by examining the inclusion, followed by the presentation of a typology for analysing political inclusion and transitions. We continue by presenting the methodology, which is followed by the four case studies, discussion, and conclusions.[1]

2 Democracy, Inclusiveness, and Transitions

Inclusion is one of the main principles of democracy. Inclusiveness is the variation in the proportion of the population entitled to participate on a more or less equal plane in controlling and contesting the conduct of the government (Dahl 1971).

Inclusiveness is analysed through political inclusion, that is, inclusion in policy processes and outcomes. It is important to evaluate it because a legitimate political choice reflects public opinion, includes the public's preferences, and brings about changes (Scharpf 1999).

Public Opinion and Policies

The influence of public opinion on policies is a very complex and contested issue (for details, see eg Burstein 2003). Some authors argue that interest organisations and regimes may have the resources to override public opinion and to get what they want (Wilson 1990; Wright 1996), while others argue that the influence of public opinion on policies depends on the electoral system and political institutions (Hobolt and Klemmemsen 2005; Lijphart 1994; Page and Shapiro 1983; Persson and Tabellini 2005; Soroka and Wlezien 2010). It is assumed that elected officials cannot ignore public opinion because of the threat of electoral sanctions. In this chapter, we analyse the influence of the regime and the public because in the electricity industry, the ties between the government and the industry often enable the utilities to influence policies (Granovetter and McGuire 1998; Levi-Faur 2003; Stenzel and Frenzel 2008; Wedel 2009).

Political institutions differ in their transparency, in how the public can attribute the responsibility for the policies to particular policymakers.

[1] This chapter builds on Ratinen M, & Lund P. Policy inclusiveness and niche development: Examples from wind energy and photovoltaics in Denmark, Germany, Finland, and Spain. Energy Research & Social Science 2015;6(3):136–145.

The more directly the responsibility can be linked to particular policymakers, the more incentives they have to represent public opinion and vice versa (Bower et al. 2001). However, the influence of political institutions is not clear-cut (John et al. 2011). The political culture and governing traditions also influence the responsiveness of the policy.

Finally, another important factor is the salience of the issues (Wlezien 2005). Unless the public is interested in the issues, they are unlikely to care about the related policies either (Jones 1994; Lindaman and Haider-Markel 2002). Renewable electricity technologies have often been linked with environmental ideologies. However, the salience of environmental issues is seldom constant, but fluctuates (Downs 1972). For example, the anti-nuclear movement gave an impetus to the development of green parties and to the development of renewable electricity technologies in many European countries (Müller-Rommel and Poguntke 2002; O'Neill 1997). Since then, renewable electricity technologies have also become linked with liberalisation and increasing competition in the industry, for example, opening the supply of electricity to consumers. These technologies offer many economic advantages for private consumers, such as the ability to control and manage a private energy economy, for example, against rising electricity and grid costs, and making them less exposed to technical or market failures, such as blackouts and price hikes.

Inclusiveness and Transitions

The impacts of political inclusion on sociotechnical transitions have been less studied (Coppedge et al. 2008). However, there are studies about the economic impacts of democracy. Inclusion increases the flow of new ideas to the policy process (Fung and Wright 2003). No correlation has been found between democracies and higher-than-average rates of economic growth, but political stability does have a positive impact on economic growth. For example, democracies are also linked with higher per capita incomes and more evenly distributed incomes (Boix 2003; Helliwell 1994; Przeworski et al. 2000). Moreover, democracies are associated with a greater accumulation of human capital and creative innovations, and a higher level of economic freedom (Doucouliagos and Ulubaşoğlu 2008). All of these factors can be perceived as beneficial for transitions (Markard et al. 2012), and also in the energy industry (Garud and Karnøe 2003; Toke et al. 2008), in which many efforts have been made to speed up the transition processes but in which the changes remain relatively minor (European Commission 2007; Eurostat 2014). Therefore, the area clearly merits more research.

To evaluate the relative degree of inclusion in policy processes we analyse the governing traditions and the actors who are included in the processes (John et al. 2011). Inclusion in policy outcomes is evaluated through analysing the main recipients of policy support. Inclusion is evaluated through qualitative analyses and in relative terms. The scale of the relative degree of inclusion in processes and outcomes runs from low to high. On the basis of the relative degree of inclusion in policy processes and outcomes, four categories are formed, as depicted in Fig. 14.1 (adapted from Ratinen 2012:94).

As can be seen from the above figure, depending on the level of inclusion in policy processes and policy outcomes, four different types of transitions can result, which are deregulation for sameness, ostensible transition, distinctive transition, and re-regulation for transition. The terms deregulation and regulation are used to describe the general nature of the policies. The premise is that transitioning the industry, the actors it comprises, and the manner in which it operates requires regulations to bring about those changes. Deregulation refers to minimising governmental interference and leaving the markets to market forces. In this chapter, re-regulation refers to the creation of more regulations to open the market for new actors, in particular consumers (Vogel 1996). Each category is described briefly below.

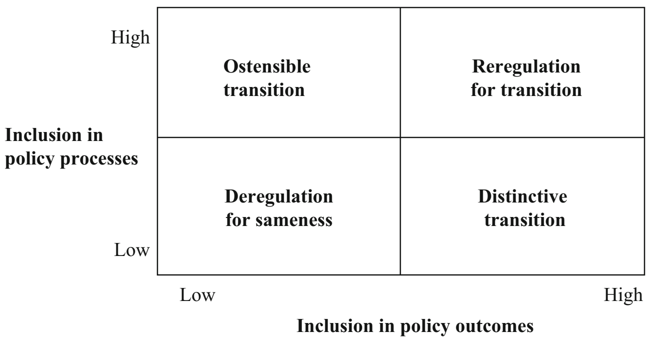

Fig. 14.1 Policy inclusiveness and sociotechnical transitions

Deregulation for Sameness

In this category, inclusion in policy processes and outcomes is relatively low. That is, few actors can participate in policy processes and equally few gain from the policies. The public is not among them. Policies are based on deregulation, hence the name. Accordingly, the electricity market remains rather unchanged.

Ostensible Transition

In ostensible transition, the inclusion in policy processes is relatively high. However, the inclusion in policy outcomes is low; the public is seldom included in the processes but their interests are represented by the government; hence, transition is ostensible. Policies have introduced some technological changes in the electricity industry while leaving them otherwise rather unchanged.

Distinctive Transition

Distinctive transition refers to a situation where, regardless of the inclusion in policy processes being relatively low, the inclusion in policy outcomes is high. Though the public is included in the policy processes and outcomes, the inclusiveness is lowered by the utilities' ability to override public opinion and to influence the policies. Changes in the policies can take place; for example, the consumers may be included in the policy outcomes, and transitions can be taking place. However, the changes are often slowed down by the utilities.

Re-regulation for Transition

In this category, inclusion in both policy processes and outcomes is high. The public is included in the policy processes and outcomes. In addition, the policies are based on re-regulation for transition, hence the name.

It should be noted here that this proposed typology is intended to be a representation of possible interpretations of the relative degrees of policy inclusiveness. Attention should also be paid to the temporal and contextual nature of this typology in its implementation.

3 Methodology

To analyse how policy inclusiveness influences transitions in the electricity industry, we chose to use qualitative analysis and a comparative case study method (Stake 2000). We study the influence of the inclusiveness of policies on transitions as unique and contextual, which justifies the choice of this research methodology (Yin 2014). Moreover, qualitative methods are also seldom used for analysing political inclusion (see eg Boix 2003; Coppedge et al. 2008; Przeworski et al. 2000). We perceive policy processes as socially constructed structures, which are created and maintained through social action (Berger and Luckmann 1991).

We chose Denmark, Germany, Finland, and Spain for this study because they are all EU member states. They are subject to the same EU policies and directives, which limit the number of variables. However, these countries have very different energy policies. In the Danish and German policies, consumer-owned and renewable electricity generation technologies are in a central position, while in Spain, consumer ownership is secondary. Finally, in Finland, utility-owned nuclear energy and biofuels form the core of energy policies. Hence, these countries offer a good sample for analysing and comparing transition processes.

The research material gathered covers the period from 1980 to 2014. A combination of primary and secondary research material was gathered from multiple sources. The primary sources consist of governmental reports, policy documents, and non-governmental reports. Statistical data was also collected. The main secondary source used was research reports.

We analysed inclusiveness in relative terms as our intention was to measure inclusiveness in relation to the countries analysed here. We used research reports to gain an understanding of the governing traditions and policy processes, of the actors included in them, and of the roles of the government, utilities, and the public. For empirical evaluation of inclusion in policy processes, we defined public political debates, elections, and negotiations in relative terms. Public political debates are processes in which debates in different arenas involve the public. In the category of elections, the public interest is represented by political parties. Finally, in negotiations the public has secondary roles, while unions and other interest organisations, leading politicians, and financiers have a primary role. Direct representation (elections) indicates that inclusion is high in the processes, followed by representative participation, which we divided further into elections and negotiations, in the latter of which the inclusiveness is the lowest.

We used policy documents, statistics, and research reports to evaluate the inclusiveness of policy outcomes. To evaluate the relative degree of inclusion in policy outcomes, we analysed the scope of liberalisation and the recipients of the policy support. According to our interpretation, policies that support consumer ownership are more inclusive than policies that support utility ownership. In the next section, the case studies on the differences in policy inclusiveness and changes in the electricity industries will be presented and analysed.

4 Policy Inclusiveness and Changes in the Electricity Industries

In this section, we analyse and compare policy inclusiveness and changes in the electricity industries in Denmark, Germany, Finland, and Spain. First, the change processes in each country are described, followed by a summary of the findings.

Denmark: The Public as an Initiator

Prior to the energy crises, the governmental energy policies in Denmark were focused on oil and nuclear energy. However, unlike in the other countries analysed here, no nuclear power plants were constructed. As a country formed of a peninsula and several hundreds of islands, in Denmark energy has been considered a local and regional affair (Lyhne Ibsen and Skovgaard Poulsen 2007).

During the 1970s, a national debate about future energy alternatives began. In the debate, the main alternatives were nuclear and wind energy. Contrary to other countries, the debate was not driven by the green parties and elections but based on political debates, which included the public, environmental activists, the wind energy association, and other NGOs (Garud and Karnøe 2003; Lipp 2007; Meyer 2007). Wind energy was not presented as an alternative energy source but as a complementary source of energy (Lipp 2007). Finally, after debate about the energy policy alternatives that lasted almost a decade, the decision not to develop nuclear energy but wind energy instead was made in 1985.

At the same time, the political resistance to wind energy and support for nuclear energy has been rather weak. The electricity industry is politically rather weak, consisting of local and regional utilities (Klaassen et al. 2005; Lyhne Ibsen and Skovgaard Poulsen 2007). Nor were there energy-intensive industries that would have supported nuclear energy. However, only in 2006 was the development of nuclear energy finally abandoned as an energy policy based on 100% renewables was published (Danish Ministry of Climate, Energy, and Building 2015).

The public had quite a significant role in the development of wind energy, however, less as an electorate and more as a wind energy actor, as many of the owners of the first windmills were private consumers. Not surprisingly, the support for consumer-owned windmills has been quite extensive and consumer ownership of large-scale offshore wind parks is supported.

Consequently, consumers are actors within the electricity industry. As more affordable technologies become commercially available, consumers' interest in investing in generating capacity is likely to increase. For example, even though the policy support for photovoltaics is marginal, the installed capacity in 2014 (597 MW) already exceeded the national target (6 MW) for 2020 (EPIA 2014).

Germany: The People as a Political Actor

In Germany, energy and economic policies have been somewhat interlinked. Nuclear reactors were constructed during the 1970s and 1980s to meet the electricity needs of energy-intensive industries. The anti-nuclear movement was organised around the German Green Party, which established a political programme for phasing out nuclear energy. In that programme, also known as the *Energiewende*, a wide range of technologies and renewable fuel sources were presented as alternatives to nuclear energy. The Green Party gained substantial electoral support for its programme early on (O'Neill 1997; Rüdig 2002). Consequently, the electricity markets were liberalised and feed-in tariffs introduced to support the deployment of consumer-owned generation.

However, the pace of the development of consumer-owned electricity generation, for example, wind energy and photovoltaics, was slowed down by the fluctuating popularity of the Green Party and the salience of renewable electricity. Moreover, the energy-intensive industries resisted changes; for example, they managed to slow down the introduction of feed-in tariffs and phasing out of nuclear energy (Rüdig 2002; Stenzel and Frenzel 2008). However, after the accident at Fukushima in 2011 the public opposition to nuclear power increased. The phaseout of nuclear energy was reintroduced and the support for consumer-owned electricity generation increased (Jacobsson and Lauber 2006; Lauber and Jacobsson in print).

Currently, consumer-owned generation, such as wind energy and photovoltaics, forms a substantial source of renewable electricity in Germany, in fact, to the extent that it has begun to influence the utilities' businesses

(Richter 2013). However, the recent reductions in feed-in tariffs have slowed down investments. Nevertheless, consumers have an important role in the electricity industry.

Finland: Exclusion of the Electorate

In Finland, the electricity industry was developed by the government and private firms, which also owned the utilities. The government remains in the electricity supply business through its shareholdings in utilities. As in Germany, also in Finland, energy and economic policies have been linked. The policy processes have been based on negotiations between the government and the energy-intensive industries. Finland is the only one of these countries where nuclear energy and bioenergy are the main methods for reducing greenhouse gas emissions. Nuclear and bioenergy have received strong support from the utilities, energy-intensive industries, and the government (Kojo and Litmanen 2009). The anti-nuclear movement and support for the development of renewable electricity have mainly been organised around the Green Party. However, when the opposition to nuclear energy was at its most salient, the Green Party was a heterogeneous movement and the party did not manage to gain notable political power (O'Neill 1997).

Though the current policy processes are formally open and anyone can comment on proposals and policies, the processes are, in practice, rather closed negotiations between unions, top politicians, and civil servants (Ruostetsaari 2010). The government has been relatively uninterested in introducing new actors to policy processes (Kojo and Litmanen 2009). The electorate has not been included in the policy processes, energy policy alternatives have not been contested in elections, and there have not been referenda. Consumers have not been included in the policy outcomes either. For example, investment subsidies are available for the development of new technologies, not for deployment. In addition, the feed-in tariffs are only for large-scale generation (European Union 2015; Finnish Ministry of Employment and the Economy 2013).

As a result of these kinds of policies, the traditional division into utilities and consumers in the electricity industry persists. Consumers can choose the supplier and the energy source of the electricity they buy. Nevertheless, consumers have demonstrated their interest in investing in renewable electricity generation technologies. For example, there are several privately owned wind parks (VTT 2014). In addition, the deployment of photovoltaics, which are more affordable for consumers, is increasing: The installed capacity (11 MW) already exceeds the national target (4 MW) for 2020 (EPIA 2014).

Spain: More Power to the People but Not by the People

As in Denmark, in Spain too the energy-intensive industries are marginal and services, such as tourism, are among the main industries. In Spain, there was substantial support for phasing out nuclear energy; however, the green movements were local, fragmented, and complicated by many cleavages and the movement never managed to gain significant national electoral support or political power (O'Neill 1997). The Spanish government considered wind energy a particularly interesting potential electricity source, and the Spanish utilities responded to that demand (Ratinen and Lund 2014; Stenzel and Frenzel 2008). Among the main drivers were the lack of domestic fuel sources and increasing demand for electricity rather than green parties and anti-nuclear movements.

Though democracy was quickly reinstated after the death of Franco, and liberalisation and privatisation have been extensive, the public has not been included in the policy processes or outcomes. The main actors in the development of renewable electricity have been governmental agencies and the Association of Renewable Energy Producers (Meyer 2007). Though the utilities have been privatised, municipal governments are involved in wind park consortia (del Río and Unruh 2007). Regardless of the fact that Spain has the greatest potential for photovoltaics of these countries, the utilities' attitudes towards photovoltaics have been more sceptical (del Río and Unruh 2007). In addition, the national target for photovoltaics by 2020 is only 8600 MW, which is about 1/6 of the German target.

Similarly as in Finland, in Spain too the consumers have the role of the buyers in the electricity industry. However, only in Spain has the state introduced measures that will most probably restrict the private ownership of photovoltaics. In 2013, a levy on private generation and tariffs for grid connection were introduced (EPIA 2013; European Union 2015) for consumer-owned photovoltaics. That will make owning photovoltaics economically unattractive and the added costs will most probably hinder consumer ownership.

Summary of Findings

Our interpretation of the level of inclusion in policy processes and outcomes in these countries is summarised in Table 14.1 (Danish Ministry of Climate, Energy, and Building 2015; Finnish Ministry of Employment and the Economy 2013; German Federal Ministry of Economic affairs and energy 2015; Spanish Ministry of Tourism, Industry, and Trade 2015).

As can be seen from Table 14.1, the policy processes that are relevant for electricity transitions in Denmark are combinations of public debates and negotiations, while in Germany, elections and negotiations are used. Finland and Spain rely mainly on negotiations. Looking at the outcomes, only in Denmark and Germany has policy support also been established for consumers, while in Finland and Spain, the support is limited to large-scale generation, hence to utilities.

Among the first efforts to transform the electricity industries were policies to privatise state-owned utilities and to liberalise, to open up the market for new actors. These countries differ from each other quite considerably in the way the national electricity industries have been privatised and markets liberalised, as presented in Table 14.2 (Danish Ministry of Climate, Energy, and Building 2015; Finnish Ministry of Employment and the Economy 2013; German Federal Ministry of Economic affairs and energy 2015; Spanish Ministry of Tourism, Industry, and Trade 2015).

As can be seen from Table 14.2, the Danish electricity industry is the most liberalised. It was the first country within the EU to introduce feed-in tariffs that support consumer ownership of electricity generation, and so far the only country to liberalise power distribution. Germany was also quick to introduce feed-in tariffs for consumers and to open up the market. In

Table 14.1 Inclusion in electricity policy processes and outcomes in Denmark, Germany, Finland, and Spain

Inclusion			Denmark	Germany	Finland	Spain
Policy processes	**Direct participation**	Public political debates	x			
	Representative participation	Elections		x		
		Negotiations	x	x	x	x
Policy outcomes	**Recipients of support**	Consumers	x	x	–	–
		Utilities	x	x	x	x

Table 14.2 Electricity privatisation and liberalisation in Denmark, Germany, Finland, and Spain

	Privatisation	Full opening of the markets	Feed-in tariffs introduced	Opening of distribution for competition
Denmark	Partially	2004/2007	1986	2003
Germany	Partially	1999	1990	Not opened
Finland	Partially	1997	2011	Not opened
Spain	Fully	2004	1994	Not opened

Table 14.3 Shares of renewable electricity in Denmark, Germany, Finland, and Spain

	Denmark	Germany	Finland	Spain
Shares of electricity from renewable sources in gross final consumption				
1997	9%	4%	25%	20%
2013	43%	26%	31%	29%
Increase in per cent points	34	22	6	16
National targets for renewable electricity	50% by 2020 100% by 2050	80% by 2050	–	–

Denmark and Germany, the introduction of feed-in tariffs coincided with the political movements to increase renewable and consumer-owned generation. In Spain, the tariffs were part of the efforts to liberalise the market. Contrary to these countries, in Finland, feed-in tariffs were introduced nearly two decades later in compliance with an EU Directive. In addition, in Finland and in Spain, the feed-in tariffs do not include consumers. However, only in Spain have the utilities been fully privatised. In the other countries, the government remains a shareholder in the utilities, although in Denmark, this is only in DONG Energy, which is also in charge of oil and natural gas exploration. In Germany, municipalities own shares in utilities, and in Finland the state-owned utilities were only partially privatised and the state also owns shares in other utilities.

Table 14.3 depicts the increase in the shares of and targets for renewable electricity generation (Eurostat 2015).

As can be seen from Table 14.3, Denmark and Germany had the lowest shares of electricity from renewable sources but the highest increases in those shares. Moreover, both countries have the most ambitious target. Looking at Finland and Spain, it can be maintained that their shares of renewable electricity were the highest, at 25% and 20% respectively. However, the increase in these countries has been rather moderate. Moreover, no national targets have been set other than the ones set by the EU (European Union 2015).

The increase of the share of renewable electricity does not directly reflect the fact that the electricity industry is undergoing transitions, though there have been changes in the electricity sources. The main difference between these countries is that because of the differences in policies, in Finland and Spain, the new generating capacity is owned by utilities, whereas in Denmark and Germany, consumers own large portions of the wind energy capacity and nearly all of the photovoltaics capacity. Hence, in Denmark and in Germany new actors have been introduced to the industry, while in Finland and Spain the changes are mainly technical.

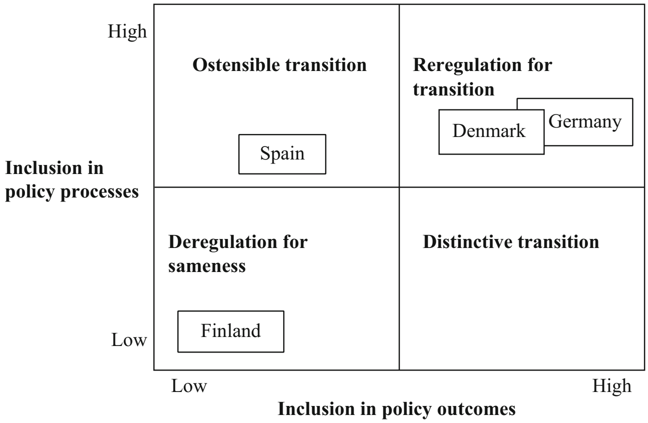

Fig. 14.2 Policy inclusiveness and transitions in Germany, Denmark, Spain, and Finland

On the basis of our analysis, we find differences in inclusion in policy processes and outcomes that seem to influence transitions in these countries, as summarised in Fig. 14.2.

We placed both Denmark and Germany in the *Re-regulation for transition* quadrant. The relative degree of inclusion has been high in both countries, and substantial changes in the electricity sector have taken place. Governing traditions are based on the inclusion of the public. However, the level of inclusion in policy processes has been somewhat higher in Germany, where the public has remained as a political actor, whereas in Denmark the public was the initiator but does not have a similar political role. There are also differences in inclusion in the outcomes. The Danish energy market has been more extensively liberalised. However, in Germany, the policy support is extended to a wider range of technologies. It seems that the primary policy target in Denmark is increasing renewable electricity generation and consumer ownership has been more of a continuance of the perception that energy policies are a local and regional issue, whereas in Germany increasing consumer ownership is a newer issue introduced by the *Energiewende*. Though the approaches to transitions are somewhat different, in both Denmark and Germany the regulations seem to be introducing transitions in their electricity sectors. However, in Germany the large utilities and energy-intensive industries seem to be able to slow down changes, at least periodically.

Finland falls into the *Deregulation for sameness* quadrant. The level of inclusion in both policy processes and outcomes is the lowest of the countries analysed here. Governing traditions are based on negotiations, and the public is rather excluded from policies. In addition, the government has a double role in the industry. It is a regulator and a shareholder in the largest utilities. Policy support for renewable electricity has been limited to large-scale generation and bioenergy and wind energy. Because of the limited policy support, the changes in renewable electricity generation are the smallest. Moreover, consumer ownership is not supported in the policies. Hence, the developments that have taken place in the electricity industry are promoting sameness rather than changes.

Spain is located in the *Ostensible transition* quadrant. At the outset changes seem to have taken place, but a closer look reveals that they are rather limited, and mainly technological in their nature. The energy policy processes and outcomes are somewhat more inclusive than in Finland, as the government can be perceived as representing a wider range of interests than it is in Finland. However, the local government is involved in the supply business. Moreover, the governing traditions are rather young, and energy policies have not been contested in elections in Spain either. Similarly, regardless of the extensive privatisation and liberalisation, the policy support not only excludes consumers but also discourages them to invest in photovoltaics, hence leaving the impression that the transition processes are rather ostensible.

5 Discussion

This section sets out to analyse how policy inclusiveness influences transitions. On the evidence of the findings presented here, inclusive policies seem to have a positive impact on transitions. Inclusiveness increases citizen participation and democracy, as alternatives are weighed as more or less equals and more actors and interests are included in the processes and outcomes. Inclusiveness also engages people to act both in the political arena and in the electricity sector, hence reducing the influence of the incumbent firms and their political and economic power over time (C. Hendriks 2008; Smith and Kern 2009).

It also seems that inclusiveness increases the scale of liberalisation and rate of technological changes towards transitions. Denmark and Germany, where policy inclusiveness was the highest, were also the countries where the biggest changes had taken place, while in Finland and Spain inclusiveness was the lowest and the changes were also the smallest. We can argue that inclusiveness increases dynamism and susceptibility to changes. Thus, a relatively high degree of inclusion could be used as a means to cultivate the ability to react to new information and knowledge towards transitions and sustainable development (Garud and Gehman 2012).

On the basis of the findings presented here, it seems that the governing traditions, the manner in which policies are made, influence the level of inclusiveness. The governments have an important role in deciding which actors are included in the processes and in introducing new actors to the processes (C. Hendriks 2008; Maggetti 2014). Governing traditions also influence the transparency of the processes (Bower et al. 2001). Poor transparency seems to favour the incumbent firms. If the transparency is poor, the firms can manipulate and obscure the goals of transitions, such as liberalisation and sustainable development (Walker and Shove 2007; Wedel 2009). As presented in the case studies, there was a wide range of interpretations of the desired transitions in the electricity industry.

6 Conclusions

It is often argued that transitions are slow because infrasystems are rigid (Frantzeskaki and Loorbach 2010), technological development is slow, and regimes are resistant to changes (Markard et al. 2012). However, we would like to suggest that the slowness of transitions is also influenced by two interlinked dimensions, the governing traditions and the ties between the government and the incumbent firms.

Governing traditions, which are based on a relatively low degree of inclusion, also appear to be linked with relatively close ties between the government and the incumbent firms. That seems to slow down transitions, whereas governing traditions, which are more inclusive seem to have looser ties between the incumbent firms and the government. In sum, it seems that complex transitions could be speeded up if the ties and shared economic interests between the incumbent firms and the government were unbundled (Wedel 2009).

Transforming an industry is sometimes represented as a pursuit that can be planned by a group of experts and achieved by following a few long-term policies. We propose the opposite, to set transitions in motion and to keep them going, new knowledge, interests, and actors must be continually included in the decision-making and realisation processes.

The implications of the findings to policymakers are twofold. First, tolerance to uncertainty must be cultivated. Policymaking is based on current knowledge and as new knowledge is obtained policymaking and policies must be modified accordingly. Second, diversity is required to create radical innovations and radical changes. A method to do that would be to increase democracy, to treat all parties and alternatives equally.

Finally, inclusion and democracy seem to be important dimensions of transition processes, and clearly merit more research, for example, how governing traditions influence transition processes. In addition, even though diverse actors are often formally included in policy processes, many of them lack the ability to influence policies and gain from them. In-depth research on political inclusion could shed more light on those kinds of inequalities, for example, what they are, and how they are produced and maintained.

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15

Second Life or Half-Life? The Contested Future of Nuclear Power and Its Potential Role in a Sustainable Energy Transition

M.V. Ramana

1 Introduction

Can nuclear power be part of a transition to a more sustainable energy future? This question has been debated for some time now without any consensus emerging. Most scholars agree that in comparison with fossil fuels, nuclear power generation results in a low level of carbon dioxide emissions even after taking into account emissions associated with different steps in the nuclear fuel chain. Given the great concern about climate change and the need to reduce carbon dioxide emissions, the low emission level is the main reason that nuclear power has entered the debate about sustainable energy. Some others add other sustainability indicators, and nuclear power is good on some of them; examples include ozone depletion and photochemical smog (Stamford and Azapagic 2011). The points of disagreement about the sustainability of nuclear power are often related to some well-known problems associated with the technology: the production of radioactive waste, the potential for catastrophic accidents, and the linkage with nuclear weapons. Those who argue for considering nuclear power a sustainable source of energy claim that these problems can be controlled, especially through the use of newer reactor designs, and in any case pale in comparison to the dangers posed by climate change (Adamantiades and Kessides 2009; Duffey 2005; Omoto 2005; Sailor et al. 2000). Opponents

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see these problems as not going away anytime soon and argue against thinking of nuclear power as a sustainable source of energy (Mez 2012; Smith 2006; Sovacool 2011).

This chapter takes a different tack and addresses this question by examining the future prospects of nuclear power around the world and the main challenges that confront an expansion of nuclear reactor construction. These suggest that although nuclear power is going to remain part of electricity generation in several countries, its future is highly contested. If this contest results in future nuclear growth being significantly limited, then it reduces the desirability of a nuclear solution to climate change, which requires a very rapid and drastic reduction in emissions, and this has relevance for the question of whether nuclear power can be a part of a sustainable energy future.

If anyone were to have been in doubt that reliance on nuclear energy is contested, those doubts would surely have vanished in 2011 after the multiple accidents at the Fukushima Daiichi nuclear power plant. The accident set off widespread protests, and opinion polls around the world showed declining support for the construction of new nuclear reactors (Ramana 2011). There was also, however, a significant effort mounted by the nuclear industry and various governments that support nuclear power to shore up support for the technology. As this chapter demonstrates, those efforts have had mixed success, leading to future prospects for nuclear power showing dramatically wide geographical variations. At the same time, a number of factors, including mounting costs and intense competition from other sources of electricity generation such as natural gas and renewable technologies, have propelled a decline in the share of nuclear energy in the world's power production.

This chapter begins with a brief overview of the present state of nuclear energy around the world as well as future projections by the International Atomic Energy Agency (IAEA) as well as by various national governments; these point to an energy technology struggling to maintain a significant market share. This is followed by a short examination of the economics of nuclear energy and other social challenges to nuclear power. The chapter continues with an overview of the different strategies used by the nuclear industry to promote reactor construction, before concluding with some thoughts on how nuclear power might or might not play a role in the transition to a sustainable energy future.

2 Overview of the Nuclear Industry and Future Projections

As of October 2015, the IAEA reported a total of 438 'operational reactors' in 31 countries and Taiwan (IAEA 2015c). As shown in Fig. 15.1, these reactors are mostly concentrated in a few countries, and nine of these countries have just one or two reactors. Together these had a combined generating capacity of nearly 380 gigawatts (GW) (a billion watts) of electricity. However, not all of these 'operational reactors' are necessarily operating. Apart from reactors that are shut down for routine maintenance or refueling, this count includes 43 in Japan, only one of which was operating and generating electricity in October 2015. Independent analysts estimate that as of July 2015, the current world fleet has a total nominal electric net capacity of only 337 GW (Schneider and Froggatt 2015, p. 29).

As of October 2015, the IAEA also listed 67 reactors with a total capacity of over 65 GW as being under construction. Again, this listing included some that are unlikely to ever be completed, such as two reactors in Japan with a combined capacity of 2.65 GW, and some that have been under construction for very long periods of time. Among reactors that have started operating in the last decade, since 2005, construction periods varied widely, from a mini-

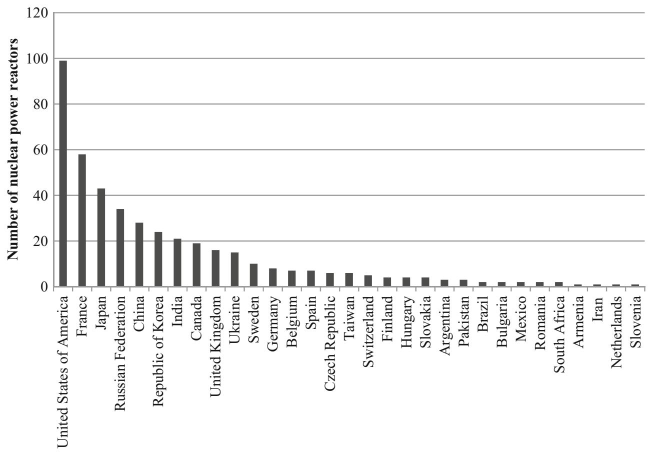

Fig. 15.1 Geographical distribution of operational reactors as of October 11, 2015 (*Source:* https://www.iaea.org/PRIS/WorldStatistics/OperationalReactorsByCountry.aspx)

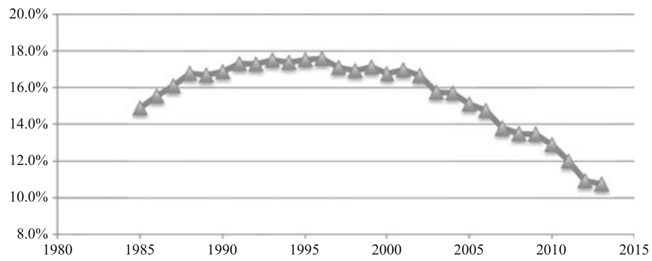

Fig. 15.2 Nuclear power's share in global electricity generation, 1985–2013

mum of 3.9 years (in Japan) to a maximum of 36.3 years (in Iran); the mean figure was 9.4 years (Schneider and Froggatt 2015, p. 34).[1]

In terms of electrical energy generated, nuclear power contributed 2410 terawatt hours (TWh, a billion kilowatt hours) in 2014 (IAEA 2015b, p. 19), down from 2629 TWh in 2010, the year before the Fukushima accidents (IAEA 2011b, p. 19). As shown in Fig. 15.2, nuclear power's share of global electricity generation is now only about 11% (BP 2015), nearly 39% below the historical maximum of 17.6% in 1996.

Future prospects, even according to nuclear establishments around the world, are no better; the latest of the IAEA's projections for nuclear power's share in 2030 range from 11.3% in its high estimate to 8.6% in its low estimate, with even lower projections for 2050 (IAEA 2015a, p. 21). This is much lower than foreseen by even the IAEA a decade ago, when it projected the share of nuclear power declining only to 15–17% by 2020 and 13–14% by 2030 (IAEA 2005, p. 41).

This decline in future projections is a function of both anticipated reactor shutdowns due to aging and a reduced rate of construction of new reactors. As shown in Fig. 15.3, over the last five years, the IAEA's projections (both high and low estimates) have steadily declined (IAEA 2010, 2011a, 2012, 2013, 2014, 2015a). The 2015 high estimate for 2050, for example, is 32% below the 2010 high estimate for 2050.

Projections for nuclear power in specific countries have also declined, even those in which governments have continued to support the continued con-

[1] The figure of 9.4 years is significantly higher than the number that is assumed in many studies of the economics of nuclear power. For example, the OECD's Nuclear Energy Agency routinely assumes seven years as the construction period for nuclear reactors (NEA 2010, p. 44, 2015, p. 43), whereas many members of national nuclear establishments planning to construct nuclear power plants assume five years or less; for example, Araj (2014). Countries seeking to build their first nuclear plants would like the construction period to be less than five years (IAEA 2009, p. 51).

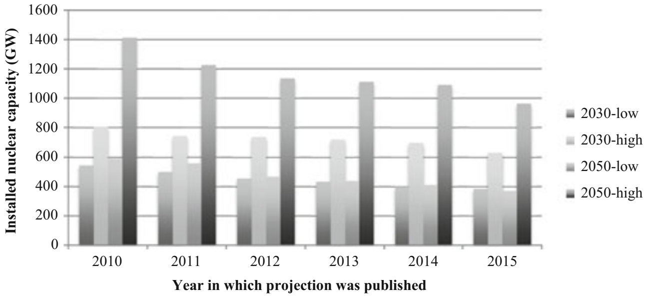

Fig. 15.3 IAEA projections for installed nuclear generation capacities in 2030 and 2050

struction of nuclear power plants in the wake of the Fukushima accidents. Of course, in other countries, such as Germany, that have decided to either reduce their reliance on nuclear power or phase out nuclear power altogether, future projections are naturally lower (or zero). Even in France, the country with the greatest share of electricity supplied by nuclear reactors (74.1% in 2010 [IAEA 2011b, p. 18]), plans are to reduce the nuclear share to 50% by 2025 (Marx 2015). Likewise, several countries, such as Venezuela, Israel, and Italy, decided after Fukushima to shelve their plans for building nuclear plants, and hence their contribution to future projections have vanished. With the exception of France and Germany, however, governments in countries with large numbers of reactors persisted in continuing to push for an expansion of nuclear power (Ramana 2013).

For the USA, the country with the highest number of nuclear power plants in operation, the US Energy Information Administration reference case estimate published in 2015 for installed nuclear capacity in 2035 is 102.1 GW (EIA 2015, p. A–20), down from the corresponding figure of 112.9 GW made in 2010 (EIA 2010, p. 68). The projected decline is despite the strong support shown by President Barack Obama and his administration for nuclear power, including public statements and through the allocation of $450 million to support the design and licensing of new reactor types (The White House 2012).

The country that, for over a decade, has been constructing the largest number of nuclear plants, China, had announced a target of 70 GW by 2020 (Patel 2010). Toward the end of 2009, the director of science and technology at the China National Nuclear Corporation—one of the major state-owned enterprises involved in constructing and operating nuclear power plants—announced that 'reaching 70 GW before 2020 will not be a big problem'

(Stanway 2009). But in the aftermath of Fukushima, China's State Council issued a freeze on the approval of any new nuclear power projects and it was only in March 2015 that it approved the construction of any new reactors (NIW 2015a). Partly because of this hiatus, China's current target for 2020 is only 58 GW and even this is unlikely to be met (Yu 2015).

India, another country with a long if unmet history of ambitious nuclear plans (Ramana 2012), has lowered its forecasts. In 2010, a target of 35 GW by 2020 was announced by the Secretary of the Department of Atomic Energy (PTI 2010). But by 2015, these figures had come down to 14.6 GW by 2020–2021, and even this is seen as a stiff challenge (Sasi 2015). Again, this reduction is occurring despite the strong support for nuclear power demonstrated by the government of India, which, despite intense protests, went ahead with commissioning nuclear reactors and with plans for constructing more, including expensive reactors imported from France and the USA (Kaur 2012; Ramana and Raju 2013).

As home to Fukushima, Japan's targets have naturally fallen. Prior to Fukushima, in 2010, the country's nuclear plants contributed 29.2% of the country's electricity (IAEA 2011b, p. 18). Japan's 2010 Strategic Energy Plan called for this to be substantially increased so that nuclear power would generate 50% of the country's electricity by 2030, which was to be achieved by building more than 14 new nuclear reactors by 2030 as well as increasing the capacity factors of nuclear power plants (Duffield and Woodall 2011). But in April 2015, the Ministry of Economy, Trade, and Industry proposed that the nuclear share by 2030 be set at 20–22% of the country's electricity generation (Watanabe 2015). Given that there are only two operating nuclear reactors in the country, this target is by no means easy to meet, but it is an indication of Prime Minister Shinzo Abe's government demonstrating its strong support for nuclear power in the face of widespread public opposition (Katsuta 2015; Kingston 2013).

Just one more example should illustrate the prevalence of the trend. In Russia, the country that is dominating the reactor export market, nuclear energy was to grow to more than 51 GW by 2020, according to an October 2006 plan (Pomper 2009, p. 9). This target has since been revised down to about 30 GW in 2020 (Schneider and Froggatt 2015, p. 167).

These reductions in projections are a result of multiple factors, some of which we describe here. Others that we do not examine in any detail here are the rapid reductions in costs of alternative energy sources, in particular renewable sources like wind turbines and solar photovoltaics and, in some specific countries, natural gas.

3 Economic and Social Challenges to Nuclear Power

That nuclear power is costly is not a new insight. As early as 1950, C.G. Suits, director of research at General Electric (GE), told the American Association for the Advancement of Science, 'At present, atomic power presents an exceptionally costly and inconvenient means of obtaining energy which can be extracted more economically from conventional fuels … The economics of atomic power are not attractive at present, nor are they likely to be for a long time in the future. This is expensive power, not cheap power as the public has been led to believe' (Suits 1965, p. 28). Such statements are less well known today, having been eclipsed by promises of 'too cheap to meter' offered by individuals and agencies promoting nuclear power, but the economic challenge involved in nuclear power was well known to those involved in building power plants. Indeed, US utilities were initially averse to the idea of building atomic power plants and had to be pressured by the federal government to invest in these (Clarke 1985). Although there was no experience in building nuclear power plants at that time, the next few decades bore out the veracity of the prognosis.

Construction Costs

The most important determinant of the economics of nuclear energy turned out to be the cost of constructing the power plant. There are other components that are large in absolute terms, such as the costs of decommissioning a reactor after it is shut down and the cost of constructing a repository for the radioactive waste produced by the reactor, but these do not contribute more than a few percent to the cost of generating each unit of electrical energy. This is for two reasons: these large costs are spread out over a large number of units of energy typically generated by a reactor, and these costs are mostly incurred decades into the future, possibly up to a century, which means that when they are included in the standard discounted cash flow analysis methodology adopted by project financiers, their 'present value' at the beginning of the plant construction would be relatively small.[2] There is, however, enormous uncertainty about these cost elements, especially waste disposal, because there

[2] There is a debate over whether the use of a positive non-zero discount rate is justified when dealing with multi-generational problems (Howarth and Norgaard 1993), but this debate has not affected energy policies so far.

are no operating geological repositories for radioactive waste from commercial nuclear reactors, in large part due to intense social opposition to their siting.

The wave of nuclear reactor construction that ensued also demonstrated another persistent feature: cost and time overruns, which did not become any better with more construction experience, a feature that has been termed 'negative learning' (CBO 2008; Grubler 2010; Komanoff 1981; OTA 1984; Ramana et al. 2005; Rangel and Lévêque 2013). Nuclear reactors routinely exceeded initial cost estimates, often by as much as 200–400%. One recent survey of cost overruns in a variety of electricity infrastructure projects found that 175 out of 180 nuclear construction experiences had resulted in increases, leading the authors to conclude that 'nuclear reactors are the riskiest technology in terms of mean cost escalation and frequency' (Sovacool et al. 2014, p. 907). These increases lead to another problem confronting anyone considering nuclear reactor construction: uncertainty, which could in turn translate into increased financing costs.

While these high costs have been known for some decades now, around the turn of this century, there was a lot of talk about a nuclear renaissance that envisioned a new wave of reactor construction.[3] Several agencies that promote nuclear power claimed that there were proven and new ways of reducing capital costs using means such as improved construction methods, design improvements, and economies of scale (IAEA 2002; NEA 2000). Shortly thereafter, there were many prominent reports, mostly in the USA, that came up with estimates of reactor construction (CERI 2004; Deutch et al. 2003; NEA 2005; UC 2004; WNA 2005). Among the most cautious of these when it came to predicting the economic prospects for nuclear power was the influential report produced by a team at the Massachusetts Institute of Technology (henceforth the MIT study). The MIT study stated clearly that unless supported by some subsidies or other means of additional financial remuneration, nuclear power was 'not now cost competitive with coal and natural gas' on the electricity marketplace (Deutch et al. 2003, p. ix).

After examining a wide variety of cost forecasts and a few construction experiences in Japan and South Korea, the MIT study assumed a cost figure of \$2000 per kilowatt (kW), or \$2 billion dollars for a 1000-megawatt (MW) reactor, with a five-year construction period as its base case.[4] For its more optimistic scenario ('plausible but unproven'), it assumed \$1500/kW and a

[3] The term nuclear renaissance was probably first used by Alvin Weinberg, the former head of the Oakridge National Laboratory in a 1985 article (Weinberg et al. 1985), but it was only after 2000 that the term began to be used frequently when talking about nuclear power.

[4] Note that this is the overnight construction cost that ignores the interest and other costs that have to be spent over the period during which the reactor is being built.

four-year construction schedule. In comparison, a study from the University of Chicago from the same period assumed a midrange cost figure of $1500/kW, and used a range between $1200 and $1800/kW, expressing the hope that this range 'represents a confidence interval for overnight capital costs associated with a higher degree of reliability' (UC 2004, pp. 3–20). All of these figures were specific to the USA. But because of the sheer size of the nuclear fleet in the USA and the country's unique historical role, the experience there is of great importance for the rest of the world as well.

That these estimates were too optimistic became evident with the first firm project plans for nuclear construction. In Europe, the two European Pressurized Reactor (EPR) flagship projects of the French Areva corporation were initially estimated at around $2250–2475/kW in the case of the Olkiluoto Unit 3 reactor in Finland in 2004 and around $2600/kW in the case of the Flamanville plant in France in 2006 (Thomas 2010). In the USA, cost estimates by electric utilities building reactors were higher. The initial estimates for the two AP1000 reactors currently being constructed at the Vogtle nuclear power plant in Georgia were $4745/kW, or $6412/kW when transmission and other charges are included, and a total cost of about $14 billion (Du and Parsons 2009, p. 15).

As in the past, these numbers were to go up once construction started. As of early 2015, Vogtle's total cost is estimated to be around $17 billion (Henry 2015), which would translate to a per kilowatt cost in the range of $7300. The last update for the Olkiluoto-3 reactor in Finland from 2012 estimated that total cost of that reactor to be €8.5 billion ($9.5 billion) (Rossi 2014), up from the initial estimate of €3 billion. For the Flamanville-3 reactor, the latest revision announced in September 2015 estimates are now at €10.5 billion ($11.7 billion) (NIW 2015c), up from €3.2 billion.

Other countries have also shown this trend. The construction cost Russia's Leningrad NPP-2 power plant went up from an estimated 133 billion rubles to 244 billion rubles (about 8 billion USD), which translates to over $4000/kW (Diakov 2013, p. 171). In the case of India's Koodankulam reactors that are imported from Russia, the cost estimate in 2010 was 131.71 billion Rupees (MoSPI 2010), but this has gone up to 224.62 billion Rupees ($3.5 billion) (MoSPI 2015). There are few reliable figures for the reactors being built in China, but one report suggests that even between 2006, when initial estimates were made for four AP1000 reactors being constructed in China and 2011, costs had increased from $1940 to $2600/kW (Li and Chaffee 2011).

Reactor construction times were likewise stretched to the point that initial estimates now seem completely absurd. Olkiluoto-3's construction time went from 4 years to 13 and Flamanville-3 from 5 to 11 (NIW 2015c; Rossi 2014). One of the Koodankulam reactors took 12 years to be commissioned, in comparison with the initial estimate of six years (IAEA 2016; MoSPI 2015). And so on. The bottom line is clear: the old problem of cost and time overruns for nuclear reactor construction continues to plague the industry.

What of the strategies suggested for reduction of construction costs? An important one that was touted by reactor vendors was the use of 'modular construction' wherein many components of the reactor are manufactured in factories and put together on the site; in particular, the leading USA nuclear vendor, Westinghouse, hailed this approach as a 'significant innovation' in the design of its AP1000 reactor (Matzie 2008, p. 1860).[5] The experience of the four AP1000 reactors being built in the USA as well as the four under construction in China all suggest that this strategy comes with its own problems and may not rescue nuclear power from the curse of high capital costs. As a former member of the Georgia Public Service Commission, the state utility authority overseeing the Vogtle nuclear power plant, told the *Wall Street Journal*, 'Modular construction has not worked out to be the solution that the utilities promised' (Smith 2015).

In the case of Areva's EPR, the company boasted of having invested '2 million hours of design and development' and of adopting 'simplifying system design' as a guiding principle (Twilley 2004, pp. 28–29). But, as explained in the 2010 Roussely report,[6] the EPR design has turned out to be highly complex and this is 'a handicap for its construction, and its cost. These elements can partly explain the difficulties encountered in Finland or Flamanville' (NEI 2010).

These are but two of the initiatives taken by nuclear reactor designers to lower construction costs and neither has worked out as envisioned when put into practice in the real world. Other proposed solutions to the problem of high construction costs, including standardization and generic design reviews, have also not delivered the promised cost savings (Schneider and Froggatt 2015). Any realistic appraisal for nuclear power in the future, therefore, should assume that construction costs will remain high and reactors will take long to commission.

The implications of the high construction costs are particularly severe for liberalized electricity markets, where nuclear power, like other forms of electricity generation, has to compete on cost in a marketplace. Because electricity prices are subject to fluctuation, investors tend to prefer less capital-intensive

[5] Westinghouse also touted the same approach for its pebble bed modular reactor in South Africa (Wallace et al. 2006).

[6] This report was authored by Francois Roussely, European vice president of Credit Suisse and honorary president of Électricité de France, and was commissioned in the aftermath of France losing a contract to supply nuclear reactors to the UAE.

technologies. To the extent that nuclear power plants are being built in such markets, it is almost entirely because of massive government subsidies. The case of the proposed Hinkley Point C nuclear reactor in the UK offers a good example; the government is offering the owner of the plant a guaranteed price that is substantially above the current average electricity tariff as well as £2 billion in financial support from the Treasury. Other forms of government intervention in support of nuclear power are loan guarantee offers, liability caps for plant operators (and payment of any costs that exceed this cap), nuclear reactor supplier indemnification, large budgets for research and development of nuclear reactors, and fuel cycle facilities, including repositories for radioactive waste management. Such subsidies are also extended by governments in countries that have not liberalized, or only partly liberalized, their electricity markets. Without such subsidies, nuclear power is essentially a non-starter.

Operating Costs

While the problem of construction costs is old, what seems to be new in nuclear power economics, at least as suggested by the cases of the USA and France, the countries with the largest nuclear fleets, is that the marginal costs associated with reactors have been rising. As a result, the standard assumption among utilities that nuclear reactors are expensive to build but cheap to operate has come under challenge.

Figure 15.4 shows the various annual expenditures associated with running a nuclear reactor in the USA, averaged for the whole fleet. These are for reactors whose construction costs have essentially been paid off; the capital expenditures include the costs of uprating the generation capacity, equipment

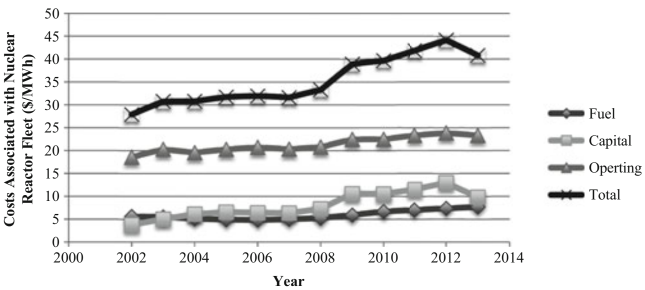

Fig. 15.4 Annual expenditures associated with running a nuclear reactor in the USA in dollars per megawatt hour (*Source:* data from Nuclear Energy Institute's annual presentation to Wall Street (NEI 2014a, 2015))

replacement, and regulatory expenditures (NEI 2014a, 2015). The total figures that are now in the vicinity of \$40–\$45 per megawatt hour (MWh) should be seen in the context of recent bids for new solar photovoltaic projects (i.e., including the cost of recouping initial construction expenditures) that are around \$50/MWh, and even lower than \$40/MWh in some parts of the country (Bolinger et al. 2015; Lacey 2015).

Within the nuclear fleet, the average costs for nuclear power plants with only one reactor are much higher than power plants with multiple reactors; in 2013, the average for single-unit sites was \$49.69/MWh as compared to \$34.50/MWh for multiple-unit sites (NEI 2015). As a result, in the past few years, several such single-unit power plants have been shut down; the 2014 closure of the Vermont Yankee power plant brought the number of operating reactors within the USA below 100 (Wald 2013). Utilities with such plants are seeking government subsidies to continue operating them.[7]

In France, the country with the highest share of nuclear power, the Cour des Comptes, the country's audit court, estimated that production costs for the Électricité de France's 58 reactors had risen from 49.6 to 59.8 €/MWh between 2010 and 2013 (Rose 2014). These increasing costs were at the root of Électricité de France's income deficit in 2012 of about €1.5 billion (Froggatt and Schneider 2015). The company has also been selling much less electricity to its competitors as compared to earlier years, leading analysts to conclude that 'nuclear energy is less competitive than it was in the past' (Bloomberg 2015a).

Sweden, another country with a high share of nuclear power, has also experienced increasing production costs, which was the main reason cited by Vattenfall, the Swedish state-owned utility, for its plans to close down two reactors at the Ringhals nuclear power plant earlier than previously planned (Enformable 2015). Another large utility, E.On., justified its decision to shut down two of the reactors at the Oskarshamn power plant by saying that 'there are no prospects of generating financial profitability either in the short or the long term' (WNN 2015c).

The effect of all these economic factors and the reasons for why this trend will likely continue for the next decade or more are well summarized by Steve Kidd, the former head of the World Nuclear Association, an industry lobbying organization: 'Closures for economic reasons are increasingly worrying. Electricity markets are changing rapidly and grids are getting integrated. The incursion of cheap shale gas and lots of renewable power is beginning

[7] In 2015, this was best exemplified by Exelon Corporation that sought to get the state of Illinois to offer it subsidies to continue operating its reactors (Daniels 2014, 2015).

to cause acute problems for today's operating nuclear units. Load-following, which is economically sub-optimal, will become essential for some reactors to continue. Even where production costs are maintained at low levels, revenues become unstable and reactors can start losing money. Incentives for zero-carbon and reliable operation are found to be insufficient' (Kidd 2015).

Public Attitudes

In addition to the economic challenges outlined above, another problem for nuclear expansion that has become more acute is popular opposition to the siting of nuclear reactors. This public resistance has made it difficult to site and build new reactors; in turn, this resistance has shaped siting choices made by electric utilities and governments.

The backdrop to protests and movements opposing nuclear facilities is public attitudes to nuclear power. In most countries, the public reaction to Fukushima was quite uniform: it led to a lowered preference for nuclear energy (Bird et al. 2014; Ertör-Akyazı et al. 2012; Huang et al. 2013; IPSOS 2011; Kim et al. 2013; Zhu 2014). Opposition to nuclear power, of course, predated Fukushima. Even in 2005, nearly 20 years after the last catastrophic nuclear accident at Chernobyl in April 1986, a survey of public opinion in 18 countries done for the IAEA found that about 60% of the public opposed building new nuclear power plants (GlobeScan 2005).

Efforts to change public attitudes toward nuclear power by stressing its potential role in reducing carbon emissions have not been very successful, leading at best to reluctant support (Bird et al. 2014; Pidgeon et al. 2008). Although people might be more favorable to nuclear power when it is framed as a climate mitigation strategy, 'most people are unlikely to spontaneously evaluate nuclear power in this way' and 'people who did not think that nuclear power can help to prevent climate change were also those who are most concerned about the environment and about climate change' (Spence et al. 2010, pp. 399–400). In the USA, there is a significant overlap between those who support nuclear power and those who are dismissive or doubtful about the reality of climate change; in contrast, support for an expansion of nuclear power is lowest for those alarmed or concerned about climate change (Leiserowitz et al. 2013).

Also contributing to lowered public acceptance of nuclear power is a decrease in the perceived benefits from that technology (Siegrist et al. 2014). This factor has become even more influential with the significant reduction in costs of renewable technologies and widespread excitement at the growth in the rates of installation of solar and wind energy. Polls in many countries observe widespread public support for increased reliance on renewables (Ertör-Akyazı et al. 2012; Greenberg 2009; Park and Ohm 2014).

To summarize, then, the expansion of nuclear power continues to encounter significant public resistance. Despite some high-profile exceptions, by and large, those who see themselves as environmentalists and are most concerned about global warming do not see nuclear power as a desirable or even necessary for mitigating climate change. With the rapid expansion of solar and wind energy and their declining costs, renewable energy and improved energy efficiency remain the climate mitigation strategy of choice for the majority of those wishing to deal with the problem.

4 Responses by the Nuclear Industry and Its Supporters

The nuclear industry and its supporters have, of course, been reacting to this state of affairs, and adopting a number of strategies aimed at obtaining continued support for nuclear reactor construction. These include developing new reactor designs that are advertised as capable of overcoming the multiple challenges confronting nuclear power; marketing these as well as older reactor designs in countries around the world, especially developing countries, many with little or no nuclear capacity; and using standard bureaucratic techniques such as engaging in propaganda and forming alliances to try to win over new customers and retain old clients.

New Reactor Designs: The Case of the Small Modular Reactor

The first reaction that we document is the industry's advocacy for what it terms 'advanced reactors', which are held out as an answer to one or more of the problems confronting nuclear power. Many 'advanced reactor' designs are held out as solving all of the problems. In the last decade, the overwhelming focus of this effort has been on what are called small modular reactors (SMRs).[8]

[8] The acronym SMR is also used to mean 'small and medium-sized reactor' by the IAEA. For the IAEA, a 'small' reactor is one having electrical output less than 300 MWe and a 'medium' reactor is one having a power output between 300 and 700 MWe.

The idea of small reactors is not new and a belief in the power of small nuclear reactors to energize different communities that were not currently served by atomic energy dates back to the 1950s and 1960s, but the early experiments were mostly failures (Ramana 2015). This has not stopped the nuclear industry from raising expectations about such reactor designs, in part because it practices a selective kind of remembrance, choosing to forget or underemphasize earlier failures (Sovacool and Ramana 2015).

The country that has invested most in SMRs is the USA, with the Department of Energy (DOE) funding research and development of such reactors since the 1990s. In 2012, the DOE established a cost-share funding opportunity aimed at commercializing SMR technology, with an initial funding level of $452 million over five years to cover costs associated with research and development, design certification, and licensing. The two SMR designs that were selected by the DOE for funding were mPower, developed by Babcock & Wilcox, and NuScale. Of these, only NuScale has continued with the development of its reactor design, but its plans for submitting its design for regulatory approval, a necessary step before any reactors are constructed, have been significantly delayed.

The Russian nuclear establishment has a number of SMR designs under development too, of which the KLT-40S, which is based on the design of reactors used in the small fleet of nuclear-powered icebreakers that Russia has operated for decades, will likely be the first one to be deployed. Construction of the Akademik Lomonosov, the first prototype ship that will use the KLT-40S reactor design, began in April 2007 but the project is already at least four years late.

South Korea has been developing the system-integrated modular advanced reactor (SMART) for nearly two decades. In July 2012, the South Korea's regulator approved the SMART design for construction. However, the reactor has not received any orders so far, except for an agreement with Saudi Arabia to 'conduct a three-year preliminary study to review the feasibility of constructing SMART in Saudi Arabia' (WNN 2015b). The absence of orders for the SMART does not bode well for SMR exports in general.

Even more indicative of the future of the SMR market is what happened to some SMR vendors in the USA. After the DOE had provided it $111 million in funding, Babcock & Wilcox decided to slash its spending on SMRs in April 2014 because it could not find other companies willing to invest in its product or customers willing to enter into a contract for its SMR (Downey 2015; Ruiter 2014; WNN 2014a). Another vendor that had applied for DOE funding was Westinghouse, which had long pushed the concept of SMRs. After unsuccessfully submitting its new design for DOE funding in both

2012 and 2013, Westinghouse 'reprioritised staff devoted to SMR development' (i.e., stopped working on the SMR) and decided to focus its efforts on the AP1000 reactor and 'gaining new decommissioning contracts' (Hashem 2014).[9] Explaining this decision, Danny Roderick, president and CEO of Westinghouse, announced: 'The problem I have with SMRs is not the technology, it's not the deployment—it's that there's no customers … The worst thing to do is get ahead of the market' (Litvak 2014).

The bottom line is that the expectations that SMRs will offer a way to expand nuclear power into various new markets are unlikely to be met. The nuclear industry's primary strategy of dealing with the poor economics of nuclear power has been through constructing larger reactors, in the hope that through economies of scale, nuclear generation costs would be reduced sufficiently to allow it to compete with other cheaper sources of electricity, such as coal. The fact that this hope has by and large not been realized makes it only more difficult for small reactors to succeed economically.

Search for New Markets

The other strategy that nuclear vendors have adopted is an active search for new markets. These are usually in developing countries with fast growing energy demands or countries that have long sought but never built a nuclear power plant (or both).

Among vendor countries, Russia has been extremely aggressive in recent years and has entered into various kinds of agreements with countries that have very few or no nuclear reactors currently. Barely a year after Fukushima, the head of Russia's nuclear supply company, Rosatom, announced that they had doubled foreign orders to build nuclear reactors last year and had a '\$50 billion order book' (de Carbonnel 2012). Two years later, in 2014, Rosatom announced another doubling, claiming to have \$98 billion 'for work in the next ten years' (WNN 2014b).[10] It is unlikely that all these 'orders' will actually

[9] Westinghouse is not alone in looking at decommissioning old reactors as a promising activity. As a conference brochure put it, 'decommissioning continues to dominate the US nuclear landscape' and various companies are gearing up for very large decommissioning projects, including dealing with the spent fuel that has accumulated in old reactors. See http://www.nuclearenergyinsider.com/nuclear-decommissioning-used-fuel/.

[10] Because of the proprietary nature, nuclear contracts are typically not available for public scrutiny and thus the monetary value of this claim cannot be verified. Nevertheless, the physical act of signing various agreements is usually accompanied with widespread publicity and this provides some indication of the potential number of countries that might become reactor customers. Among the countries that Russia has signed agreements (not necessarily formal purchase/sale contracts) are Jordan, Bangladesh, Turkey, India, Belarus, China, Finland, Hungary, Vietnam, and South Africa.

materialize into financial contracts and construction of reactors. Regardless of how many of them are successfully constructed, there is little doubt that Russia has far outstripped other reactor vendors on the nuclear marketplace in the last decade.

Two inducements that Russia has adopted to increase its export market share have been offers to take back the radioactive spent fuel produced in reactors it supplies and financial incentives. Russia is the only country in the world that has adopted a policy of taking back spent fuel, as long as the spent fuel 'is of Russian origin and irradiated in Soviet or Russian-built reactors' (Feiveson et al. 2011, p. 73). Russia's ability to import spent nuclear fuel dates back to a 2001 legislative bill, itself a part of a larger set of legislative measures that considerably weakened the country's environmental laws (Dawson and Darst 2005).

Russia has also offered cheap loans to help its client countries building nuclear reactors.[11] In Belarus, which signed a $10 billion contract to build two VVER-1200 units (Ria Novosti 2012), Russia is reportedly allocating a loan to finance the entire project (Belsat 2014). Likewise, in Vietnam, Russia agreed to loan up to $9 billion to construct the Ninh Thuan nuclear plant (Prakash 2011). In Turkey at the Akkuyu site, Russia has adopted an unprecedented build own operate model, wherein Rosatom will pay for the construction and own the plant (with four reactors), and will get revenues for supplying electricity. When construction started in 2015, the plant was estimated to cost $20–$22 billion (DS 2015). The novel ownership pattern and Turkey's relatively weak regulatory capacity has raised concerns about safety and liability in the event of an accident (Heffron and Hatinoğlu 2014).

Finally, Russia's success appears to be partly a result of forceful governmental action to secure contracts. As a trade journal put it while discussing ongoing negotiations with Egypt, which appears to be still undecided about whether or not to purchase a nuclear plant: 'Rosatom has managed to muscle out competitors in tentative new-build markets from Bangladesh to Algeria through the use of the government pen: in each case it has pushed through a series of bilateral agreements, with each one more detailed than the previous. It appears to be attempting the same tactic in Egypt: pushing for enough

[11] Though precise interest figures are not available in the public domain, an indication of why Russia's loans are attractive to potential customers can be seen from a comment offered to Bloomberg News about an agreement with South Africa by Viktor Polikarpov, Rosatom's regional vice president for sub-Saharan Africa; he said that Russia could offer a loan with a possible duration of 20 years and South Africa would only start repayment when the first plant starts operating, adding 'The interest rate the government is offering is not very high, it's really lucrative … [you] won't get this interest rate anywhere, at any bank' (Bloomberg 2015b).

intergovernmental deals that a commercial contract is ultimately inevitable' (Bakr et al. 2015, p. 5).

The other player is China, whose interest in becoming an exporter of nuclear reactors has been well documented (Chen 2014; Sina 2015). Apart from Pakistan, to which it has exported reactors in the past and continues to do so, Chinese nuclear companies have no experience in executing any nuclear construction projects outside China. But in recent years, these companies have entered into agreements with Argentina to 'participate in the construction of a new nuclear plant' (WNN 2015a),[12] and with South Africa to explore the 'possible utilisation of Chinese nuclear technology in South Africa' (RSA 2014). Like Russia, China has also offered loans and easy financing for potential reactor exports.

China's main challenge is the widespread perception that Chinese designed reactors are lacking in safety (Economist 2014; Lieggi and Pomper 2015; Patel and Haas 2014; Zhu and Stanway 2015). In part to address this concern, China has developed what it terms a third-generation design called the Hualong One design, which was certified by the National Nuclear Safety Administration in 2014 (Hore-Lacy 2014). The Hualong One reactor is the design now being promoted outside China as its most advanced reactor, and is the reactor design specified in the agreement with Argentina (WNN 2015a).

In parallel, China has also tried to use its financial clout to enter new markets, purely either as an investor or to build some of the non-nuclear components of the power plant. Although this effort does not directly lead to any contracts to construct a nuclear reactor, it could give Chinese companies experience in managing large nuclear projects outside of China. For example, in the UK, the China General Nuclear Power Group (CGNPC) is to invest in the Hinkley Point reactor, in return for being allowed to construct a Hualong One reactor down the line at the Bradwell site in Essex (Gracie 2015). In 2013, CGNPC signed a contract with a Romanian utility to invest in the construction of two reactors, which are expected to be of a Canadian design, at the Cernavoda site (NEI 2014b). Jordan, which has entered into an agreement with Rosatom to build two water-water energetic reactors with large 1000 MW reactors, is in talks with China to take over financing and construction of the non-nuclear parts of the power plant (Chaffee 2015b).

In the USA, Westinghouse still continues to be hopeful of selling the AP1000 design. Its Chief Executive Danny Roderick confidently told journalists in September 2014, 'The newbuilds just keep coming in. I'd just say that we

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[12] Nuclear market analysts have raised questions about whether Argentina, which is facing severe economic problems, will be able to pay for this reactor (Yurman 2015).

probably have more new customers knocking on our door every month now than what we were getting in a year a couple years ago' (Chaffee 2014). Such talk is most likely intended to maintain interest among investors. Even if there are customers knocking every month, no one seems to be signing on the dotted line; apart from two power plant contracts (4 AP1000 reactors) with China from the mid-2000s that are still under construction and two power plants (4 AP1000 reactors) under construction in the USA, Westinghouse has no firm contracts. But the company is certainly looking at reactor construction possibilities at specific sites in India, Vietnam, Bulgaria, and the UK, as well as more generally at countries like Saudi Arabia, Kazakhstan, Egypt, South Africa, and Brazil (NIW 2015b).

Plans in the vast majority of these countries face significant obstacles. Bulgaria, for example, is reportedly looking for Westinghouse to finance and commit to a significant stake in the Kozloduy-7 reactor, a clear parallel to Rosatom's financing model in Turkey, but this may be beyond Westinghouse's capabilities; in the words its chief executive, '[as] a technology company, I don't want to tie my capital up for 60 years' (Chaffee 2015a). Westinghouse considers India to 'be huge' as a market, but is unhappy with the fact that the country's laws that require the reactor supplier to take on a small amount of liability (less than $250 million at current exchange rates) in the event of an accident (Litvak 2015; Ramana and Raju 2013).

The other US supplier, GE, is also worried about the Indian liability law and has refused to consider constructing any reactors in India (PTI 2015). This is more noteworthy in the case of GE because it has no other firm projects anywhere in the world. Like its competitors, it has expressed an interest in various projects, including in Egypt and Saudi Arabia (NIW 2015b), but it is not considered a very likely winner.

Another reactor vendor that is facing trouble is the French Areva Corporation. Areva was the first to start construction of what is considered an advanced Generation III reactor, but with the possible exception of the UK, where Électricité de France (EDF) is still considering the construction of an EPR, it does not have any firm contracts. Thanks to its cost overruns as well as the discovery of a problem with the pressure vessel manufactured for the Flamanville-3 plant, there is a 'global collapse of confidence' in the EPR, leading some analysts to ask if the EPR 'is finished' (Green and Tickell 2015). Areva became 'technically bankrupt after a cumulated four-year loss of €8 billion and €5.8 billion current debt on an annual turnover of €8.3 billion' and its reactor division is to be taken over by EDF (Landauro 2015; Schneider and Froggatt 2015, p. 16).

Following the United Arab Emirates' (UAE) decision to purchase an APR-1400 from South Korea, the latter had been held out as a growing nuclear exporter (MacLachlan 2010). The UAE's choice was reportedly influenced by South Korea's flexibility in meeting the UAE's bid requirements (Ebinger et al. 2011), as well as attractive financing. But to secure this contract, South Korea's Korea Electric Power Corp, the state-owned energy group, reportedly 'bid at about 20 per cent beneath the industry average', in essence offering a loss-leader, and its ability to continue such low-cost reactors and finance them have been questioned (Chaffin 2011). Another problem for South Korea might be the evidence of widespread and systemic corruption in its nuclear industry that came to light in 2012 (Tanter 2013). South Korea has not won any other reactor export orders after the UAE one, although, as mentioned earlier, it has entered into a preliminary agreement with Saudi Arabia to do a feasibility study.

Propaganda Campaigns

The effort to sell nuclear reactors in established and new markets has been accompanied by propaganda campaigns, both by reactor vendors and governments interested in acquiring nuclear power plants, tailored to local circumstances.[13] Two of the most widely used—and contestable—claims in nuclear propaganda are that an expansion of nuclear power is critical for climate mitigation and that nuclear power is essential to meet present and future energy demands. The latter idea is sometimes framed using the term energy security, which is perhaps intended to evoke a feeling of insecurity in the reader.

Typically, the first argument is used more often in advanced industrialized countries where electricity demand growth is low, whereas the latter argument is more often used in developing countries that might already face electricity shortages. Of course, in many cases, both arguments are simultaneously presented as well.[14]

[13] A helpful definition is offered by the philosopher Randall Marlin: propaganda is 'the organized attempt through communication to affect belief or action or inculcate attitudes in a large audience in ways that circumvent or suppress an individual's adequately informed, rational, reflective judgment' (Marlin 2002, p. 22). Propaganda is, of course, only one element in the array of bureaucratic techniques that are employed by the nuclear industry and their supporters. Other commonly used methods are the formation of alliances with other powerful groups and lobbying with elected officials to win government subsidies.

[14] For example, Horizon Power, the company set up in the UK to sell the Advanced Boiling Water Reactors developed by Hitachi and General Electric, announces on its website, 'Nuclear power can play a vital role in meeting the challenge of maintaining affordable and secure energy supplies for the UK, while also tackling the global threat of climate change' (Horizon 2015).

In March 2015, for example, following the European Commission announcing agreement on a Strategic Framework for its energy future, Westinghouse's president for Europe, Middle East, and Africa announced that its nuclear reactors were 'the way forward to successfully achieve a low-carbon, competitive and energy secure system', adding that 'Westinghouse and the nuclear energy industry in general are continuously seeking to make a significant contribution to EU energy and climate objectives' (Westinghouse 2015). Or as the North American subsidiary of the French Areva corporation put it, 'Nuclear energy is critical to tackling the 21st century's greatest energy challenges by enhancing energy security and helping combat climate change' (Areva 2015).

The other element in the campaign to establish nuclear power as necessary for climate mitigation has been attacks on renewable energy. In the past, the main point of attack was that generation of solar and wind power was expensive. But as these sources have become cheaper, the nuclear industry has shifted focus to highlighting the intermittency of wind and solar energy, a problem that the traditional utility industry has also focused on (Sovacool 2009). For example, the US Nuclear Energy Institute, which represents the interests of the nuclear industry, dismisses wind and solar power as being at best complementary to other sources of electricity because of their intermittency (NEI n.d.). In India, a former head of the Atomic Energy Commission argued that while 'solar and wind power can be used for some applications like desalination of sea water or hydrogen production … expecting continuous power from these sources to the grid is a problem' (IANS 2014). This argument is specious, since there are many ways that energy planners have dealt with the intermittency of renewable sources of energy. And in any case, most of these countries are far from the levels of renewable energy penetration where intermittency becomes a significant, let alone insurmountable, constraint.

These attacks point to deep economic reasons for antagonism between nuclear power and renewables. In countries with privatized electricity sectors, nuclear power plants are, and, given their high costs, can only be, owned by large electric utilities that profit from monopolies over power supply.[15] Renewables, especially in their distributed avatar with homeowners generating a significant fraction of their consumption, pose a threat to their economic interests. This antagonism is most visible in the USA and Japan, and utilities have lobbied extensively against tax credits to renewable energy generators and net metering of distributed solar power (Daniels 2014; Warrick 2015).

[15] These utilities often also own coal plants and natural gas plants and are not very keen on implementing any reductions in emissions to mitigate climate change in the first place.

The second main plank in nuclear propaganda is the idea that there is no alternative to nuclear power in order to meet energy demands. The idea seems to be to replace the public's fear of reactor meltdowns with fear of blackouts.[16] Although this is much more resonant in developing countries, where blackouts are not uncommon to start with, this argument is even deployed in industrialized countries. In making a case for why the Hinkley Point C reactor should be built in the UK, the very first argument offered by EDF Energy, which is to be the majority partner in the project, was that it was necessary for 'keeping the UK's lights on' (Hinkley Point C media team 2015). In South Africa, a nuclear project management company put it thus: 'the Cape provinces need large scale reliable power, and the only option is nuclear' (Kemm et al. 2015, p. 8).

A particularly effective tactic has been the use of long-range projections, based on some constant rate of increase in demand, leading to eventual energy shortages. Thus, for example, at a workshop on SMRs hosted by the Jordan Atomic Energy Commission in June 2014, Jordanian Energy Minister Mohammad Hamed claimed that electricity demand will triple by the year 2030 in the Kingdom (Ghazal 2014).

Some combine the two arguments to make a case for nuclear power allowing for meeting future growth of energy demand while controlling emissions (Kessides 2014; Tanoto and Wijaya 2012; Xu 2014).

All of these arguments sometimes fall on fertile ground, where key institutions and political players are favorably inclined toward nuclear power to start with. Elites in many developing countries, for example, view the acquisition of nuclear reactors as a sign of becoming a modern nation, indicative of the country's place in the world.[17] Political leaders who often win elections on the basis of promising rapid economic growth see energy shortages as a major impediment and nuclear power as a way of delivering that energy.[18] Promising construction of a large nuclear capacity is also one way that large developing countries like China and India have tried to deal with international pressure, particularly from the USA and the European Union, to reduce their emission levels. And finally in some cases, elites and influential institutions realize that

[16] See, for example, Japanese philosopher Takashi Hirose's description of TEPCO's strategy in the first year following the Fukushima disaster (Hirose 2011).

[17] When construction started at Turkey's Akkuyu site, the Energy Minister Taner Yıldız proclaimed, 'Development cannot take place in a country without nuclear energy' (DS 2015).

[18] When Bangladesh signed a deal with Russia to import two 1-GW reactors, its Science and Technology Minister Yeafesh Osman reportedly said, 'We have signed the deal … to ease the power crisis that hampers our economic activities' (BBC 2011). In India, Prime Minister Narendra Modi 'saw an essential role for nuclear energy in India's energy strategy, given the scale of demand in India' (PIB 2014).

the acquisition of nuclear power plants offers a possible route to developing nuclear weapons, and this could be the source of political power.

In light of the experience of high costs and time overruns recounted in the earlier part of the chapter, the goals set by these leaders and elites are very likely unreachable. Yet, making such promises carries political benefits, including vast quantities of funding that can then be used to attract several institutional supporters, but without any accountability. Further, many of the problems associated with nuclear energy—the incalculable risk of catastrophic accidents, the production of long-lived radioactive wastes, or even simply the high economic costs—are typically costs that someone else within society, rather than elite decision makers, will bear. Given the long periods of time before such problems become apparent, there is little to lose for these leaders, and much to gain.

5 Conclusion

Prospects for a vast expansion of nuclear energy have dimmed in recent years, and the talk of a nuclear renaissance that was widespread for some years at the beginning of this century has faded in the aftermath of Fukushima. Many of the problems it has confronted for a long time, in particular high economic costs and public opposition, have intensified. At the same time, the nuclear industry and its supporters have engaged in a wide variety of tactics to promote nuclear reactor construction. Further, despite all these known problems with nuclear power, there are many countries whose political elites remain wedded to supporting further nuclear reactor construction for multiple reasons. The result of all these drivers is that the future of nuclear power remains contested, with uneven patterns of growth, stagnation, and decline—or deliberate phase out—of nuclear power capacity across the world.

Broadly speaking, it is only among developing countries that nuclear reactors are being constructed at a relatively rapid rate. Such countries are typically investing in multiple kinds of energy sources. For their ruling elites, it is not a choice between nuclear energy and fossil fuel based energy; they choose both nuclear energy *and* fossil fuel based energy (and renewables, for that matter). In contrast, in the industrialized economies of Western Europe and the USA and other Organisation for Economic Co-operation and Development (OECD) countries, energy demand is relatively stagnant or declining and prospects for nuclear energy are bleak. To the extent that nuclear power grows in these countries, it will likely be at the expense of renewable energy. In both kinds of countries, however, local communities contest the expansion of nuclear power, fiercely in some cases, and this factor, in addition to the high economic costs associated with nuclear reactors, acts as a brake on accelerated nuclear construction.

The differing prospects for nuclear power represents a geographical shift, and rapid construction of reactors has moved from countries that have traditionally built many reactors to countries that currently have few or no reactors. Likewise, within the nuclear vendor market, there is a shift from dominance by traditionally leading companies from the USA and France to suppliers from Russia, South Korea, and, potentially, in the future, China.

Finally, we return to the question of what role nuclear power could play in the transition to a sustainable energy future. The relatively small and declining fraction of global electricity production constituted by nuclear power and its contested future suggest that nuclear technology will not be a major source of emission reductions. Viewed in combination with the well-known problems associated with the technology, and the current antagonism to renewables expressed by nuclear advocates, there is good reason to think that nuclear power does not fit well into a world based on sustainable energy.

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16

Decarbonizing Transport: What Role for Biofuels?

John A. Alic

The USA, Brazil, and the European Union (EU) account for most production and consumption of biofuels, almost all of this still consisting of first-generation bioethanol and biodiesel (Table 16.1). These fuels, which can be made from various feedstocks, cost more than petroleum, with the exception of ethanol produced in Brazil from sugarcane, and output would be near-negligible without government subsidies. These have been available in a number of countries since the oil crises of the 1970s, and production has increased, with ups and downs, since that time.

"Advanced" biofuels made from cellulosic biomass—agricultural residues ordinarily left in the field or inedible bioenergy crops such as switchgrass—or possibly from algae or bacteria might avoid or at least reduce competition with supplies of food needed to feed a swelling world population, but whether their promise will be fulfilled remains uncertain. Development of cellulosic biofuels has been disappointingly slow, and costs appear to be higher than anticipated. "Third-generation" fuels made from sources such as algae remain subjects of fundamental research, their future prospects unknowable.

Over the years, rationales for government support have shifted, with policymakers deemphasizing "energy security" and stressing the potential of biofuels for reducing emissions of carbon dioxide (CO_2) and other greenhouse gases (GHGs) that drive climate change, emissions that

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Table 16.1 Biofuels production, 2014 (billions of US gallons)[a]

	Ethanol	Biodiesel	Total[b]
USA	14.4	1.24	15.0
Brazil	7.0	0.9	7.9
EU-28	1.4	3.1	4.8
World	*24.7*	*7.9*	*33.8*

Source: Renewables 2015 Global Status Report (2015) (Paris: Renewable Energy Policy Network), p. 129; based primarily on data from F.O. Licht

[a]Figures for production differ from those for consumption because of cross-border trade, which varies depending in part on prices in various parts of the world

[b]Includes renewable diesel (also known as green diesel) and biojet

stem mostly from combustion of fossil fuels—coal, oil, and natural gas. How big a difference biofuels might make in reducing GHG emissions over the next few decades remains uncertain. This question—the prospective contribution of biofuels to mitigation of climate change—is central to the discussion following.

1 Biofuels and Climate Change

Climate science is extraordinarily complex. Even so, three statements can be made with confidence. First, there is no sign of moderation in the climate dynamics driven by the release of GHGs into Earth's atmosphere (Blunden and Arnd 2015). Second, there are only two routes to mitigation, large GHG reductions or climate modification through geoengineering. GHG reductions have been preferred because no one has any real grasp of the risks, potentially very large, posed by geoengineering (National Research Council 2015). Third, in part because low-probability but potentially calamitous climate events cannot be ruled out, (Weitzman 2009) and also because the "ordinary" dynamics of climate change seem if anything to be accelerating, very large reductions in GHG emissions will be needed within the next two to three decades to begin slowing atmospheric warming and its consequences, such as sea level rise.

Climate change poses extraordinarily difficult issues for governance, and transport the knottiest set of technical issues (Box 16.1). The nature of these problems has been recognized for many years, and biofuels have often been viewed as part of the solution. Thus in the 1990s, an EU white paper found that "Specific measures are needed to help increase the market share of *liquid biofuels* from the current 0.3% to a significantly higher percentage" (European Commission 1997, p. 16). A few years later, EU authorities declared that "Greater use of biofuels for transport forms a part of the

Box 16.1 Degrees of malignity

Climate change has been called a wicked, or malign, problem (Levin et al. 2012). The appellation sets GHG reduction apart from control of ozone-depleting chlorofluorocarbons (CFCs) under the Montreal Protocol, an agreement that served as something of a model for the Kyoto Protocol. One indication of the disappointing outcomes of the Kyoto treaty: the Montreal Protocol, negotiated in the 1980s and silent on climate change, nonetheless has resulted in greater GHG reductions (Velders et al. 2007).

Differences begin with the narrow scope of the CFC problem. Scientific evidence widely accepted as conclusive linked a small number of chemicals used chiefly as refrigerants and aerosol propellants to readily apparent dangers such as heightened risks of skin cancer. A handful of firms produced CFCs, and at least one had substitutes in development. By contrast, GHGs implicate the entire world economy, or nearly all of it: hundreds of thousands, perhaps millions of firms, and an uncountable number of technologies. The far more complicated science of global warming, moreover, creates many opportunities for opponents to sow confusion and misunderstanding. At the same time, personal risks seem, to many, ill-defined and distant, certainly compared to malignant melanomas linked with ozone depletion, feared alike by politicians, corporate executives, and ordinary citizens.

The briefest look at the major sources of energy-related GHGs—electric power generation; buildings (residential and commercial, with their electrical and other energy loads); industry, goods production especially; and transport—will find the last of these heading almost any sort of malignity ranking. Technical solutions can be envisioned for the others. Nuclear power releases only incidental GHGs; Brazil gets three-quarters of its electricity from hydropower, and Norway even more; solar and wind energy continue to expand. Green design principles, well known and steadily improving, can cut building energy consumption to quite low levels. Much the same is true for many energy-intensive industrial processes, such as papermaking and cement production. Even if transition pathways seem to stretch interminably into the future, they can be marked out. Not so for transport. Oil still provides over 95% of transportation energy, and even as other uses for oil decline, markets for transport fuels (and for petrochemicals) continue to expand. Alternatives such as electrification pose stubborn technical and transition problems, and the probability of some sort of "game changing" technical fix, the transportation equivalent of, say, solar photovoltaic cells, seems essentially nil.

Table 16.2 Biofuels as percentage of all transportation fuels, 2014[a]

Brazil	22–23%
USA	8.3%
EU-28	4.5–5%
World	*3.5+%*

Sources: Brazil—production estimate based on *Petrobras 2030 Strategic Plan* (2015) (Rio de Janeiro: Petróleo Brasileiro S.A., February), 26, and *Brazil: Biofuels Annual*, GAIN Report No. BR14004 (2014) (Washington, DC: Department of Agriculture, USDA Foreign Agricultural Service, July 25), 7 and 15; USA—consumption, from *July 2015 Monthly Energy Review*, DOE/EIA-0035(2015/07) (2015) (Washington, DC: Energy Information Administration, July 28), 63, 151–52; EU-28—consumption estimate based 2012 figures in *EU Energy in Figures* (2014) (Luxembourg: European Commission), 112; World—production/consumption estimate based on 2013 figures in *Renewables 2015 Global Status Report* (2015) (Paris: REN21 Secretariat), 35

[a]Estimated share of bioethanol and biodiesel production/consumption

package of measures needed to comply with the Kyoto Protocol" (EU 2003, p. 42). Binding targets followed for all member states and consumption, supplied in part by imports, rose. Even so, biofuels account for no more than around 5% of EU consumption (Table 16.2). And while community-wide emissions from other major GHG sources have declined since 1990, those from transportation have risen by more than 15% (European Commission 2014, p. 33).

Transport accounts for nearly one-quarter of energy-related GHG emissions worldwide (Edenhofer et al. 2014). Serious efforts at mitigation of climate change require substantial reduction in GHG release from this sector. Yet it is not clear how this might be accomplished. As the EU example indicates, even when governments make strong commitments to decarbonization, the sector proves resistant. There is no obvious way to reduce CO_2 and other GHG emissions from transport except through partial and piecemeal shifts in modes (e.g., heavier reliance on high passenger-volume transit systems in urban areas), platforms (new generations of higher-efficiency aircraft that burn less fuel, hence emit less CO_2 per passenger mile), and diversification of the technologies embodied in road vehicle fleets (such as battery-electric power trains). This sort of transition pattern resembles that in other major GHG-emitting sectors, such as electric power generation. The difference is that *none* of the prospective transport technologies, with the possible and still uncertain exception of biofuels, holds out the promise of near-total decarbonization, as associated with solar or wind power. The central questions in this essay, then, can be narrowed to a focus on GHG emissions from transportation, and especially road vehicles. This was not, however, the original thrust of government policies.

2 Policy Rationales

As of 2015, more than 60 countries had adopted policies of one sort or another to encourage biofuels production and consumption (REN21 2015; Clark 2015). They divide into three main categories. Financial incentives such as tax preferences, which take many forms, aim to erase the cost/price disadvantages of biofuels noted in Box 16.2, as do price guarantees. Indirect subsidies such as consumption mandates—in place in around 30 countries in 2015—require suppliers to blend biofuels with gasoline or diesel fuel in some generally small percentage. The effect is to create a guaranteed market fenced off from competition with petroleum and therefore insensitive to price, an indirect subsidy. Many governments also fund research and development (R&D); topics range from yield-enhancing cultivation practices for first-generation bioenergy crops to long-term, fundamental research.

Broadly speaking, the search for energy security in the wake of the 1973–74 Arab embargo and the 1979 Iranian Revolution drove the original push for biofuels. Facing gasoline shortages and seeking to stretch supplies, governments in a number of countries added bioethanol and biodiesel to lists of energy interests gifted with policy favors.

Oil markets have become far more resilient since the 1970s (Kilian 2008). Even so, energy security remains a popular political trope. National economies differ greatly in their dependence on imported oil and vulnerability to price fluctuations. Even so, the essential point is simple enough: global biofuels production, now about 2.2 million barrels per day, is insufficient to offset even a supply interruption comparable to that during the 1991 Gulf War, when Iraq's production fell from about 3 million to 0.3 million barrels per day. And this, like other production declines before and since, did not result in a price shock remotely comparable to those experienced in the 1970s

Box 16.2 First-generation bioethanol and biodiesel

Many types of biomass can be processed into liquid (or gaseous) fuels of many types. Processes for making bioethanol from corn (maize) or sugarcane resemble those for alcoholic beverages, some form of milling followed by distillation. Biodiesel, the other first-generation biofuel, is likewise easy to make from oilseeds or organic wastes. For both these fuels, purchased feedstock accounts for up to two-thirds of total costs, sometimes more, depending on crop prices. For both these fuels too, leaving aside sugarcane ethanol in Brazil, costs exceed those for petroleum at generally prevailing crude oil prices (Cazzola et al. 2013). A price on carbon would alter the picture, and a sufficiently high price would obviate subsidies governments have put in place; so would oil prices in the range of, say, $200 per barrel.

Both first-generation biofuels also have technical limitations. They differ chemically from petroleum, which can result in instability (e.g., decomposition over time) and, more seriously, renders them incompatible with most existing vehicles and infrastructure (pipelines, tanks, and pumps) except in low-percentage blends with petroleum (Alic 2013). Ethanol, on the other hand, has compensating advantages in boosting octane and reducing smog-creating tailpipe emissions. And while biomass can be processed into hydrocarbons chemically indistinguishable from petroleum—biogasoline and "renewable" or "green" diesel—this requires further refining steps at added cost.

Historically, a plantation economy, Brazil, is uniquely favored for bioethanol, with abundant land suited to growing cane sugar (two crops per year in some places), ample rainfall (at least until the 2014 drought), and large numbers of low-wage agricultural laborers who hand-harvest the cane—labor that in the eyes of some continues to be grievously exploited (McGrath 2013). In the 1970s, the military government then ruling Brazil in essence dictated creation of a biofuels industry. Since those years, inflation-adjusted production costs have decreased by a factor of three—low enough that Brazilian bioethanol can compete with petroleum even at oil prices below $50 per barrel (Mendes Souza et al. 2015, p. 495).

(Blanchard and Gali 2007). Unless biofuels output were to greatly increase—and there are no guarantees that large increases would be sustainable, for reasons discussed below—and costs were to come down to levels competitive with petroleum, biofuels will not have much effect on oil markets.

Governments frequently voice additional justifications for biofuels policies, such as rural development and job creation. These too are dubious as policy rationales. Rural development is a common watchword among politicians; yet even in countries that take it seriously, bioenergy crops, while providing supplemental income for some farmers, will probably never be very profitable for smallholders. Most, if able to grow higher valued-added crops, whether strawberries or coffee beans or flowers—or biofeedstocks for specialty chemicals—can expect to do better than by trying to compete with commercial growers of commodity bioenergy crops. Not only do large concerns dominate agriculture in many parts of the world, multinational corporations (MNCs) dominate downstream production. US-based Archer Daniels Midland reportedly operates the world's five largest bioethanol facilities (REN21 2015), and Abengoa, a major biofuels supplier based in Spain, gets more than 85% of its revenues outside its home country. (Abengoa, under severe financial pressure, sought protection from its creditors at the end of 2015). Even in Brazil, for many years a partially closed economy, MNCs (including Abengoa) account for a substantial, and rising, share of output (Damaso et al. 2014). Big MNCs have market power to bid down feedstock prices, and with subsidies tilted toward biorefiners rather than growers, generally reap the bulk of the rewards.

The benefits of job growth have frequently been overstated too. While any new biorefinery will hire workers locally, the numbers tend to be modest. Biorefineries on average are small, their capacity limited by shipping charges for low-value biomass (Alic 2015). Most employ only a few dozen people. Although indirect jobs such as driving trucks add to those inside the plant, other work meanwhile vanishes, albeit elsewhere and not necessarily in equal numbers. Gains in Iowa, for instance, may be offset by losses in North Dakota or Louisiana (or perhaps the Brazilian state of São Paulo). Politicians will always brag of jobs created, saying nothing of net effects. The latter cannot in any case be estimated with much accuracy, being small differences in large aggregates displaced geographically and temporally. For such reasons, and again leaving aside local impacts, the figures put forward for creation of "green jobs" seldom have much credibility (Berck and Hoffmann 2002). This leaves reductions in GHG emissions—possible but not guaranteed—as the primary reason, looking ahead, for government support of biofuels. Yet even as this rationale has gained prominence, concern over the full range of impacts has risen.

3 Assessing Impacts

Because growing plant matter takes up CO_2 from the atmosphere, substituting biofuels for fossil fuels can lower *net* GHG emissions, but only *if* removals of CO_2 exceed emissions elsewhere over the entire life cycle and along the entire supply chain, from land clearing for new cultivation through to processing and final consumption. Many imponderables cloud life-cycle analysis (LCA), and not all LCAs include the full range of environmental effects, those beyond GHG emissions themselves. These are many and can be large (Davis et al. 2009). Increased production of cultivated biomass, for example, normally means more usage of fertilizer, and fertilization releases large volumes of nitrous oxide, a warming agent some 300 times more powerful than CO_2. And because grasslands and forests serve as major terrestrial carbon sinks, clearing additional land for cultivation releases large amounts of CO_2, whether through burning or slow decomposition. Many years may then pass before cumulative GHG reductions from displacement of fossil fuels overtake the initial CO_2 release (Elshout et al. 2015).

Published LCA figures, not surprisingly, span wide ranges and often prove controversial. Even for LCAs restricted to GHG emissions from first-generation biofuels, which have been intensively studied, "the range of uncertainty can be larger than the average expected benefit," creating "a risk that such fuels provide no benefit or even produce higher rates of greenhouse gas emissions than oil products" (International Transport Forum 2007, p. 2). Box 16.3 provides further discussion.

The US Congressional Budget Office (CBO) has presented a useful comparison of GHG estimates (only) gathered from several sources. These show emissions for corn ethanol relative to gasoline that range from decreases of nearly 50% to large increases (CBO 2014, pp. 24–5). Sugarcane ethanol and biodiesel do better, with GHG reductions generally in the range of 50% or more. Both these fuels also offer superior energy balances—the ratio of the energy available in the final fuel to that consumed in cultivation, processing, and so on. Estimates for second-generation cellulosic ethanol tend to be still more favorable. Made from the inedible cell walls of plants including byproducts such as corn stover (postharvest remnants ordinarily left in the field) and woody energy crops, cellulosic fuels have the additional advantage of reducing or eliminating upward pressure on food prices. The estimates CBO presents for corn-stover ethanol range from small GHG decreases relative to gasoline to reductions of more than 100%. The necessary caution: there is as yet little empirical data for input into LCA analysis of cellulosic ethanol; processing technology has proven unexpectedly recalcitrant, with production underway in only a handful of mostly small plants (Alic 2015).

Box 16.3 Life-cycle analysis

Not all environmental impacts associated with biofuels are as obvious as, say, soil degradation and water pollution through runoff, and many assessments slide over non-GHG impacts of all types: "From a representative sample of LCA studies on biofuels, less than one third presented results for acidification and eutrophication and only a few for toxicity potential (either human toxicity or eco-toxicity, or both), summer smog, ozone depletion or abiotic resource depletion potential, and none on biodiversity" (UNEP 2009, p. 17).

Besides neglect of non-GHG impacts, two additional factors contribute to the wide range of published LCA estimates. Reliable empirical data for input and calibration of computer models remains scarce, especially as concerns biomass growth, which takes place under vastly different conditions from place to place and time to time. Agrochemical applications vary widely, for example, and less than average rainfall one year may mean more than usual irrigation, consuming extra energy and depleting aquifers. Second, because of the opacity of LCA models and the many assumptions they embody, "it is much too easy to use a model to generate, and thus seemingly validate, the results one wants" (Pindyck 2015, p. 8).

In recent years, indirect land-use changes, which take place when farmers bring new land under cultivation, have been especially contested. Demands on arable land—as terrestrial carbon sinks; for bioenergy crops; for growing food to feed growing population, in poorer countries especially—lead to sharp conflicts. At the same time, agricultural land goes in and out of production constantly, and for many reasons. In recent years, for example, much land in countries including Indonesia has been clear-cut for crops such as palm oil, sold both for biodiesel and as an ingredient in food products and cosmetics. How much palm oil goes for biodiesel and how much for food depends on market prices determined by supply and demand. For such reasons, indirect land-use changes cannot be linked to biofuels production in meaningful ways—another major unknown in trying to assess long-term sustainability (Finkbeiner 2013).

There is no real question, conversely, that expanded cultivation of bioenergy crops exerts upward pressure on food prices (Wright 2014). In the USA, biorefiners have recently taken as much as 40% of the corn crop and food prices have risen broadly; much corn is sold as livestock

Box 16.3 (continued)

feed, and more costly feed means more costly chicken and beef, while corn syrup is a common sweetener in processed foods. Even in a country as wealthy as the USA, rising food prices mean hardship for some, and arguably contribute to unhealthy diet choices.

Algae and other advanced biofuels could skirt at least some of the liabilities sketched above. Their promise cannot as yet be judged with any confidence. There are thousands of possibilities, relatively few of which have been explored in much depth, so that projected costs, net GHG emissions, and effects on land and water usage represent little more than informed speculation (National Research Council 2012).

4 The Transport Dilemma: Personal Vehicles

If biofuels are to make much difference for mitigation of climate change, it will be through replacement of petroleum fuels for road vehicles. Cars and trucks account for over 70% of GHG emissions from transportation, far exceeding those from waterborne shipping and aviation, each in the range of 11% (Edenhofer et al. 2014). The world stock of cars and trucks (plus buses, motorcycles, etc.), now around 1.2 billion, is expanding rapidly (OICA 2015). By midcentury, the total will probably exceed 2 billion, and could reach 3 billion. Much of the growth will be in developing countries, driven by rising levels of disposable income. Market projections suggest increases over the period 2010–2030 of perhaps 80% in Brazil, more than 200% in China, and as much as 600% in India, compared with no more than 20–30% in the USA and Europe (International Council for Clean Transportation 2013, p. 11). No one expects such forecasts to be accurate; still, the relative rates of growth should be indicative.

New vehicles sold in wealthy country markets incorporate many GHG-reducing technical advances to meet increasingly strict regulatory standards for fuel mileage, CO_2 emissions, or both. These include hybrid, battery-electric, and, soon, fuel cell-electric power trains, along with modified conventional power plants (and transmissions) of several types. At the level of the vehicle system, lighter weight and reductions in aerodynamic drag, friction and rolling resistance, and auxiliary loads (heating, air conditioning, power steering, and brakes) yield further gains. Even though battery costs for electric vehicles, to take one example, have been declining quite rapidly (Nykvist and Nilsson 2015), all this comes at a price, one that markets in poorer countries will not easily support. Most developing countries have no fuel mileage or CO_2 standards; others, including China and India, have proposed, announced, or put in place standards. Even so, these standards tend to be less stringent than those in the USA and EU (to hold down costs), and future enforcement could prove lax.

The world fleet, at the same time, turns over slowly. The average age of vehicles worldwide is around 15 years. Millions of older vehicles remain in use more-or-less indefinitely, often passed on to developing country markets as used cars or trucks. Under any scenario, then, it will take many years to replace today's vehicle stock with newer low-GHG types, or with alternatives suited to dense urban conurbations. After all, even in affluent markets, sales of vehicles incorporating more advanced, and expensive, technologies have been slow. Nissan's battery-electric Leaf is the world's best-selling car of its type; the company no doubt lost a considerable sum on each Leaf built in 2014—about 60,000. And even 600,000 battery-electric vehicles per year would not make much difference for GHG emissions, which are largely displaced to fossil fuel power plants (with exceptions for nuclear-dependent France and a few countries with abundant hydropower); in the USA, for instance, electric vehicles may increase CO_2 emissions compared to hybrids and even conventional vehicles, depending on region and time of day of charging (Graff Zivin et al. 2014). To be sure, if self-driving battery-electrics eventually replace large numbers of personally owned vehicles in cities, energy consumption and emissions per passenger mile would decline; battery-electrics save energy through higher overall efficiency than conventional vehicles; self-driving vehicles save additional energy through more nearly optimal route planning and, eventually, lower levels of congestion; and sharing of such vehicles reduces GHG emissions per passenger mile still further. Yet most future megacities will be relatively poor, at least initially, with infrastructures ill-suited to such innovations (and perhaps to electrified transit systems as well).

The great majority of vehicles entering the world fleet over the next decade, at least, will continue to run on gasoline or diesel fuel (product development cycles in the auto industry run half a dozen years or more, and longer still for engineering work on innovations that count as more than incremental). Greater numbers of such vehicles traveling more miles means increasing volumes of tailpipe CO_2 at a time when fast action is needed to control climate change. There is only one way to reduce CO_2 from such vehicles—change the fuel. Policymakers are right to ask whether and by how much biofuels could hold down life-cycle GHG emissions from transportation.

5 Comparing Policies: Brazil, the USA, the EU

Path dependent policy outcomes reflect institutional, political, and administrative structures, which, for biofuels, interact with technological advance and the dynamics of national economies and the international economy. Corn ethanol in the USA illustrates. A myriad of subsidies and incentives at federal and state levels, built up over the years under the influence of agribusiness interests, has meant that essentially all gasoline (or gasohol) contains 10% corn ethanol, even though this is the least desirable of all biofuels in terms of GHG emissions and energy balance. If US policies reflect interest group politics, Brazil, under military rule at the time, made sugarcane ethanol part of the country's fuel mix by government fiat. In much of Western Europe, meanwhile, popular support for environmental protection slowly moved biofuels onto policy agendas. The rest of this section offers a rather impressionistic view of policies in the Brazil, the USA, and the EU, without attempting to be exhaustive.

In late 1975, when Brazil's ProÁlcool, or National Alcohol Program (Programa Nacional do Álcool) took effect, the country's offshore oil reserves had yet to be discovered and imports made up around 80% of consumption. When oil prices skyrocketed, so did the country's trade deficit. Even so, ProÁlcool, which included measures such as subsidized loans for construction of biorefineries and guaranteed purchases of their outputs, should not be taken simply as a response to energy shock. Rather, the program was conceived and implemented as part of Brazil's long-running economic development strategy, its version of the import substitution industrialization (ISI) policies widespread in Latin America after the Second World War (Meyer et al. 2013). With measures such as import barriers to shield domestic firms from MNC competition and local content rules requiring foreign-owned investors to procure inputs from domestic suppliers, ISI policies aim to enhance indigenous capabilities. ProÁlcool built on earlier measures directed at MNC auto firms that wished to sell into South America's biggest market. Despite policy stumbles and market shifts, the program retains its overall shape and thrust (Box 16.4).

In the USA, in some contrast to Brazil, weak and divided government and sharply clashing private interests leave energy policy incoherent to the extent that it is easy to argue no such thing exists. Congressional committees and subcommittees jostle one another for oversight and control, scattering administrative responsibilities among major and minor agencies and subagencies with vague or overlapping charters and little provision for coordination. Such

Box 16.4 Ethanol in Brazil and flexible-fuel vehicles

Brazil's economic development policies spurred rapid growth of domestic auto production starting in the late 1950s. By the midpoint of the following decade, MNCs including General Motors and Volkswagen were buying nearly all their parts and components from local firms (Teitel and Thoumi 1986). At the time ProÁlcool took effect, Brazilian engineers employed by MNCs and domestic suppliers had no trouble developing power trains suited to ethanol.

In the mid-1980s, oil prices began to fall and Brazil's balance of payments improved. With cheap gasoline again available, ethanol subsidies were cut, output flattened, and Brazilians who had purchased ethanol-only vehicles could not always find fuel; as a result, sales of gasoline-only vehicles rose sharply (Goldemberg and Horta Nogueira 2014). The government, by then democratically elected, responded with legislation mandating 22% ethanol in gasoline, and several years later required automakers to produce flexible-fuel vehicles able to burn gasoline or ethanol in essentially any proportions. The key feature of these flex-fuel power trains, again developed by locally owned suppliers and the Brazilian employees of MNC automakers and parts firms: an exhaust sensor that detects the alcohol content of the fuel based on products of combustion and a control system that adjusts fuel injection volumes accordingly.

Since 2003, many new cars sold in Brazil, and in some years most, have been able to run on either gasohol (the mandate is now 27% ethanol) or straight ethanol. Consumers choose which fuel to buy based on prices at the pump, set by government depending on oil prices and on available supplies of ethanol, which vary regionally, seasonally, and with demand for sugar as a food product. Brazil now exports considerable quantities of both fuel ethanol and sugar.

Automakers also produce flex-fuel vehicles in the USA, but sales have been modest, despite tax incentives, in part because retailers have not made high-alcohol fuels (e.g., E85, 85% ethanol and 15% gasoline) widely available. No more than 3000 of nearly 160,000 US fuel outlets sell E85, and they do not always price it below gasoline to compensate for lower energy content (Pouliot and Babcock 2014). Brazil remains alone in having a large market for high-ethanol fuels and flex-fuel vehicles.

a setting gives private interests abundant openings to press for measures, or interpretations, they prefer. The record since the time of the First World War, when mechanization on land and in the air as well as at sea made energy in the form of oil a major national security concern, reads as a grab-bag of measures with something for nearly everyone: coal and oil first, joined later by natural gas, then in the 1950s by nuclear power, and since the 1970s by renewables.

Biofuels policies grew by accretion. Midwest farming interests retain great influence in Washington even though agriculture now accounts for only around 1% of economic output. Corn is big business in Iowa, the state routinely leading all others in production. Iowa's early presidential caucuses attract national attention. Hopefuls endorse corn ethanol subsidies almost universally, regardless of their views on economic affairs more generally. When Barack Obama entered the White House in 2009, he named Thomas Vilsack, two-term Iowa governor and a former rival for the Democratic Party's nomination, Secretary of Agriculture. Well into President Obama's second term, Vilsack, a tireless ethanol booster, continues in the position.

Lacking much in the way of party discipline, legislation results only when coalitions come together, perhaps fleetingly, in Congress. More than in most countries, US policymaking can be considered a garbage can, into which flow "independent, exogenous streams" bearing "problems, solutions, decision-makers, and choice opportunities" (Olsen 1991, p. 92). On occasion, the cooks manage to serve up a stew, or a menu of stews. The laws that encapsulate current US biofuels policies—the 2005 Energy Policy Act; the 2007 Energy Independence and Security Act; and the 2008 Food, Conservation, and Energy Act (the title given that year's farm bill)—total some 1500 pages. These laws, with a few subsequent modifications, established a complicated structure of tax incentives for biofuels, some now expired, consumption quotas, some unrealistic and unenforced, plus ancillary measures such as import duties on bioethanol, aimed at sugarcane ethanol from Brazil and also now expired (Yacobucci 2012). The mélange is grossly inefficient in an economic sense, far more costly than would be such alternatives as a price on carbon (Holland et al. 2011).

In 2006, with petroleum prices on the rise, President George W. Bush deplored the nation's "addiction" to oil in his State of the Union address, and went on to register his support for biofuels: "We will increase our research … in cutting-edge methods of producing ethanol, not just from corn but from wood chips and stalks or switch grass. Our goal is to make this new kind of ethanol practical and competitive within 6 years" (Government Printing Office 2006, p. 150). It did not happen. Congress established quotas mandating production of "advanced biofuels" such as cellulosic ethanol beginning in 2009—made from feedstocks of the sort to which Bush had referred—with quantities stepping upward through 2022. Given assured markets, written into law, perhaps 200 companies, large and small, announced R&D and investment plans. Process development for cellulosic ethanol proved much more difficult than expected, estimated production costs rose, and a number of high-profile bankruptcies followed (Alic 2015). In the absence of production capacity, the mandated quotas could not be met. Congress had charged the Environmental Protection Agency (EPA) with administrating the quotas, including discretion to adjust them. EPA had no choice but to cut those for advanced biofuels year by year to token levels.

Regulations covering automobile fuel economy and GHG emissions provide a further illustration of the incoherence common in US governance. Amendments to the Clean Air Act (CAA) in 1970 made EPA responsible for tailpipe emissions. A few years later, at the time of the first energy crisis, Congress wrote the first Corporate Average Fuel Economy (CAFE) standards into law, assigning them to a subagency of the Department of Transportation, the National Highway Traffic Safety Administration (NHTSA). In 2007, following years of administrative and legal proceedings, the Supreme Court finally ruled that EPA had authority under the CAA and amendments to regulate GHGs from road vehicles. Since tailpipe CO_2 depends almost entirely on fuel economy, hence on CAFE standards, EPA and NHTSA then had to find ways to coordinate their actions likely to be found acceptable under existing laws and decades of sometimes strained interpretations and court decisions—all under the watchful eyes of environmental groups, affected industries, Congress, and also the White House Office of Management and Budget, which, ever since Ronald Reagan's presidency, has intervened frequently but erratically in environmental rule-making, nearly always to weaken (or delay) them (in Republican and Democratic administrations alike) (Heinzerling 2014).

In contrast to the opacity of so much that goes on in Washington, the early agenda-setting stages of EU policymaking feature steams of green papers, white papers, and other more-or-less technocratic documents intended to inform, reflect, and build consensus—or not, since seemingly endless discussion and debate sometimes leads to nothing, or to stalemate, or to toothless compromise. At the culmination of one such process, EU legislation adopted in 2009 will require each member state, by 2020, to get at least 10% of "final energy consumed in transport" from renewable sources (EU 2009). Amendments pending as of mid-2015 would cap the contribution of first-generation biofuels at 7%, reflecting rising concerns over land use and sustainability.

6 Conclusion: The Future of Biofuels

At the time of the 1970s oil crises, when governments began to promote biofuels, only a few skeptics foresaw their limitations. These are real, and a good deal of the early enthusiasm had dissipated well before oil prices began their most recent decline. Investment continues, especially in South America (Argentina, Colombia) and Asia (China, Indonesia), but the worldwide trend has been sharply downward: global annual biofuels investments have dropped from nearly $30 billion in 2007 to about $5 billion in 2014 (UNEP 2015, p. 15). The International Energy Agency projects only slight increases in output over the next few years, from 2.2 million barrels per day currently to perhaps 2.4 million barrels in 2020 (IEA 2015, p. 6).

In the longer term, how much of the global market for transport fuels might bioenergy supply? With sustainability a criterion, most estimates cluster not too far from 20% (REN21 2014, p. 41; Department of Energy 2015, p. 422). Such estimates depend on assumptions that begin with acreage that might be available for bioenergy crops without encroaching on agricultural land needed to feed a world population expected to exceed 11 billion by century's end, on ongoing technological advances in producing cellulosic ethanol, and on overall demand for fuel, which will depend on variables including vehicle efficiency improvements and changing patterns of transport usage. Perhaps needless to say, large uncertainties attach to most of these factors. There seems little reason today to go beyond the view expressed some years ago by the UK Royal Society: "Biofuels have a limited, but potentially useful, ability to replace fossil fuels, largely due to technical and economic constraints" (Royal Society 2008, p. 62). If anything, the constraints seem to tightening, particularly those rooted in land use and competition with food crops (Johnson et al. 2014).

Over the longer term, prospects for biofuels hinge on radical innovation. Many possibilities remain to be explored: genetic engineering of algae; bacteria; perhaps "solar fuels," hydrocarbons made by removing CO_2 from the atmosphere (or perhaps from the flue gases of fossil fuel-burning power plants) and, with energy inputs from sunlight, combining the carbon in the CO_2 with hydrogen from water to yield synthetics chemically interchangeable with petroleum. Yet while incremental innovations of the sort ongoing with cellulosic ethanol can often be predicted, radical advances cannot, and policymakers should not assume that research spending will pay off: innovations, quite simply, cannot be forced into being. Still, if transport emissions cannot in one way or another be reduced, much of the crude oil still in the ground will sooner or later be burned and Earth will continue to warm, with results that no one can predict—but which will almost certainly be enormously disruptive for billions of people, especially those in low-income countries with limited capacity to adapt.

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Part V

Energy Conflict and the Resource Curse

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17

No Blood for Oil? Hydrocarbon Abundance and International Security

Michael T. Klare

For most of the past century, the international security dimensions of energy have largely been governed by perceptions of *scarcity*: a presumption that global reserves of oil and other basic fuels are insufficient to meet the anticipated needs of all major powers and that energy-poor states must undertake extraordinary measures—economic, diplomatic, and, on occasion, military—to ensure access to adequate supplies. In undertaking such efforts, the major energy-importing countries have been guided by a number of core assumptions: first, that an adequate supply of energy is essential for the successful functioning of a modern industrialized economy; second, that global supply reserves of oil, natural gas, and other basic fuels are finite and often located in areas of recurring turmoil and conflict; and third, that satisfying national energy requirements is a critical government responsibility (Kalicki and Goldwyn 2013). Summarizing these views, Spencer Abraham, former US Energy Secretary, told Congress in 2002, 'Energy security is a fundamental component of national security' (Abraham 2002). As a component of national security, moreover, energy security can become the justification for using military force—a stance articulated by several US presidents when authorizing military action in the Persian Gulf area.

Perceptions of energy scarcity played a key role in the strategic thinking of the major powers during World War I and in the years leading up to World War II. When Great Britain began converting its warships from

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coal to oil propulsion in 1912, it was almost totally lacking in domestic reserves of petroleum (this was long before the discovery of the North Sea fields) and so sought to acquire control over a foreign source of supply—an effort that led in 1914 to the nationalization of the Anglo-Persian Oil Company (APOC, the forerunner of BP), a UK-based firm that had acquired a promising concession in southwest Persia (now Iran). Described as an essential move for national security, the takeover of APOC led the British to seek a dominant military position in the Persian Gulf area and seek access to other promising reservoirs (Jones 1981; Yergin 1991). After World War I, the other European powers—most of which, like the UK, lacked substantial oil reserves of their own—followed Britain's lead by seeking concessions of their own in the area. Energy scarcity played a role in strategic planning for World War II, with both Germany and Japan ultimately undertaking foreign invasions—Germany of the Soviet Union, Japan of the Dutch East Indies—with the hope of securing access to major oil reserves.

To this day, perceptions of scarcity and a willingness to safeguard vital energy supplies through military means continue to shape government policy in many parts of the world. In the Gulf area, for example, the US Central Command (Centcom) remains poised to undertake extensive military operations in the event that Iran attempts to block the Strait of Hormuz—the narrow waterway through which approximately 30% of the world's shipborne oil passes every day (Talmadge 2008). In early 2012, amid unveiled threats by Iran to block Hormuz in retaliation for the new round of Western sanctions, General Martin E. Dempsey, Chairman of the Joint Chiefs of Staff, confirmed that the USA will 'take action and reopen the Strait' if blocked by Iran (as quoted in Bumiller et al. 2012). Similarly, China and India have declared their intent to bolster their high-seas naval capabilities and to employ force if necessary to protect their own energy imports.

Recently, however, energy analysts have begun to question this scarcity-driven outlook. Instead of growing scarcity, it is claimed, the future promises greater energy availability, not less. This is especially true for the USA: as a result of the 'shale revolution,' entailing the use of hydraulic fracturing ('fracking') to extract oil and natural gas from underground shale formations, this country is now producing more natural gas than at any time in its history and more oil than at any time except for a brief period in the early 1970s (EIA 2015a, b). At the same time, other countries have begun to utilize new drilling technologies in their efforts to exploit oil and gas reserves once considered inaccessible or non-commercial. Canada, for example, is using a variety of techniques to convert its bituminous tar sands (also called 'oil sands') into a synthetic form of petroleum, vastly increasing the nation's output. Iran, Iraq, and Saudi Arabia all expect to increase their future oil and gas output by employing enhanced recovery techniques to boost output at existing fields and allow the development of new ones. Meanwhile, the rapid expansion of wind and solar installations—driven, in large part, by global efforts to reduce carbon emissions and thereby slow global warming—is bolstering confidence that any future shortages of fossil fuels (or restrictions on their use) can be offset by a greater reliance on alternative forms of energy (Yergin 2011a). As a result of all this, the perception of energy scarcity is being replaced by one of relative optimism regarding the future availability of energy. 'Instead of facing an Era of Scarcity,' avowed Rex Tillerson, the Chairman and CEO of ExxonMobil, 'we are now witnessing the transition to a new Era of Abundance' (Tillerson 2013).

Along with expressing greater optimism regarding the future availability of energy, many analysts are beginning to question the need to continue relying on military means to safeguard the delivery of energy supplies (Yergin 2011b; Crooks and Dyer 2013). With a greater abundance of energy available from an increasing range of domestic and international sources, it appears pointless to devote enormous military resources on the protection of any particular foreign supplier. Indeed, for some, the natural response to diminished US reliance on Middle Eastern oil would be the withdrawal of American forces from the Persian Gulf and their redeployment home or to areas of greater strategic significance. 'If America can produce its own oil,' the *Economist* opined in 2014, 'Why waste so much blood and treasure policing the Middle East?' (*Economist*, 2014).

Any effort to reduce the application of military means to the protection of imported energy supplies would have some obvious attractions. The termination of Centcom's oil-protection mission in the Gulf area, for example, could save the US Treasury tens or hundreds of billions of dollars per year, without even counting war-related expenses (O'Hanlon 2010). A diminished US military presence in the Gulf could also abate some of the anti-Americanism that pervades the area, perhaps robbing Islamic extremists of their primary funding and recruiting appeal. On a global scale, the elimination of energy scarcity as a rationale for deploying military forces abroad could reduce regional tensions and lessen the risk of war. But will the newfound perception of abundance actually result in these outcomes? At this point, it is too early to reach such a conclusion. The belief that ensuring access to adequate energy supplies is essential to national security runs deep, and few states appear poised to eliminate their reliance on the use of military instruments for this purpose. As will be shown, moreover, the historic tie between energy scarcity and military action has spawned the creation of powerful military organizations, such as Centcom, which exert considerable sway in policy-making circles. It is essential, then, to examine the historical relationship between energy consumption and international security and investigate how it is (or is not) being altered by the current expansion of global supplies.[1]

1 The Militarization of Energy (In)Security

The relationship between energy availability, national security, and the use of force first took shape during World War I, when oil-powered weapons—notably tanks, planes, and submarines—made their initial appearance on the battlefield. With few sources of petroleum then in production, mostly concentrated in the USA, Romania, Iran (then Persia), and Baku in Czarist Russia, the belligerents sought to control these areas or deny them to their opponents. Believing that possession of abundant supplies of oil would be essential for success in any future contests of this magnitude, the surviving great powers engaged in a competitive struggle to extend their control over the major oil-producing areas (Yergin 1991). The major European states, possessing few domestic reserves of their own, largely focused their efforts on acquiring concessions in the oil-bearing regions of the Middle East. This was the era of the San Remo Agreement of 1920, under which Britain obtained control over Iraq and France of Syria under mandates from the League of Nations (Key 2003, pp. 124–29). Meanwhile, Japan—a rising industrial power with a similar paucity of oil—harbored imperial ambitions over the Dutch East Indies, then the major oil producer in Asia.

As World War II approached, the need to secure overseas sources of oil to sustain both industrial and military operations played a significant role in the strategic planning of Germany and Japan, both of which feared the consequences of inadequate domestic supplies. In 1941, when full-scale combat broke out, both countries undertook military strikes with this purpose in mind: Germany invaded the Soviet Union, with Baku as one of its primary objectives; Japan invaded the Dutch East Indies. And, because Tokyo feared that its invasion of the Dutch East Indies would provoke a US military response—particularly, a naval drive to starve Japan of oil—it simultaneously attacked the US naval base at Pearl Harbor in Hawaii, thus ensuring American entry into the war (Yergin 1991).

[1] The author first examined these issues in Klare (2015).

Until this point, the USA had not participated in the strategic (as distinct from the commercial) pursuit of overseas oil, as it possessed sufficient domestic reserves to satisfy its wartime military requirements and those of its principal allies. As World War II progressed, however, President Franklin D. Roosevelt and his senior advisers worried that the heavy wartime exploitation of domestic oil was rapidly depleting US reserves, eroding America's capacity to sustain another full-scale war on the magnitude of World War II. Accordingly, Roosevelt ordered the State and Commerce Departments to seek a reliable foreign source of oil to supplement American reserves in the event of a future conflict (Painter 1986; Stoff 1980). After considering the various possibilities, government experts concluded in 1943 that Saudi Arabia represented the best candidate to serve in this capacity. With this in mind, Roosevelt met with King Abdul Aziz ibn Saud on February 14, 1945, and forged an agreement with him under which the USA would obtain privileged access to Saudi oil in return for an American pledge to protect the monarchy against its assorted enemies (Painter 1986; Stoff 1980).

In the years that followed, the USA became ever more deeply involved in Persian Gulf affairs. Following London's 1968 decision to withdraw all British forces from the region by 1972, President Richard Nixon chose Iran—then controlled by Shah Mohammed Reza Pahlavi—to serve as a substitute 'gendarme' in the Gulf and, in accordance with this plan, agreed to provide the Iranians with a vast array of modern American weapons (Klare 1985, pp. 108–26). Later, after the Soviets invaded Afghanistan and the Shah was overthrown, President Jimmy Carter concluded that the USA could no longer rely on surrogates but would have to assume direct responsibility for ensuring the safety of Persian Gulf oil supplies (Palmer 1992, pp. 101–11). This stance was first articulated in his State of the Union address of January 23, 1980, and has been known since as the Carter Doctrine. 'Let our position be absolutely clear,' he declared. 'An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force' (Carter 1980). Because the USA did not at that time possess any forces specifically earmarked for operations in the Gulf area, Carter also created a new military organization—the Rapid Deployment Joint Task Force (RDJTF)—to provide this function.

Carter's successor, President Ronald Reagan, elevated the RDJTF into a region-wide military organization, the US Central Command, and tasked it with protection of the oil flow from the Gulf area.[2] Reagan was also the first American president to fully implement the Carter Doctrine: when Iranian forces attacked Kuwaiti tankers during the Iran–Iraq War of 1980–88, he determined that such action constituted a severe threat to the free flow of oil and authorized the 'reflagging' of those tankers with the American ensign, thereby allowing their protection by the US Navy (Palmer 1992). The protection of Persian Gulf oil was also cited by Reagan's successor, President George H.W. Bush, as the justification for US efforts to protect Saudi Arabia following the Iraqi invasion of Kuwait on August 2, 1990.[3]

Although the Persian Gulf area has long been the principal focus of US efforts to ensure the safety of foreign energy supplies, American leaders—fearing overdependence on one often-imperiled source of supply—have also sought to increase reliance on other foreign producing areas. This drive, known as 'diversification,' has, in particular, focused on the procurement of additional oil from the Caspian Sea basin and West Africa, both considered attractive new producing zones.[4] But while attractive as alternatives, these areas also harbor threats to the safe flow of oil—and so growing reliance on their hydrocarbon output has led to increased US military involvement in both areas.[5]

The Caspian Sea basin first attracted widespread interest in the early 1990s, following the breakup of the Soviet Union. Until then, oil production in this region was under the control of central planners in Moscow and there was little opportunity for local firms or foreign companies to become involved; after the Soviet breakup, however, the energy-rich states of the Caspian region—Azerbaijan, Kazakhstan, Turkmenistan, and Uzbekistan—opened their countries to foreign investment, usually in conjunction with state-owned companies. This resulted, before long, in the establishment of several major international consortia for the extraction and export of the region's copious energy resources (Johnson 2009; Klare 2009).

Viewing these undertakings as a substantial contribution to the diversification of Western energy imports, US leaders vowed to do whatever they could to facilitate their success. By promoting Caspian exports, President Bill Clinton told his Azerbaijani counterpart, Heydar Aliyev, 'we not only

[2] Although Centcom has since then been assigned a number of other missions, including prosecution of the wars in Iraq and Afghanistan, it continues to perform its original, oil protection role (Austin III 2015).

[3] 'Our country now imports nearly half the oil it consumes and could face a major threat to its economic independence,' and so 'the sovereign independence of Saudi Arabia is of vital interest to the United States,' Bush declared at the time (Bush 1990).

[4] This was a major objective of the energy policy adopted by the Bush administration in 2001. See National Energy Policy Development Group (2001, Chapter 8).

[5] The author first examined this topic in Klare (2005).

help Azerbaijan to prosper, but also help diversify our energy supply and strengthen our nation's security' (Clinton 1997). In consonance with this outlook, Clinton worked closely with Aliyev and other Caspian officials to construct the Baku–Tbilisi–Ceyhan (BTC) pipeline from Azerbaijan across the Caucasus to Turkey (thereby bypassing both Russia and Iran as transit states) and to bolster their self-defense capabilities in the face of widespread regional instability (Klare 2005). Clinton's successor, President George W. Bush, also placed a high priority on securing access to Caspian oil and gas, backing local leaders in their efforts to resist domination by Moscow and providing stepped-up military assistance (Klare 2009; Yergin 2011b).

A similar trajectory of increased US involvement can be seen in the oil-producing areas of West Africa. Keen to reduce US reliance on the Persian Gulf area and to increase drilling opportunities for American oil firms, the George W. Bush administration placed particular emphasis on increased US energy investment there (Klare 2009, pp. 157–64). But, as in the Caspian area and the Gulf, such efforts were imperiled by widespread violence and instability. Accordingly, Washington expanded its military aid and training programs for friendly local governments (Klare and Volman 2006).[6] To help sustain and manage these endeavors, President Bush authorized the establishment of yet another new military organization, the US Africa Command (Africom), in 2007—much as President Carter followed the enunciation of his famous doctrine of January 1980 with the creation of (what became) the US Central Command (Ploch 2011).

The drive to diversify US sources of imported oil was largely intended to diminish the nation's dependence on Persian Gulf oil, and thereby minimize the risks and complications of American involvement in that chronically unstable area. By turning to the Caspian region and Africa, however, the USA did not escape the security dimensions of reliance on imported energy. In fact, these areas harbored many of the same sorts of internal fissures as those encountered in the Gulf, and so again Washington found it necessary to respond with military measures of one type or another. Because the BTC pipeline crosses through Georgia, passing near such war-torn areas as Chechnya and South Ossetia, the Clinton and Bush administrations provided substantial military aid to Georgia's military forces, at some points stationing large military training contingents there (OGJ 2003). Similarly, President Bush found it necessary to increase US arms and training aid to Africa, particularly to Nigeria and other states bordering the oil-rich Gulf of Guinea.

[6] Annual appropriations for military aid to Africa are tabulated in US Department of State (DoS), *Congressional Budget Justification*, vol. 2, *Foreign Operations* (by Fiscal Year).

2 Energy Abundance and America's 'Enduring Posture' in the Persian Gulf

Most of the policies and programs adopted by the USA to ensure the safety of foreign oil supplies, such as the formation of Centcom and Africom, were put in place during the years between World War II and the first decade of the twenty-first century. By 2010, however, America's reliance on imported oil began to contract as the shale revolution resulted in a dramatic increase in domestic production. US field production of crude oil jumped from 5.4 million barrels per day (mbd) in January 2010 to 9.3 mbd in January 2015, a remarkable increase of 72% (EIA 2015b). At the same time, US consumption of oil remained relatively flat, a consequence of sluggish economic conditions and the growing efficiency of US-manufactured motor vehicles. According to the Energy Information Administration (EIA), domestic consumption rose by only 3% between January 2010 and January 2015, from 18.7 to 19.2 mbd (EIA 2015c). Subtracting one from the other, this means that US *imports* of oil fell from 13.3 to 9.9 mbd over this period, a decline of 83%.

Even as US reliance on foreign oil has declined, the country has also achieved greater diversity in its imported supplies, with fewer supplies coming from the ever-turbulent Middle East and more from Canada, a stable and friendly neighbor. Whereas 25% of US oil imports originated in the Persian Gulf in January 2003, only 14% did so in January 2015; at the same time, imports from Canada rose from 20% to 42% over this period (EIA 2015d). It is these trends that have fueled the calls for scaling back US reliance on military means to secure the safety of overseas oil deliveries.

But while some analysts have favored such a pullback, many others have not, claiming that the uninterrupted flow of energy remains essential to global economic stability and that the USA has an inalienable obligation to perform that role (Chapman 2009).[7] Given the world's continuing vulnerability to sudden disruptions in the global flow of oil, it is argued, the USA must continue to protect that flow, even if the supplies involved are not destined for the USA. As suggested by Rex Tillerson of ExxonMobil, the uninterrupted flow of Persian Gulf oil is essential 'to global economic stability,' and thus to the well-being of the US economy. Even if 'we're no longer getting any oil from the Middle East because we're secure here,' he explained,

[7] In an unusually candid expression of this outlook, a group of senior policymakers, including former Secretary of Defense and Energy, James R. Schlesinger, observed in 2000, 'As the world's only superpower, [the United States] must accept its special responsibilities for preserving access to worldwide energy supply' (Schlesinger and Nunn 2002, p. 30).

'a disruption of oil supplies from that region will have devastating impacts on global economies,' ours included (Tillerson 2012). This logic appears to have been embraced by President Obama, who has pledged to retain a strong military presence in the Gulf. 'The United States of America is prepared to use all elements of our power, including military force, to secure our core interests in the region,' he told the UN General Assembly on September 24, 2013. These include, he indicated, 'ensur[ing] the free flow of energy from the region to the world.' Even though America is steadily reducing its dependence on imported oil, he continued, 'the world still depends on the region's energy supply, and a severe disruption could destabilize the entire global economy' (Obama 2013).

Obama has, however, indicated that there will be a major shift in US strategy in the Persian Gulf region. Instead of employing troops on the ground to affect the outcome of regional power struggles, as it has in the past, this country will now rely on air and naval forces to safeguard the free flow of oil. In particular, the administration has made it clear that it will use force to overcome any Iranian effort to block the flow of oil through the Strait of Hormuz. According to the *New York Times*, President Obama, through intermediaries, has told Iran's Supreme Leader, Ayatollah Ali Khamenei, that closing the Strait is a 'red line' that would provoke an automatic US military response (Bumiller et al. 2012). To ensure that this is not an empty threat, Obama has ordered Centcom to deploy sufficient air and naval strength in the area to overcome any Iranian move to block the Strait. As noted by Centcom's commander, General Lloyd J. Austin III, 'The U.S. fully intends to maintain a strong and enduring military posture in the [Gulf] region, one that can respond swiftly to crisis, deter aggression and assure our allies' (Austin III 2014).

3 Following in America's Footsteps: China's Approach to Energy Security

The policies and programs described above were largely put in place in the second half of the twentieth century and the early years of the twenty-first century, when the bulk of international energy transfers were directed to the major Western industrialized powers (mostly members of the Organization for Economic Cooperation and Development, or OECD) and the USA assumed overarching responsibility for ensuring their safety. The further we look into the future, however, the greater the degree to which world energy consumption will be dominated by the developing nations of Asia, especially China and India. In 2040, the EIA predicts, non-members of the OECD will account for approximately 65% of world energy demand, reducing the OECD share to a mere 35%; China alone will account for about 27% of world energy demand at that time, and an estimated 25% of world oil consumption (EIA 2013a). The question thus arises: To what extent will China, India, and other emerging nations follow Western precedents and view the protection of energy imports as a matter of national security, potentially involving the use of military instruments?

Historically, Chinese leaders have sought to rely as much as possible on domestic sources of energy to satisfy the country's needs, fearing dependence on external sources of demand that could be cut off or impeded by hostile powers. As China's economy has grown, however, it has proved increasingly difficult for that country to rely on domestic energy alone and so Beijing has had to seek ever-expanding quantities of imported energy (Newmyer 2009; Klare 2009). Despite China's recent efforts to exploit its vast reserves of shale oil and gas, its ability to raise domestic output via fracking appears limited due to a lack of the necessary know-how and infrastructure, as well as severe water shortages in key producing areas (Gunningham 2014). As a result, China will be forced to rely on imports for an ever-growing share of national requirements. In the case of oil, for example, China's oil import requirement is expected to jump from 5.2 mbd in 2010 to 14.2 mbd in 2040, an increase of 177% (EIA 2013).

To ensure its access to all this imported oil and gas, China is extending its diplomatic and military sway to the major energy-producing regions, with a particular focus on Africa, the Middle East, and Central Asia. Central Asia is of special interest to Beijing because its oil and gas exports can be carried by pipeline directly to the Chinese border, eliminating the need for reliance on tankers that would travel through waters controlled by the US Navy (which could, in theory, block such deliveries in the event of a major Sino-American confrontation). To promote such links, China has showered Central Asian leaders with economic aid and diplomatic attention, and invited them to play a conspicuous role in the Shanghai Cooperation Organization (SCO), a regional economic and security organization sponsored by Beijing (Gill and Oresman 2003). Under the auspices of the SCO, China has been supplying Central Asian forces with military aid and participating with them in joint military maneuvers (Perlez 2013a).

Africa is attractive to China as a source of energy because local governments are largely open to increased Chinese involvement and because the Western presence—though substantial—is less overbearing than in other energy-producing areas. To cultivate ties with African oil producers and allow for increased participation in their extractive operations by Chinese firms, Beijing has provided African governments with substantial economic aid and invited their leaders to diplomatic extravaganzas like the Forum on China–Africa Cooperation. As in Central Asia, moreover, it has provided friendly governments with various forms of military assistance (Klare 2009).

Still in question is the degree to which China will imitate the USA by using military power to ensure the safety of its vital energy supply lines. Chinese naval officials have become particularly insistent on China's need to enhance its ability to protect these lines. 'With the expansion of the country's economic interests, the navy wants to better protect the country's transportation routes and the safety of our major sea lanes,' Rear Admiral Zhang Hua-chen declared 2010. 'In order to achieve this, the Chinese Navy needs to develop along the lines of bigger vessels and with more comprehensive capabilities' (quoted in Wong 2010). Recent comments by President Xi Jinping suggest that top government officials share this outlook: according to one account, Xi told a Politburo meeting in 2013 that China must become a 'maritime strong power' (Perlez 2013).

Much like their Chinese counterparts, India's leaders are well aware of the security implications of their country's growing reliance on imported energy supplies and are determined to take steps to safeguard their vital supply lines. According to the EIA, India's oil import requirement will jump from 2.4 mbd in 2010 to 7.1 mbd in 2040—about the same amount as US imports at that time (EIA 2013). As most of these imports will travel by ship across the Indian Ocean—a body of water considered by New Delhi to be a natural extension of India's strategic space—India has sought to bolster its sea control capabilities in this vital maritime region. 'India's economic resurgence is directly linked to her overseas trade and energy needs, most of which are transported by sea,' a 2007 strategic blueprint released by the Indian Navy declared. 'The primary task of the Indian Navy towards national security is, therefore, to provide insulation from external interference, so that the vital tasks of fostering economic growth and undertaking developmental activities can take place in a secure environment' (Integrated Headquarters Ministry of Defence 2007, p. 10). In consonance with this policy, India is steadily enhancing its deep-sea naval capabilities, focusing in large part on the Indian Ocean, but also extending to neighboring bodies of water like the South China Sea.

4 New Sites of Contention

The global energy picture has also been transformed by the extension of oil and natural gas drilling to new areas of the world, notably the Arctic region and the deep oceans. Once considered inaccessible, these areas have come within the reach of producing companies through the application of new drilling technologies and, in the case of the Arctic, through the warming effects of climate change. The onset of drilling in these areas, when combined with the shale revolution in the USA and the exploitation of tar sands in Canada, largely accounts for the growing sense of energy abundance. However, these endeavors have also created new forms of friction and conflict, thereby erasing the purported security benefits of energy plenty.

Energy companies have, of course, long drilled for oil and natural gas in shallow coastal areas adjacent to major onshore deposits, as, for example, in waters of the Gulf of Mexico off Louisiana and the Caspian Sea off Baku (in what is now Azerbaijan). Drilling has also occurred in Alaska, northern Siberia, and other onshore areas of the Arctic. Drilling in deep waters and the offshore Arctic, however, is a relatively recent phenomenon. In 2005, Chevron set a record by drilling in 3500 feet of water in the Gulf of Mexico, a major site for deepwater innovation. Just one year later, Chevron doubled that depth at its Jack No. 2 well at another Gulf location. Shell was the next to break records, announcing in 2010 that it had drilled 8000 feet beneath sea level at its Perdido field, 200 miles east of the Texas coastline (Klare 2012, pp. 44–49). Record-breaking depths have also been reached in waters off Angola, Brazil, India, and Vietnam. Meanwhile, major drilling firms have begun to venture into the Barents, Beaufort, Chukchi, and Kara Seas, and other extensions of the Arctic Ocean (Ibid., pp. 70–93). Although not all of these endeavors have panned out—Shell announced in September 2015 that it would abandon its drive to drill in the Beaufort and Chukchi Seas after spending some $7 billion on exploration there (Adams and Crooks 2015)—together they account for a significant share of the additions to the world's oil and natural reserves over the last decade or so.

While most of these activities are taking place in waters that lie within the undisputed maritime territory of adjacent nations, such as Shell's and Chevron's operations in the US portion of the Gulf of Mexico, others are occurring in areas claimed by two or more countries, as is the case in the East and South China Seas. These constitute semi-enclosed extensions of the western Pacific Ocean that are bordered by China and a number of other states: the East China Sea by Japan and Taiwan; the South China Sea by Brunei, Malaysia, the Philippines, Taiwan, and Vietnam. In both cases, the bordering countries have laid claim to significant swaths of these waters, citing historical ownership of assorted islands as well as development rights provided under the United Nations Convention on the Law of the Sea (UNCLOS) (EIA 2012, 2013).

The UNCLOS treaty, first approved in 1982, grants signatory powers an 'exclusive economic zone' (EEZ) extending up to 200 nautical miles from their coastline. In the case of continental states, such as China, the UNCLOS treaty also allows state parties to exploit their outer continental shelf, even if it extends beyond 200 miles. Given the relatively small size of the East and South China Seas, this has led to a welter of overlapping claims to the waters involved, with China claiming the lion's share of both areas and the other states claiming significant portions. In order to demonstrate their resolve to protect their claims, most of these countries have deployed naval or coast guard vessels in their respective EEZs and in some cases established small garrisons on contested islands. On some occasions, this has resulted in maritime clashes between the contending forces (Kaphle and Gottlieb 2012).

Until now, most of the oil and gas drilling in the East and South China Seas has occurred at sites in the undisputed EEZs of one or another of the states involved. Recently, however, China has begun drilling in parts of the South China Sea claimed by Vietnam, provoking naval clashes and anti-Chinese riots in Vietnamese cities. The most serious episode erupted in May 2014, when the China National Offshore Oil Corporation deployed its largest deepwater drilling rig, the HD-981, in waters off the northern coast of Vietnam. Once emplaced in the drilling area, the Chinese surrounded the HD-981 with a large flotilla of naval and coast guard ships; when Vietnamese coast guard vessels attempted to penetrate this defensive ring in an effort to drive off the rig, they were rammed by Chinese ships and pummeled by water cannon. No lives were lost in those encounters, but anti-Chinese rioting in Vietnam proper led to several deaths and scores of injuries (Buckley et al. 2014; Perlez 2014; Bradsher 2014; Perlez and Bradsher 2014).

As noted in most press accounts of these events, the naval clashes and rioting sparked by the deployment of HD-981 in Vietnamese-claimed waters were driven in large part by nationalism and resentment over past humiliations. The Chinese, insisting that the islands in the South China Sea were once ruled by China, are seeking to overcome the territorial losses they suffered under the sway of the Western imperial powers and Imperial Japan; the Vietnamese, long accustomed to Chinese invasions, seek to protect what they view as their sovereign territory. But aside from the sociopolitical implications of these disputes, both China and Vietnam are determined to exploit the oil and gas reserves of the South China Sea, and neither shows any inclination to compromise on their respective claims (ICG 2012). The same can be said of the Philippines with respect to its swath of that sea, and of Japan with respect to contested areas of the East China Sea. So long as these bodies of water are viewed as a valuable source of energy, the parties to these disputes are likely to persist in their efforts to exploit what they view as their rightful resources—even if this means risking armed conflict with their neighbors.

A similar picture could emerge in the Arctic region. Here, too, a number of neighboring states—Canada, Denmark (acting for Greenland), Norway, Russia, and the USA (via Alaska)—seek to exploit the region's copious oil and gas reserves, and here, too, a number of unresolved boundary disputes have bedeviled efforts to determine ownership of key areas. The USA, for example, has a boundary dispute with Russia in the Bering Sea and with Canada in the Beaufort Sea; Canada has a dispute of its own with Greenland over their mutual boundary in Baffin Bay; and Greenland has one with Iceland in the Arctic proper; all of these countries, moreover, are vying for control over the outer Arctic, beyond their respective 200-nautical-mile EEZs. Although the Arctic states have pledged to refrain from the use of force in asserting their claims, most have taken steps to enhance their capacity to engage in combat operations in the area (Smith 2011). Russia, for example, has announced plans to establish new bases in the Arctic and to deploy specially equipped combat forces there. This buildup, said President Putin, 'will make it possible to substantially strengthen our military and border security and also to increase the effectiveness of the protection of natural resources' (quoted in Kipp 2011; see also: Conley and Kraut 2010). Canada has also taken steps to bolster its presence in the Arctic, establishing a new base at Resolute Bay on Cornwallis Island and ordering a new fleet of ice-hardened patrol ships. Norway, which shares a border with Russia in its far north, has relocated its combined military headquarters to Boda, above the Arctic Circle, and has taken further steps to bolster its Arctic combat capabilities (Conley and Kraut 2010).

5 Conclusion

As this survey suggests, the close association between energy and national security is well entrenched and will not easily be undermined. Many of the policies and institutions established during the Era of Scarcity, such as the Carter Doctrine, Centcom, and Africom, have acquired large and unyielding constituencies. Even though the original logic for these measures—heavy US reliance on oil imports from the Persian Gulf and Africa—no longer prevails, it seems impossible for US leaders to abandon them. This is evident, for example, in President Obama's faithful adherence to the Carter Doctrine and his continuing reliance on Centcom to ensure the safety of global energy supplies. However self-reliant the USA may become in oil and gas production, it appears unlikely that it will shed its commitment to military action for energy security for the foreseeable future.

At the same time, it is evident that other states—whatever their degree of self-sufficiency or import dependence—are also likely to uphold such a commitment. China, with a growing reliance on imported energy, appears determined to enhance its ability to safeguard its far-flung resource lifelines; Russia, though self-sufficient in oil and gas, is committed to extending its sway into the Arctic and defending its resources there with force if necessary. In both, powerful constituencies—in particular, the navy—endeavor to promote such efforts. Other countries, only briefly mentioned, appear to be headed in similar directions.

The Age of Abundance may have arrived, but this does not yet seemed to have eliminated the conviction that energy supplies are essential and must be defended with military means if necessary. This could be so because major policymakers worry that the appearance of plenty is an illusion, or because they lack faith in the ability of markets to match shortages in one area with surpluses in another. They may also be influenced by powerful military constituencies that seek institutional advantage by maintaining or expanding their role as the guardians of vital resource lifelines. But for whatever reason(s), the arrival of abundance is not likely to alter the security-minded outlook of national leaders.

6 Preview of the Section

As this assessment shows, energy plays a significant role in the affairs of state. Far more than is true of any other commodity, government leaders feel compelled to monitor the production and disbursement of energy, and to intervene in the marketplace when deemed necessary to ensure the availability of adequate supplies to meet national requirements. For many states, ensuring adequate supplies is viewed as a matter of 'national security,' justifying the use of any means—including, on occasion, military force—to achieve this objective. The shale revolution and other recent technological developments, by increasing the global availability of energy, have blunted this imperative, but not erased it from the mind-set of senior officials.

Energy occupies this unique position in the affairs of states for several reasons. To begin with, it is essential for the prosecution of war—especially modern, mechanized warfare—and so is viewed as a 'strategic' commodity whose availability cannot be left to the vagaries of the market but requires, when necessary, unrestricted government intervention. An adequate supply of energy is also essential for the smooth functioning of modern economies, and, as ensuring the health of the economy is widely considered a vital government function, states will often intervene in the market to guaranty an uninterrupted flow of essential fuels. This, in essence, is the premise of the 'Carter Doctrine,' the 1980 presidential proclamation justifying the use of force to protect oil imports from the Persian Gulf. At the same time, states that enjoy an abundance of energy often enjoy significant benefits—both political and economic—from their ability to export any surpluses to nations less advantaged. For some such states, the ability to increase or decrease deliveries to (or to raise or lower prices for) an especially dependent client can be employed as a political tool, to reward subservience and punish unfriendly behaviors. Venezuela, for example, has supplied oil at a submarket rate to friendly Latin American countries in a bid to win their support for assorted anti-American initiatives; Russia, for its part, has sought to employ its role as a major supplier of natural gas to the ex-Soviet republics to ensure their loyalty to Moscow. Energy exports also generate vast amounts of money—in some cases, providing the main source of government revenues—and so senior officials are forever scheming to utilize these 'rents' in the service of favored government policies (e.g. the improvement of poor citizens' lives, as in Venezuela) or for personal financial gain.

In the chapters that follow, these and other aspects of the relationship between energy and the state are given close attention. Although they address different dimensions of the problem, they all examine ways in which states use (or attempt to use) energy as an instrument of coercion or use coercive means to ensure the safety of energy flows (whether imports or exports). In 'Do Countries Fight over Oil?' (Chap. 18), Emily Meierding argues that military force (or the threat of force) is often brandished by states in the asserting their claims to contested oil-producing areas, for example, through the deployment of gunboats in disputed waters, but that they only initiate full-scale combat when the survival of the state (or the regime) is perceived as being at stake. James Henderson, in 'Does Russia Have a Potent Gas Weapon?' (Chap. 19), looks at the use of energy as a political tool. He shows that Russia, under the leadership of President Vladimir Putin, has repeatedly sought to utilize the dominant role played by state-controlled Gazprom in the supply of natural gas to surrounding states to influence their foreign and economic policies. These efforts have, for the most part, been foiled because their intended targets have been able to secure alternative sources of supply in an ever-expanding natural gas marketplace. As Henderson demonstrates, however, the expansion of Europe's gas marketplace has been made possible, in large part, by the European Union's (EU) concerted drive to promote competition in supply and combat Gazprom's monopolistic practices.

In their chapter, 'Energy, Coercive Diplomacy, and Sanctions' (Chap. 20), Eugene Gholz and Llewelyn Hughes further explore the potential use of energy supplies as a tool of influence and coercion. Like Henderson, they see limits to the ability of energy exporters to exploit energy in this fashion, especially as the number of suppliers to the global market grows. But they also consider the ability of major consuming states to employ their collective buying power to coerce unfriendly suppliers, through sanctions on those countries' exports. Although effective in some cases—for example, US and EU sanctions on Iranian oil exports—such measures are likely to have limited value over the long term as the center of gravity of world oil consumption shifts from the West to the East. Finally, in 'The Resource Curse Across Four Waves of Work' (Chap. 21), Victor Menaldo and William Gochberg assess the argument that possession of energy riches in otherwise economically deprived states typically leads to stilted economic growth and the concentration of power in the hands of corrupt, usually authoritarian leaders. Reviewing four waves of work on the subject, they argue that the theory of a conditional resource curse enjoys wide support in the literature. This implies that resource wealth can, in some circumstances, prove a blessing rather than a curse.

Together, these chapters provide a rich and valuable contribution to our understanding of the links between energy, economics, and state power. They demonstrate conclusively that energy affairs cannot be viewed through an economic or political lens alone, but are best seen as interconnected phenomenon, with each exerting a powerful influence on—and in turn being influenced by—the other.

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18

Do Countries Fight Over Oil?

Emily Meierding

In 2007, Russian scientists planted a titanium national flag in the seafloor under the North Pole to bolster their country's claim to the disputed territory. Three years later, Chinese scientists did the same, placing a flag in an undisclosed portion of the South China Sea's seabed. Both of these maneuvers targeted territories that are believed to contain valuable oil and natural gas resources and prompted predictions that petroleum competition could trigger interstate violence (Broad 2010). Commentators have also expressed concern that contemporary disputes in other oil-rich regions, like the Caspian Sea, East China Sea, and Eastern Mediterranean, could escalate into major international conflicts (Yeomans 2005, pp. 49–50). As oil prices rose in the mid-2000s, analysts even warned that the US and China would come to blows over oil resources (Osnos 2006). Meanwhile, scholars lend support to the belief that countries fight over oil by regularly referring to certain historical conflicts, such as the Chaco War of 1932–35 and Iraq's invasion of Kuwait as "oil wars" (e.g., Caselli et al. 2015, pp. 267–8; Colgan 2013, p. 152, p. 154, p. 172; de Soysa et al. 2011, p. 3; Klare 2001, p. 28; Westing 1986, p. 205). Although predictions of imminent Great Power oil wars have diminished in the wake of the American shale oil boom and subsequent decline in oil prices, the belief that oil competition prompts international conflicts remains robust.

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This chapter challenges that belief by arguing that countries do not fight one another over control of oil resources. Instead, they spar over oil and fight for survival. Sometimes, wars for survival target oil fields. However, labeling these contests “oil wars” misrepresents countries’ motives for aggression and oil’s ability to inspire international violence. Oil possession, on its own, is not a powerful motivator for militarized interstate conflict. Although oil is an exceptionally valuable natural resource, there are extensive obstacles to seizing and exploiting contested petroleum deposits. These obstacles reduce the payoffs of fighting over oil and thus states’ willingness to use violence to increase national petroleum endowments.

Consequently, most militarized incidents that occur in oil-endowed territories are either unconnected to states’ desire to obtain more resources or are “oil spats”: mild, usually non-lethal confrontations that state leaders quickly contain. Countries have only launched major military campaigns, targeting oil fields, on three occasions: Japan’s invasion of the Dutch East Indies (1941–42), Germany’s attacks against the Russian Caucasus (1941–42), and Iraq’s invasion of Kuwait (1990). These conflicts were not simply intensified oil spats. Instead, leaders believed that they were fighting for survival; if they failed to gain control over additional oil resources, their regimes would collapse. Were it not for this existential threat, aggressors would not have attempted to seize foreign fields.

To support this argument, the chapter first defines the term “fighting over oil” and explains why the idea that oil competition inspires interstate conflict has persisted in the popular imagination. It notes that there is little empirical support for the idea that countries fight over control of oil fields. In addition, it identifies reasons for states’ restraint: specifically, the limited payoffs from seizing foreign oil deposits and leaders’ preference for satisfying national energy needs in other ways. The chapter then discusses two distinct types of conflicts that target oil resources: oil spats and wars for survival. The former, far more common type, is illustrated through two representative case studies of conflicts that have recently reactivated: Greece and Turkey’s dispute over the Aegean Sea and Venezuela and Guyana’s disagreement over Essequibo province. Next, the chapter examines the three wars for survival. It determines that the latter conflicts only arise if three conditions are met. First, aggressors must have exhausted all other means of satisfying national oil needs. Second, they must believe that controlling additional oil is necessary for regime survival. Third, their campaign must have some chance of success. Keeping these conditions in mind, the chapter concludes that the risks posed by contemporary oil competition are very mild.

1 Fighting Over Oil: Definitions, Assumptions, and Doubt

There are many ways that countries can "fight over oil," including resisting internal secessionist challenges, as occurred in Nigeria's Biafra War (1967–70), intervening in civil wars in oil-rich states, as the US has done in Colombia, and retaliating for other countries' acts of foreign aggression, through operations like Desert Shield (1990–91) and Desert Storm (1991), launched by Coalition forces in response to Iraq's invasion of Kuwait (for other types, see: Colgan 2013). This chapter, however, focuses on one particular type of contention: interstate "oil wars." In these conflicts, which have attracted significant attention over the last decade, two or more countries forcefully compete over direct, long-term control of known or prospective oil or natural gas reservoirs. Oil may not be the only issue at stake in these contests. Yet, the desire to control additional petroleum resources must be a prominent motive for international aggression (Colgan 2013, p. 154). In addition, violence need not exceed the thousand battle death threshold conventionally used to identify conflicts as international wars (Sarkees and Wayman 2010). However, the phrase "fighting over oil" suggests that, at a minimum, conflicts involve fatalities. Thus, in this chapter, the claim that countries "fight over oil" implies that states periodically engage in fatal conflicts largely to gain direct control over petroleum resources.

The belief that countries fight over oil arises from another popular assumption: that oil wars pay. This conviction, regularly expressed by Liberal and Realist International Relations scholars, is credible at first glance (Brooks 2005, p. 49; Fettweis 2010, p. 111; Krasner 1978, pp. 336–7; and Mearsheimer 2001, p. 150). Oil is an exceptionally valuable natural resource. Control over petroleum resources enhances states' military power and energy security. Countries with abundant oil endowments can reliably supply their militaries' land, sea, and air vehicles. They are also less vulnerable to foreign supply shutoff and, consequently, possess greater foreign policy autonomy. Countries with domestic oil resources can also generate enormous revenue through resource sales. In many countries, oil rents account for the majority of gross domestic product and over 80% of export earnings. Given these economic, military, and foreign policy benefits, all states should be eager to increase their national oil endowments (Morgenthau 2005, pp. 124–9).

However, an interest in owning more oil does not automatically translate into a willingness to fight for it. Empirical tests of the claim that countries fight over oil resources have not produced robust results. Although one large-N analysis finds that oil-endowed countries are more likely to experience intense militarized interstate disputes (MIDs) than those that lack petroleum deposits, another identifies no connection between oil exports and international conflict, and a third finds that oil-endowed areas experience fewer territorial disputes (Caselli et al. 2015; de Soysa et al. 2011; Schultz 2015). Moreover, statistical analyses are likely to overstate oil's ability to inspire international conflict. Since they cannot distinguish between conflicts that are fought over control of oil and contests in which conflict and resource geography merely overlap, they run a high risk of spurious correlation. This risk declines in case study-based analyses, which can examine causal connections between oil deposits and conflict. However, qualitative researchers tend to examine only one or two cases of oil-related contention, so their results are not generalizable (e.g., Deese 1981). Overall, empirical support for the claim that countries fight for control over oil resources is weak.

There are also theoretical reasons to doubt that countries fight over oil. Although petroleum resources are extremely valuable, seizing and exploiting contested fields is challenging. Oil reservoirs and extraction and transportation infrastructure may be damaged in military campaigns, reducing the productivity of newly acquired deposits. Following a military victory, local opposition can continue to constrict oil exploration and production, through attacks on industry personnel and facilities. The international community can also retaliate for acts of international aggression by imposing economic sanctions that restrict oil sales or by using military force to compel an aggressor to relinquish oil-rich territories (for additional details on these obstacles, see: Meierding 2016). These obstacles reduce the payoffs of fighting over oil and encourage countries to adopt alternative, non-violent strategies to satisfy national energy needs.

Alternative strategies are usually available to oil consuming (importing) and oil producing (exporting) states. Oil consumers can buy the crude oil and petroleum products they require from foreign suppliers. If consumers possess domestic oil endowments, they can also expand production from known deposits or search for new ones to increase national reserves. Consumers that lack domestic oil resources can develop synthetic fuel substitutes through processes like coal gasification, as Germany did during World War II and South Africa during the apartheid era (Murphy 1979; Yergin 1991, pp. 329–33). Consumer countries can also draw on strategic petroleum reserves to compensate for brief oil supply shortages or conserve resources by using energy more efficiently. Oil producers, who primarily require oil rents, rather than physical oil supplies, can raise their resource revenue by unilaterally increasing national oil production. They can also attempt to collaborate with other producers to raise oil prices. In addition, producers can draw on foreign exchange reserves to compensate for brief price drops and rent shortfalls. Countries that are targeted by economic sanctions can attempt to sell oil through the black market.

Since countries possess alternative means of satisfying national oil needs, fighting over oil is discretionary, as well as costly. Consequently, intense conflicts over oil deposits are likely to be very rare. Although countries may compete for control over oil fields, their contests should be peaceful or limited to minor sparring. Any militarized incidents that do occur in the course of these oil spats will be limited in scope, non-lethal, and quickly contained. Under normal circumstances, it is not worth the effort to launch major campaigns, targeting oil resources.

Historically, most oil-related conflicts have conformed to this pattern. Between 1919 and 2010, over 600 MIDs occurred in territories that were known or believed to contain oil or natural gas resources (Ghosn et al. 2004; Jones et al. 1996; Palmer et al. 2015). Many of these confrontations were not driven by countries' desires to control additional petroleum deposits. Even some conflicts that are frequently labeled "oil wars" were actually fought for other reasons. The Chaco War between Bolivia and Paraguay (1932–35) was motivated by national pride and leaders' fears of further territorial dismemberment, rather than a desire to seize oil resources; both belligerents were aware, prior to the war, that commercial oil discoveries in the Chaco Boreal were unlikely (Rout 1970, p. 49, p. 144). In the Iran–Iraq War (1980–88), Saddam Hussein initially aimed to acquire only 335 km^2 of territory, which he believed Iraq had been promised in an earlier bilateral accord, and full control over the Shatt al-Arab waterway. During the early stages of the conflict, Iraq repeatedly offered a full withdrawal from Iranian territory, if these two demands were satisfied ('Iraq Envoy' 1980; Ministry of Foreign Affairs of the Republic of Iraq 1980).

Of the militarized incidents that were motivated by countries' desire to control more petroleum, most were oil spats. These confrontations were limited in scope, usually non-lethal, and tended to occur in the context of ongoing territorial disputes. Many consisted exclusively of threats: the least intense category of MID. On other occasions, countries sparred over oil by putting their armed forces on alert, mobilizing or moving troops to a contested border, or engaging in minor boundary violations: briefly entering a competitor's territorial waters or airspace, or conducting minor incursions across a shared border. Seismic survey ships and oil rigs were common focal points for these militarized confrontations. Contention between Libya and Tunisia in the mid-1970s centered on drilling platforms in contested waters ('Memorial of Tunisia' 1980). In 2000, Suriname's navy compelled a Guyanese oil rig to withdraw from disputed territory (Donovan 2003, p. 64). Regardless of geographical locale, all of these spats were actively contained by state leaders. Rather than escalating, militarized activity was either halted or settled into predictable patterns, such as regularized patrols of contested territories. Often, confrontations were followed by cooperation, including intensified efforts to settle territorial disputes through bilateral negotiations or international adjudication. These efforts frequently failed to resolve countries' underlying disagreements. However, tensions temporarily abated.

On three historical occasions, however, states abandoned their restraint and launched major military campaigns, targeting oil fields. These campaigns were Japan's invasion of the Dutch East Indies (1941–42), Germany's attacks in the Russian Caucasus (1941–42), and Iraq's invasion of Kuwait (1990). These conflicts were not intensified oil spats. Only one, the Iraqi invasion, was preceded by a long-standing, oil-related territorial dispute and that contest was dormant when Iraq launched its attack. Instead of being driven by oil greed, these campaigns were motivated by existential need. Leaders believed that they were fighting for their survival. They had exhausted all other means of satisfying national oil requirements and believed that, if they failed to obtain control over additional fields, their regimes would collapse. Consequently, they were indifferent to the inefficiency of fighting over oil. As long as aggression offered some possibility of survival, it was preferable to certain collapse.

2 Oil Spats

While international oil spats are in progress, they often attract sweeping popular attention. In May 2014, when China deployed the Haiyang Shiyou 981 rig to waters claimed by Vietnam, the contest garnered headlines worldwide (Spegele and Khahn 2014). However, after confrontations die down, oil spats fade into obscurity. Few people are aware, for example, of Bahrain and Qatar's sparring over the Hawar Islands (1930s–2001), Argentina and Chile's over the Beagle Channel (1970s–1984), Equatorial Guinea and Gabon's over control of the Corisco Bay Islands (ongoing since the 1970s), or Honduras and Nicaragua's over Gracias à Dios province and their shared maritime boundary (1950s–2007) (Calvert 2004, p. 79, pp. 453–6; Donaldson and Pratt 2005, pp. 410–11; Huth 1996, p. 203). In each of these disputes, and numerous others, competition over petroleum deposits periodically inspired militarized confrontations and interstate crises. Yet, because the incidents did not escalate into serious interstate conflicts, they have been largely forgotten.

To illustrate the dynamics of oil spats, this chapter presents two representative cases that have recently reawakened popular interest: Greece and Turkey's dispute over the Aegean Sea and Guyana and Venezuela's contest over Essequibo province. These disagreements predate oil interests; both have existed for over a century. However, in the mid-twentieth century, when participants realized that disputed territories might contain valuable petroleum deposits, oil raised the stakes in each dispute. Since then, participants' oil ambitions have periodically triggered militarized confrontations. These incidents often sparked media firestorms and intense popular hostility. However, the confrontations themselves were limited in scope and did not result in any fatalities. Leaders quickly reined in state forces and tended to downplay the incidents' significance. Once the confrontations were contained, governments usually recommitted themselves to peaceful dispute resolution processes and reactivated boundary commissions or bilateral negotiations, aimed at settling the territorial disagreements. These initiatives have not yet resolved the Aegean or Essequibo disputes. However, they have repeatedly, if temporarily, returned the contests to dormancy.

Greece and Turkey's dispute recently revived because of petroleum exploration around Cyprus. In late July 2014, the Greek Cypriot government reached an agreement with ENI, the Italian oil company, on gas investigations off the island's southeast coast. When ENI began exploring in October, Turkey deployed a warship to monitor the company's activities and dispatched its own seismic survey ship, the *Barbaros*, to Cyprus' exclusive economic zone. The Greek Cypriot government protested and suspended talks on Cyprus' political reunification (Hazou 2014). However, the confrontation did not escalate and, when the *Barbaros* withdrew in April 2015, tensions declined. Reunification talks resumed the next month, after the election of a new Turkish Cypriot president. Nonetheless, the confrontation remains a vivid reminder of a much more long-standing Greco–Turkish competition over oil resources in the Aegean Sea.

Greece and Turkey's Aegean dispute predates oil discoveries. During the first half of the twentieth century, Greece gradually extended its control over the Aegean Islands, at Turkey's expense. By 1947, Greece had acquired all but three islands and some of its possessions, including Samos and Lesbos, fell within five miles of Turkey's coast. Yet, Turkey has not contested Greece's island sovereignty.[1] Instead, the states disagree over the size of territorial waters, control over airspace, the islands' militarization, and their continental shelf boundary. The territorial sea issue is Turkey's most pressing concern. If Greece extends its current 6 nautical mile (nm) territorial sea to the 12 nm permitted by the United Nations Convention on the Law of the Sea, Turkey will lose unrestricted access to the Mediterranean through the Aegean (Pratt and Schofield 1996, p. 63).

In comparison to the territorial sea issue, control over the Aegean's oil resources is a relatively minor concern. Nonetheless, petroleum competition has inspired three militarized Greco–Turkish confrontations. The first occurred in 1973–74, in the midst of the first energy crisis. Greece had begun licensing oil exploration in the Aegean in 1970 and, over the next two years, companies made uncommercial oil and natural gas discoveries off the island of Thassos. On 1 November 1973, the Turkish government issued exploration licenses for contested territories and published a new map of its continental shelf claim. The claim extended to the Aegean Sea's median line and, while it omitted Greek islands and their 6 nm territorial seas, it included the areas outside these margins, so the islands closest to the Turkish mainland were effectively surrounded (Phylactopoulos 1974, pp. 432–41).

Turkey's actions antagonized Greece, but the states initially avoided a militarized confrontation. In May 1974, however, Turkey deployed a seismic survey ship to the contested areas. The *Candarli* conducted six days of exploration, accompanied by 32 Turkish warships. Greece issued diplomatic protests, but this did not prevent Turkey from granting additional exploration licenses. However, the oil spat was soon superseded by another confrontation: Turkey's invasion of Cyprus on 20 July. The Cyprus crisis diverted Greek and Turkish attention for months. Nonetheless, in May 1975, both countries' leaders pledged to resolve the Aegean dispute peacefully and to consider sending it to the International Court of Justice (ICJ) (Wilson 1979/80, pp. 6–7).

Before they had made any progress, however, oil exploration triggered a second confrontation. During the summer of 1976, Turkey deployed another seismic survey ship, the *Sismik-1*, to contested waters. Andreas Papandreou, leader of the Greek opposition, called for the ship to be sunk. The government, however, was more restrained. Although the Greek navy shadowed the research ship, the state did not perpetrate any other militarized actions (Schmitt 1996, p. 36; Rizas 2009, p. 380). Instead, Greece raised the issue before the United Nations Security Council and unilaterally initiated pro-

[1] The islets of Imia/Kardak are an exception; Greece and Turkey engaged in a minor MID over their sovereignty in 1996. For details, see Pratt and Schofield (1996).

ceedings before the ICJ. Neither action had much effect; the ICJ refused to take up the case and the Security Council offered only a mild resolution (Gross 1977, pp. 31–41). Yet, later that year, bilateral negotiations produced the Bern Agreement, in which both countries agreed to refrain from further oil exploration until the dispute was resolved (Schmitt 1996, p. 41).

The third oil-related confrontation occurred over a decade later. In early 1987, the Greek government announced that it planned to conduct new exploratory drilling near Thassos. When Turkey invoked the Bern Agreement, Greece—now governed by Papandreou's Panhellenic Socialist Movement (PASOK) government—asserted that it was no longer valid. In late March, both countries deployed research ships to the contested areas and put their militaries on alert. The confrontation was defused when the US and NATO pushed Greece and Turkey to stand down (Cowell 1987a, b). The states called off their drilling and, over the next few weeks, recommitted themselves to peaceful dispute resolution through bilateral negotiations or adjudication (Yuksel 2014, p. 46). Subsequent discussions did not produce a settlement. However, there have been no further oil-inspired confrontations in the Aegean itself.

Guyana and Venezuela's dispute reawakened in spring 2015, when Exxon announced Guyana's first commercial oil discovery, off the coast of Essequibo province. Guyana has controlled Essequibo for over a century. However, on 26 May, Venezuelan President Nicolas Maduro issued decree No. 1787, claiming the waters off Essequibo as "Areas of Integral Defense of Marine Zones and Islands." Venezuelan officials also demanded that Exxon cease operations in the newly discovered reservoir. Guyanese officials dismissed Maduro's interference and insisted that oil development would continue ('Venezuela makes new claim' 2015). Their confidence rests on the 1899 decision of an international arbitral tribunal, which ruled that contested territories between the Essequibo River and Venezuela's current western boundary belonged to British Guiana, Guyana's colonial predecessor. Venezuelan authorities initially accepted the panel's decision and collaborated with British Guiana to demarcate the bilateral boundary. However, the dispute was reactivated in 1949, with the posthumous publication of a letter by one of the panel's jurists, which claimed that the decision had been fraudulent. Venezuela formally reclaimed Essequibo before the United Nations General Assembly in 1962 (Braveboy-Wagner 1984, pp. 106–9, pp. 124–7, pp. 131–2).

In the dispute's earlier phase, Guyana and Venezuela competed for land, non-fuel mineral resources, and national pride. However, by the 1960s, oil had raised the stakes in the contest. British Guiana began granting offshore concessions in 1958 and issued licenses for exploration for the Takutu Basin, in Essequibo's interior, in the mid-1960s (Joseph 2008, p. 251; Wessel 1969, p. 337). Venezuela protested these activities in 1965 and claimed a 12 nm territorial sea off the Essequibo coast three years later (Ewell 1978, pp. 76–7; República de Venezuela 1982, p. 47). These oil-related maneuvers heightened bilateral tensions, but did not inspire militarized confrontations. Instead, the states signed the Port of Spain Protocol (1970), which froze the dispute for 12 years.[2]

Oil first encouraged a bilateral confrontation in 1982, as the Protocol's expiration date approached. In April, Home Oil, a Canadian company, announced that it had struck oil in the Takutu Basin. The next month, Guyana reported multiple incursions by Venezuelan troops in Essequibo, as well as repeated airspace violations. However, these militarized incidents did not escalate and, in June, when the Protocol expired, both countries reiterated their commitment to peaceful dispute resolution (Calvert 2004, p. 119; 'Walker Unit Discovers Oil' 1982). The states' next oil-related confrontation followed a similar trajectory. In 1998, Guyana began issuing new licenses for offshore oil exploration. Exxon acquired a concession for the Stabroek block, off Essequibo's coast, and announced a production sharing contract with Guyana in June 1999. Venezuela swiftly protested and, on 3 October, the 100th anniversary of the controversial arbitration decision, President Hugo Chavez reiterated his country's claim to the contested territory. Over the next few days, shots were fired from a Venezuelan garrison along the border and troop movements and airspace violations were reported. However, Venezuelan officials insisted that the activities were not aggressive and tensions died down within a week ('Border Movements on Tuesday' 1999; Denny 1999).

Oil inspired a third confrontation in October 2013, when the Venezuelan navy detained the *Teknik Perdana*, a seismic survey ship that had been exploring for Anadarko Petroleum in the waters off Essequibo. The ship was escorted to Margarita Island, but released after Guyana protested. No additional militarized actions followed. Instead, the countries' foreign ministers met, reiterated their desire to resolve the dispute peacefully, and pledged to bring their states' technical experts together to discuss maritime boundary delimitation (Sanchez 2013). Again, little substantive action was undertaken following these declarations. However, the contest was effectively, if not permanently, contained.

[2] Venezuela and Guyana did engage in a minor MID in October 1966. However, it occurred on Ankoko Island, in the midst of Guyana's gold fields, far from prospective oil resources.

3 Fights for Survival

The three fights for survival look very different from the oil spats. In these conflicts, militarized action was intense, deadly, and sustained, due partly to third-party states' subsequent involvement. None of these campaigns was simply an oil spat that spiraled out of control. Japan's invasion of the Dutch East Indies and Germany's attacks against the Caucasus occurred in the context of ongoing wars. Iraq's invasion of Kuwait, in contrast, was preceded by a long-standing, oil-related territorial dispute. However, that contest was dormant when Iraq launched its attack. These were therefore a distinct type of conflict: wars for survival, targeting oil fields. In each campaign, aggressors had exhausted all alternative means of satisfying national oil requirements, prior to launching their attacks, and believed that obtaining control over additional oil resources was necessary for regime survival. Leaders also believed that aggression had some chance of successfully maintaining their regime's survival. This section first examines the campaigns initiated by oil consumers, Germany and Japan, then the one by a producer, Iraq.

Germany possesses limited domestic oil endowments so, prior to World War II, it relied on trade and synthetic fuels production to meet national oil needs. The latter program was very productive, providing 46% of the state's fuel supplies by 1940 (Yergin 1991, p. 333). Germany also purchased oil from Romania and the Soviet Union, then two of Europe's largest producers. The country's oil supply was secure enough that, in the early stages of the European war, Germany exhibited little interest in seizing direct control over additional oil deposits. Hitler did not insist on acquiring all of Poland's oil fields, in Galicia, when he split the country with Stalin in 1939. Nor did the Germans attempt to increase production from Austrian fields following the Anschluss (Goralski and Freeburg 1987, pp. 29–32).

Instead, Germany strengthened trade relationships with its main suppliers. Following the state's rapid victories in Western Europe, Romania quickly capitulated to German demands for more oil. A bilateral pact in May 1940 doubled Romania's exports to Germany. By August, personnel from Allied state oil companies had been forced out of the country and a commissar took control of oil production, directing most of Romania's surplus toward Germany. A month later, a pro-German government took power in Bucharest and, in October, Nazi forces peacefully occupied Romania's oil fields (Pearton 1971). Germany had therefore acquired control over additional oil resources, without having to fight for them.

Increasing oil supplies from the Soviet Union, however, was a larger challenge. The two countries signed major commercial agreements in 1939 and 1940, which promised Soviet raw material exports to Germany. However, Stalin repeatedly suspended oil shipments because of political disagreements and to retaliate for the Nazis' failure to deliver promised manufactured goods (Ericson 1999). The Soviet Union also threatened German energy security by seizing the territory of Bessarabia from Romania. This acquisition, in June 1940, brought the Soviets within 120 miles of Romania's main oil fields at Ploesti: too close for German comfort (Yergin 1991, p. 335).

By July 1940, Hitler had decided to attack the Soviet Union, for a combination of ideological, strategic, and economic reasons (for details, see Overy 1997). Although oil was one of his concerns, his initial petroleum-related goals were not to obtain additional oil supplies for Germany. Rather, he aimed at defense and denial: preventing Soviet attacks on Ploesti by seizing the Crimean Peninsula and interrupting fuel supplies for the Soviet military by directing part of *Operation Barbarossa* toward the Caucasus' rich oil fields (Goralski and Freeburg 1987, pp. 79–80). However, as the Russian campaign bogged down, acquiring more oil for the Nazi war machine became a strategic necessity. Without it, Germany would not be able to sustain its war against the Soviet Union and Great Britain (Trevor-Roper 1964, Directive No. 45). Thus, in June 1942, the Germans launched a new offensive, *Operation Blau*, which specifically targeted the oil fields at Maikop, Grozny, and Baku. Success was imperative. As Hitler told one of his Field Marshals, "Unless we get the Baku oil, the war is lost" (Yergin 1991, p. 337).

Hitler believed that the campaign had a good chance of succeeding and, during its first few months, German forces rewarded his optimism, seizing Maikop in August. However, the area's fields were one-tenth the size of Baku's and had been heavily damaged by retreating Soviet forces. The Soviets subsequently blocked the continuing German advance at well-defended mountain passes leading to Baku. Suffering from debilitating fuel shortages, Germany was forced to retreat from the Caucasus in January 1943. From that point on, inadequate oil access would cripple the German army, contributing to its defeat in the war (Yergin 1991, pp. 339–50, pp. 386–8).

Japan's aggression against the oil fields of the Dutch East Indies and British Borneo followed a similar trajectory. Like Germany, Japan possesses few domestic oil endowments and relies on trade to meet national energy needs. In the 1930s, Japan purchased 80 % of its imported petroleum supplies from the US and obtained much of the rest from Sumatra and Borneo (Goralski and Freeburg 1987, p. 93). Unlike Germany, Japan was not able to develop an effective synthetic fuels program. In addition, Japan's attempts to enhance its energy security by acquiring oil concessions in countries like Mexico and Ecuador met with little success (Levy 1942). Japan was therefore exceptionally dependent on international trade to satisfy national oil requirements.

This trade was threatened by Japan's aggression in East Asia. Numerous countries, including the US, criticized Japan's war with China, which began in July 1937. The American government implemented a voluntary "moral embargo" in 1938, asking companies to refrain from selling aircraft to Japan. In December 1939, the moral embargo was extended to include aviation fuel and, in July 1940, the US imposed a formal licensing system for exports of aviation fuel and lubricating oil.

In response to these restrictions, Japan attempted to strengthen commercial ties with other oil producers. Japanese officials repeatedly met with Dutch authorities and oil companies in the East Indies, trying to persuade them to increase petroleum shipments. These entreaties generated a moderate uptick in oil supplies, but failed to satisfy Tokyo's demands. In June 1941, the Dutch terminated negotiations (Goralski and Freeburg 1987, pp. 94–8). A month later, Japan's oil crisis deepened. On 25 July, the American government froze all Japanese assets in the US, in response to Japan's advance into southern Indochina. The freeze became a de facto embargo, as the government issued no additional oil export licenses. Great Britain and the Netherlands also cut off their oil exports, so foreign oil flows to Japan ceased (Feis 1950, pp. 206–7, p. 261).

Japanese leaders realized that, if the supply shutoff continued, they would rapidly exhaust domestic oil stockpiles and be forced to terminate the war with China. Throughout the autumn of 1941, officials attempted to persuade the US to lift the embargo. However, these diplomatic efforts failed, due to American mistrust of Japanese intentions and Japan's resistance to conceding to the US's demand for a full withdrawal from China. The Japanese perceived a loss in China as a threat to national survival. As Japanese Foreign Minister Shigenori Togo claimed in a leaders' meeting: "For the United States to insist that Japan disregard the sacrifices she is making in China is tantamount to telling us to commit suicide" (Ike 1967, p. 246; see also US Department of State 1943, p. 662, p. 676). Another official concurred: "It is impossible, from the standpoint of our domestic political situation and of our self-preservation, to accept all of the American demands" (Ike 1967, p. 236).

Japan's leaders believed that the only possible alternative to regime collapse was to seize the oil fields of the Dutch East Indies and British Borneo. They were not optimistic about the likely outcome of this campaign, as they knew that an invasion would trigger a war with the US, even if Japan refrained from attacking American territory. They chose to accompany their invasions with an attack on Pearl Harbor because they believed that it would hinder the US's response. However, they suspected that, in the long run, they would still be militarily outmatched (Ike 1967, p. 131, p. 153, p. 181). Nonetheless, aggression had a slight chance of succeeding, so it was preferable to certain defeat.

Iraq's invasion of Kuwait diverges somewhat from the previous two cases. In contrast to Germany and Japan, Iraq was not involved in an ongoing war when it launched its attack. It was also an oil producer, instead of a consumer, so its primary resource-related requirement was to obtain enough rents from oil sales to fulfill national budgetary commitments. By 1990, Iraq was having difficulty meeting this need. The state had emerged from the 1980–88 war with Iran with $80 billion in debts and massive reconstruction needs. Meanwhile, international oil prices were declining, partly due to other OPEC members exceeding their production quotas (Stein 1992, p. 158). If revenue failed to rise, the Iraqi government would not be able to pay salaries and sustain social spending, threatening regime security.

Iraq initially responded to the economic crisis with diplomatic initiatives. Officials were dispatched to negotiate with Iraq's Arab lenders, asking them to forgive Iraqi debts and adhere to their production quotas. Some countries were amenable, but others rebuffed Iraqi entreaties. Kuwait, in particular, refused to forgive its loans to Iraq, in spite of the protection the Iraqis had offered during the Iran–Iraq War. Kuwaiti officials also resisted adherence to their oil quota and even suggested scrapping the system entirely (Khadduri and Ghareeb 1997, pp. 86–7, pp. 115–17; Kostiner 1993, p. 112). Saddam Hussein was so incensed by this behavior that he accused Kuwait and the United Arab Emirates of waging economic warfare against Iraq (Schofield 1995, p. 783).

Saddam's sense of insecurity was exacerbated by his belief that the Gulf states' behavior was being driven by the US. As he asserted in a letter to the Arab League, "The Kuwaiti government's policy was a US policy" (Schofield 1995, p. 795). Saddam had numerous reasons to suspect American hostility toward his rule, including the US's support for a Kurdish rebellion in the 1970s and the Iran–Contra Affair, in which the US covertly supplied arms to Iran, while ostensibly siding with Iraq in its war against Khomeini's revolutionary regime (Brands and Palkki 2012, p. 625). Saddam's suspicions of American intentions increased in the 18 months preceding the invasion, as the US threatened sanctions, restricted Iraq's access to American agricultural exports, and compared his regime to recently fallen Eastern European governments (Stein 1992, pp. 161–5).

By summer 1990, Saddam was convinced that the US was determined to overthrow his regime. He believed that, if the manipulation of oil prices failed to unseat him, his adversary would turn to assassination attempts or a direct attack, probably in conjunction with Israel.[3] In the face of this implacable enmity, inaction would inevitably lead to defeat. In contrast, seizing Kuwait offered the possibility of regime survival. After invading its neighbor, Iraq would control 20% of global oil reserves, augmenting the amount of oil it could sell and increasing its influence over oil prices. It would also control the entirety of the transboundary Rumailah oil field.[4] In addition, by occupying the entirety of Kuwait, Iraq could constrain American retaliation. Saddam assumed, mistakenly, that Saudi Arabia would not allow Western troops to operate from its territory (Heikal 1993, p. 244).

Iraqi officials were not entirely sanguine about the outcome of their attack. Contrary to popular belief, they were aware that invading Kuwait would provoke a militarized American response (Aziz 1996; al-Samarai 1996). However, Saddam expected that retaliation would stop short of a complete Iraqi defeat. Aggression was therefore the only viable action; it offered a possibility of survival, whereas inaction would lead to eventual collapse. As Iraqi Foreign Minister Tariq Aziz asserted, "We were pushed into a fatal struggle in the sense of a struggle in which your fate will be decided. You will either be hit inside your house and destroyed, economically and militarily. Or you go outside and attack the enemy" (Aziz 1996). Saddam believed that he was fighting a war for survival.

4 Conclusion

Most previous studies of international, oil-related conflicts have focused on extreme cases: so-called oil wars like World War II or Iraq's invasion of Kuwait. As a result, they have overestimated the risks posed by oil competition. By adopting a more holistic approach, this chapter has demonstrated that major interstate conflicts, targeting oil fields, are exceptional. Most contests for control over oil resources are merely oil spats, which do not escalate into serious conflicts. Contemporary competitions in areas like the Arctic, Caspian Sea, East China Sea, Eastern Mediterranean, and South China Sea have thus far fallen into this category. Although oil-related confrontations, like the 2014 Sino-Vietnamese rig incident or Turkey's deploy-

[3] Document SH-PDWN-D-000-534, undated, Saddam Hussein Regime Collection, Conflict Records Research Center, National Defense University, Washington, DC.

[4] Competition over Rumailah's oil reserves is often cited as a reason for Iraq's invasion. However, this issue was raised very late in the dispute; Iraqi officials did not formally complain about Kuwait's slant drilling into the reservoir until 15 July 1990, two weeks before the invasion (Schofield 1995, p. 783).

ment of the *Barbaros* in 2014–15, occur periodically, leaders have prevented the incidents from intensifying. They are likely to maintain this restraint in the future. As the chapter's historical analysis demonstrates, even rival states, with defense guarantees from foreign powers and hostile domestic populations, do not intensify oil spats. Regional petroleum competition is therefore not a serious threat to international security. Although claimant countries may eventually fight over other issues, such as control over sea lanes, regional hegemony, or national pride, oil competition will not be the trigger for these conflicts.

Meanwhile, wars for survival, targeting oil resources, are currently improbable, both because of their historical rarity and because contemporary oil consumers and producers are unlikely to experience the three necessary conditions for launching major campaigns against foreign fields. Consumers like the US, China, and the European Union can rely on international trade to meet national import needs without compromising national energy security. Supply shutoffs, like the OPEC embargo in 1973–74, are unlikely, due to a lack of coordination among major producers. They are also unthreatening because of the oil market's current diversity and flexibility. Moreover, even in 1975, in the aftermath of the first energy crisis, American authorities concluded that it was not worth the effort to seize Middle Eastern oil fields (Congressional Research Service 1975). Today's consumers are even less inclined to do so.

Producers will also refrain from using intense militarized force to increase national oil endowments. This restraint arises as much from a lack of capacity as from a lack of will. States like Algeria, Angola, Iraq, Nigeria, and Venezuela have strong incentives to increase national oil reserves and revenue, due to their intense dependence on oil rents and their small foreign exchange reserves, which make them highly vulnerable to oil price drops. However, they lack promising targets for international aggression. Angola and Nigeria's neighbors are small producers, while Algeria has little to gain from seizing Libya's disordered petroleum industry. Venezuela has a more appealing target in Colombia, but is weaker than its neighbor, so Caracas is unlikely to launch an attack. Iraq is also constrained, both by Iran's military strength and by the certainty of a vigorous third-party response to another assault on Kuwait. Thus, today's producers, as well as consumers, are unlikely aggressors. States may continue to spar for control over oil. However, they will not fight over it.

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19

Does Russia Have a Potent Gas Weapon?

James Henderson

1 Introduction

For the majority of the twentieth and twenty-first centuries, Soviet and now Russian leaders have insisted that Russia is a large and powerful country worthy of Great Power status on the global political and economic stage. Its military might may have been undermined by economic turbulence in the post-Soviet period, but two Chechen wars, a brief invasion of Georgia and the 2014 Ukraine crisis have demonstrated Russia's willingness to assert itself using its armed forces. Economically, though, Russia's strength is largely based on its hydrocarbon industry, with oil and gas accounting for around 20 % of GDP, approximately two-thirds of exports and around 50 % of federal budget revenues (Henderson and Pirani 2014, pp. 7–8). Given the strategic nature of energy in the global economy, and the political importance of security of supply wherever oil and gas are consumed, it is hardly surprising that Russia's hydrocarbon exports are perceived as a prospective source of significant political leverage, in other words a potential *energy weapon* that could be used to threaten or exert pressure on consuming countries. In particular, this is seen as a potential threat in the gas sector where one state-controlled company, Gazprom, controls vast resources within Russia and monopolises export sales.

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Gazprom owns two-thirds of Russia's gas reserves, with its 23.5 trillion cubic metres (tcm) ranking it as by far the largest gas company in the world (Gazprom 2014, p. 4); indeed, if it were a country in its own right, it would be ranked in third place behind only Iran and Qatar (BP 2015). More importantly from a political perspective, it supplies more than 30 % of European gas demand, and is the sole or dominant supplier to a number of Central and East European countries and members of the former Soviet Union (FSU) (Stern et al. 2014, pp. 6–9). The fact that all of this gas comes via a vast trunk pipeline system that umbilically connects Russian supply with European demand adds further to the security of supply concerns, with the potential for disruptions being easy to imagine. Indeed, the image of Gazprom's political master, Russian president Vladimir Putin, threatening to turn the lever cutting off European gas supply is often painted and has powerful emotive force, especially during the winter months (Putin threatens to turn off Europe's gas supply 2014). Furthermore, it is clear that Putin does exert very significant influence over Russia's state-controlled gas company, not just by virtue of the state's 51 % stake but also through the appointments of senior management—most of whom are old associates or government ministers (Gentleman 2001). As a result, many commentators have rightly suggested that it would be naïve in the extreme to believe that there is no political motive behind many of Gazprom's decisions concerning gas exports, and, as will be discussed later in this paper, there are a number of examples where commercial pressure has been brought to bear at times when a political outcome is also the objective.

This mercantilist view of international politics, espoused by Robert Gilpin (1987) and others, would suggest that Gazprom's entire strategy is in fact driven by national interest rather than commercial logic, and that we can therefore interpret many of the company's tactics as aimed at influencing the policies of gas-purchasing countries in Europe and the FSU. Examples often cited include differential gas pricing between countries, with Russia's friends receiving significant discounts, the threat of gas interruptions for countries in dispute with Russia and the actual halting of gas flows in extreme cases, such as Georgia in 2006. Furthermore, the Ukraine crisis, which started with the annexation of Crimea in March 2014 and has escalated into an armed conflict in East Ukraine, has increased concern that one of the main transit pipelines for Russian gas to Europe could be interrupted if the Kremlin decides to exert pressure either on Ukraine itself or on Europe as a whole by using its gas weapon. Broader concerns about Russia's overall foreign policy intentions have expanded this fear to cover the risk of supply through all pipelines carrying Russian gas to Europe, and have led to calls from senior political leaders within the European Union (EU) and the USA to prevent new pipeline construction and pursue a diversification strategy for Europe that will reduce its dependence on Russian gas (Simon 2015). For example, former Polish prime minister and current EU Council president Donald Tusk has urged that Europe confront the dominance of Russia's position in the gas market and has warned that countries such as Germany risk being exposed to an 'addiction to Russian gas' (Tusk 2014; Tusk warns Merkel against Russian gas addiction 2014).

However, although concern is understandable, and on occasion politically useful, the reality of the mercantilist approach to foreign policy is that politically driven commercial pressure can be met with a commercial response. Furthermore, any energy weapon in a global energy market can become a weakness as well as a strength if the forces of international trade start to work in the buyers' favour, or if the buyers take steps to multiply their purchasing options. In the case of European gas, the market has long been dominated by a few suppliers (Russia being the largest) within a regional market where a few large utilities have been the main buyers. However, this monopolistic situation is now being broken down by the increasing prevalence of liquefied natural gas (LNG) in a global gas market and by changes in the market structure which are being encouraged by EU legislation and regulation. As a result, the key question for this chapter will be not whether Russia has a gas weapon but rather how potent it really is, in a world where there is a clear interdependency between Gazprom and its customers and where those customers are increasingly able to create a competitive environment for energy supply.

2 Gazprom as a Domestic and Foreign Policy Tool

There would seem to be little doubt that, despite the company's privatisation in 1994 and the fact that private investors own 49 % of the company,[1] President Putin regards Gazprom as a state entity to be commanded by the Kremlin. His oft-cited PhD thesis makes it clear that as far as the energy industry is concerned, 'the state has the right to regulate the process of their [the country's energy resources] development and use' (Goldman 2010, p. 98), while his influence over Gazprom itself was underlined by Vladimir Milov, the Deputy Minister for Energy in 2002, who stated that 'Putin effectively controls the company and makes all key decisions about its strategy' (Ostrovsky 2006). Subsequent commentators have been in little doubt about who drives

[1] http://www.gazprom.com/about/history/company/.

the company, with Marshall Goldman, for example, asserting that it is ‘hard to tell where Putin begins and Gazprom ends’ (Goldman 2010, p. 143), and it was clear from the first senior appointments made after Putin became president in 2000 that he planned to dominate the company. Dmitry Medvedev and Alexei Miller, both associates from Putin’s days as a Party official in St Petersburg, became chairman and chief executive respectively, and subsequent appointments of government ministers to the company’s board of directors have confirmed the Kremlin’s authority (Dawisha 2015, pp. 280–285).

This political control has been useful in a domestic as well as a foreign policy context. Gazprom dominates the Russian gas sector, not only due to the fact that it owns the majority of the country’s reserves and production as well as the trunk gas pipeline system (the United Gas Supply System) but also because following the arrival of Putin as president the company began consolidating its ownership of Russia’s gas distribution network. By 2004, it controlled 75 % of the country’s distribution pipelines and owned 206 of 330 distribution companies, allowing the Kremlin to exert significant economic, and by default political, pressure over the country as a whole via the medium of energy supply (Stern 2005, pp. 38–40). In effect, regions, regional governments or local businesses could be threatened with gas ‘issues’, such as reductions or interruptions in supply if a dispute with the central government arose, providing a powerful bargaining chip for the Kremlin.

In a similar fashion, gas infrastructure has played a key role in Russia’s relations with its FSU neighbours and then, by default, its European customers. Effectively, since the break-up of the Soviet Union in 1991, Russia and other former members of the Soviet Union, in particular Ukraine but also Belarus and the Central Asian states, have struggled to address the problem of transitioning from a situation where one combined state—the USSR—owned significant gas reserves and a vast pipeline system stretching to the borders of Europe to a new reality where one country (Russia) controls gas supply while others (Ukraine, Belarus and other FSU countries) rely on that supply but also have significant influence over its delivery to important export customers. Through the 1990s and early 2000s, Russia has consistently debated the balance of a fair gas price and cost of transit with Ukraine and Belarus, with Gazprom always keen to see the price approach international levels while the governments in Kiev and Minsk insisted on their need for low prices and used their implicit strategic position within the Russian sphere of influence and their provision of security of transport for Russian gas exports as important bargaining chips. Various remedies to the pricing issue were attempted, including the direct supply of Central Asian gas to European markets and the use of intermediaries, such as RosUkrEnergo (RUE) and EuralTransGas, which provided a middleman for Gazprom in negotiations with Naftogaz Ukrainy (the Ukrainian gas provider) and the Ukrainian authorities. However, by the mid-2000s it had become clear that, with European gas prices rising rapidly in line with the oil price, Gazprom would need to take a direct hand in negotiations if the price discount enjoyed by Ukraine was to be reduced (Henderson 2015, pp. 2–6).

3 Two Disputes with Ukraine

This new Russian strategy led to a series of annual negotiations with Ukrainian officials—normally held in late December—where the next year's gas contract was discussed, including agreements on price and volume. Given the importance of the outcome to both countries, the debates tended to continue to the very last moment, with the underlying threat of a cessation of supply from the Russian side matched by the threat of a cut in transit of exports to Europe by Ukraine. This threat finally materialised in January 2006, when at the height of the annual disagreement, Russia withheld the gas supply intended for Ukraine and the Ukrainians started to syphon off gas intended for the European market (but which it believed it was owed by Russia), causing shortfalls in a number of countries in the south-east of the continent (Pirani et al. 2009, pp. 5–11). Although no Gazprom customer suffered a complete cessation of supply, and the interruption was very brief and indeed was hardly noticed in some countries, the impact of the incident on Russian export strategy was profound. For President Putin, it confirmed his view that Russia needed to continue its tactic of removing Ukrainian transit risk, already started via the building of the Yamal–Europe pipeline (via Belarus and Poland), the Blue Stream pipeline to Turkey and the plans for the Nord Stream line across the Baltic Sea, by creating a new line through the Black Sea (South Stream) to finally free Russia of its reliance on a potentially disruptive neighbour (Hendetson and Mitrova 2015, pp. 57–59).

A key question, though, is whether there was a political dynamic in this 2006 dispute. In one sense, as identified by Pirani et al. (2009), the answer is no, because the brief gas interruption came as a result of efforts to resolve both a pricing dispute and also the issue of the transit contract, which raised a further question of the possibility of Gazprom gaining an equity stake in the Ukraine pipeline system. However, in another sense, gas supply and gas transit were, and continue to be, so intrinsically linked to Ukraine's relationship with Russia—with the former striving to assert its independence and the latter attempting to retain continued influence—that political considerations were undoubtedly part of the equation. In 2006, the situation was further confused by the complex commercial arrangements surrounding gas supply from both Russia and Central Asia to Ukraine via the intermediary companies mentioned above, which were linked to Gazprom and allegedly to Ukrainian and Russian businessmen and politicians. As a result, the potent cocktail of power and money was evident beneath the surface of the debate, even though Gazprom's commercial arguments were the overt reason for the dispute (Pirani et al. 2009, p. 41).

The 2006 dispute was ended thanks to the signing of gas supply and transport contracts which satisfied both parties and that did not lead to any Russian ownership of Ukrainian infrastructure but did continue the use of an intermediary trader, RUE, 50 % owned by Gazprom. However, in less than 12 months, the gas issue was again politicised thanks to the removal of Kremlin-friendly Ukrainian president Viktor Yanukovich in the 'Orange Revolution' of 2004–2005 and his replacement by the much more Western-oriented President Viktor Yushchenko and his assertive Prime Minster Yulia Timoshenko (Karatnycky 2005). Both were keen to move Ukraine further away from Russia's orbit and also to break the control of intermediary traders over gas imports to Ukraine, while also attempting to minimise the price for Russian gas. Unfortunately, they were hampered by a rising oil, and consequently gas, price in Europe (prices for gas in Europe under long-term contracts have frequently been tied to the price of oil or oil products) as well as the growing debts of Ukrainian gas company Naftogaz, which had fallen into arrears with Gazprom. As a result, by the end of 2008 the Russian gas company had a strong commercial argument both to demand a higher gas price from Ukraine and also to demand repayment of debts owed to it for previous gas sales (Pirani et al. 2009, pp. 12–18).

Negotiations on a new gas price for 2009 and the repayment of more than $2 billion of debt to Gazprom continued through the fourth quarter of 2008, but by the end of the year no agreement had been reached and on 1 January all supply to Ukraine was cut off. The Ukrainian authorities responded by taking what they argued was 'technical gas' from the system but which Gazprom argued was theft of gas meant for transit to Europe, with the result that Gazprom then reduced and finally cut off all gas in the pipeline, leading to a two-week interruption of Russian gas exports to Europe in the middle of winter. Commercially, this appeared to be a disaster for Gazprom, denying it export revenues, leaving it open to fines from customers for undelivered gas and destroying its reputation, built up over 40 years, as a secure energy supplier. The only logic, therefore, appeared to be a political desire by the Kremlin to punish a Ukrainian government that had come to power at the expense of the former Russia-friendly president, to pull Europe into a dispute over ownership and control of the Ukraine transit pipeline (Russia was keen to encourage tripartite ownership between Russia, Ukraine and the EU) and to extract political concessions from Ukrainian authorities (Pirani et al. 2009, p. 31).

Interestingly, though, the immediate result of the dispute, which ended with the resumption of gas supply to Ukraine and Europe on 20 January 2009, did not appear to bring much immediate political benefit for the Kremlin. New ten-year gas supply and transit contracts were signed, with specific price provisions that would see the gas price rise to 100 % of the European level by 2010, while the transit contract provided for new higher prices and a commitment to security of supply by Ukraine. However, perhaps the most important outcome was that the deal laid the ground for future conflict, as the gas price established in the new contract was so high it was almost bound to create another payment crisis, providing a new opportunity for further political bargaining. Indeed, it was interesting to note that President Yushchenko was already calling the agreement, which had been signed by Prime Minister Timoshenko, a 'bad deal' only days after it had come into force (Barber 2009).

In one sense then, the Kremlin had at least made a small political gain by creating disunity among the Ukrainian authorities, but the real victory came when the Ukrainian government was forced to return to the negotiating table in 2010 as Naftogaz again struggled to make payments at the new higher gas price (Pirani et al. 2010, pp. 6–11). Rather than threatening a gas interruption, Gazprom was this time encouraged to offer a significant price discount (30 %) in return for Russia securing a 25-year extension on the lease of the Black Sea naval base at Sevastopol, with the final agreement also being catalysed by the return of Viktor Yanukovich to the presidency of Ukraine following electoral defeat for Yushchenko in April 2010 (Osborn 2010a).

As such, the Russian strategy of using a commercial row to underpin a renegotiation of gas contracts with the potential for political benefits had been clearly established, but one key facet of this tactic is that it was also based on Russia's dominant position as the only supplier of Ukrainian gas imports. Ukraine does have indigenous gas production, with output of around 19 billion cubic metres (bcm) in 2010 (BP 2015), but with demand of over 50 bcm in the same year, gas imports from Russia were clearly essential. Furthermore, Gazprom was able to exert increased commercial pressure by permitting Naftogaz's debts for gas purchases to build up, allowing the Kremlin to pick the optimal time to make repayment a major issue, while the return of a

Russia-friendly president also facilitated the final agreement, which saw a commercial problem resolved via a political/military solution.

However, any political gain brought with it a significant longer-term commercial issue, as the dispute highlighted the security of supply risk inherent in Ukraine transit for the EU, catalysing discussion about the need to diversify away from Russian gas. European exports are the largest source of Gazprom's gas revenues (accounting for almost 60 % in 2014) (Gazprom 2015) and also contribute up to 5 % of Russia's budget revenues (Mitrova 2014), meaning that this change in European outlook has become a significant issue for the Russian government. Indeed, the clear mutual interdependence between Russia and Europe highlights an obvious weakness in the potential use of gas exports as a weapon by the Kremlin, given the need for continued gas sales to Gazprom's major export market. Europe is obviously vulnerable to an interruption in the short term, but any disruption (or even threat of it) undermines Russia's long-term ability to maximise its export revenues.

4 Similar Problems with Belarus

Similar characteristics also presented themselves in three comparable gas crises involving another former Soviet state, Belarus, in 2004, 2007 and 2010. All three cases involved comparable elements to the Ukraine disputes described above, with the commercial catalysts being Gazprom's desire to improve the terms of its trade by increasing prices towards international levels, as well as to gain some control over the Belarusian gas transport system, run by Beltransgaz. Meanwhile, an underlying political dynamic was also evident as the Russian government appeared to be determined to reset its relationship with Belarus after its plans in the 1990s to integrate the country more fully into Russia had failed, with the ultimate goal of encouraging Belarus to join an Economic Union with Russia and Kazakhstan that was due to commence in 2012 (Yafimava 2010, p. 3).

The 2004 dispute was relatively simple, with Belarus refusing to pay a higher tariff for gas supply, at which point Gazprom responded by reducing flows through the pipeline. Belarus then countered by taking gas out of the export pipe to Europe, at which point Gazprom cut off all supplies through that pipe as well. However, this situation only lasted for one day, before Belarus signed short-term gas contracts with some Russian independent producers, providing a first example of diversification as a response to Gazprom pressure. Finally, a new contract with Gazprom was signed six months later and relations were normalised again, with Gazprom also paying a higher transit tariff.

As a result, it appeared that both sides had achieved reasonable outcomes (Yafimava 2010, p. 5).

By 2007, though, the oil price had risen towards $100 per barrel, taking gas prices with it, and Gazprom had reconfirmed its commitment not only to ‘equivalent pricing’ for all its customers but also to taking a stake in Beltransgaz. Effectively, the Russian company offset one goal against the other in this instance, as when Belarus refused to pay a higher gas price—$200 per million cubic metres (mcm)—Gazprom offered a compromise by halving the tariff to $100 in return for being able to buy a 50 % interest in Beltransgaz for $2.5 billion, well below the Belarusian government’s valuation of $17.5 billion (although this was no doubt inflated for effect) (Gazprom finally bags Beltransgaz 2011). As a result, Russia was able to use commercial leverage to gain more control over Belarusian infrastructure, increasing its influence in the country.

In 2010, though, the situation had become even more complex due to the impact of the 2008 economic crisis on Belarus, the continuation of high gas prices, Russia’s desire to bring Belarus into its new Economic Union and the announcement of plans to build the Nord Stream pipeline that would offer Russia a bypass route which would weaken the bargaining position of both Belarus and Ukraine in gas negotiations. The commercial catalyst for the crisis, though, was the rather imprecise nature of the 2007 agreements, which had allowed room for continuing negotiation and interim arrangements between politicians keen to offer favours and create new spheres of influence (Yafimava 2010, pp. 8–12). For example, when gas prices had risen sharply in 2008–2009 due to the increase in the oil price to $147 per barrel, Belarus had been informally granted permission to pay an average annual price to smooth the impact, but no official agreement on the issue had been reached with the result that, based on actual prices, Beltransgaz’s debts to Gazprom had risen to $500 million by mid-2010. This may have been a deliberate ploy by the Russian government to create some bargaining leverage, but in any case by June of that year President Medvedev agreed that Gazprom should reduce gas volumes until the debt had been repaid. This set off a series of moves and countermoves by both sides involving demand for repayment of debts for gas sales and gas transportation fees followed by threats to interrupt gas volumes and gas transit, with Belarus understanding that this could be one of its last opportunities to use its leverage as a transit country prior to the construction of Nord Stream. Indeed, EU countries were warned by both sides that supplies to the continent could be cut, although the fact that it was midsummer made this a less serious issue, and indeed no countries reported a serious loss of pressure (Osborn 2010c).

Politically, the row became gradually more heated, as Belarusian president Lukashenko and Russian prime minister Putin (as he then was) made increasingly pointed comments about the benefits or otherwise of the Customs Union, and indeed it appears that this issue may have been the subtext for the entire dispute (Osborn 2010b). Belarus had clearly been trying to assert some form of independence from Russia prior to agreeing to join the Customs Union, for example, by failing to acknowledge the independent status of South Ossetia and Abkhazia as well as offering asylum to an ousted Kyrgiz president, much to the annoyance of the Kremlin (Lukashenko blames Russia for Minsk's failure to recognise Abkhazia and South Ossetia 2010). Meanwhile, it had also argued that prices and taxes within the Customs Union should be much lower, and indeed it did ultimately achieve its goal, receiving a lower gas price based on the Russian domestic tariff rather than a netback price founded on the European price,[2] as part of its agreement to join the Customs Union in July 2010. As a result, once again Russia did achieve some limited success in securing a political goal (creation of the Customs Union) via a commercial tactic, although arguably it did have to make very significant concessions to achieve its objective (Kramer 2010).

5 Explosive Issues with Georgia and Turkmenistan

Two other examples of apparent use of a gas weapon are worth mentioning briefly, as both involved a more aggressive approach. Firstly, after the 2003 Rose Revolution in Georgia, during which Eduard Shevardnadze was replaced as president by Mikheil Saakashvili, Russia responded by, among other things, starting to increase gas prices. More specifically, though, as Georgia and Saakashvili accelerated their shift towards the West, ultimately applying for NATO (North Atlantic Treaty Organisation) membership and receiving weapons from the Czech Republic, Russia responded by cutting off gas supplies altogether in the guise of an explosion on the gas export pipeline in January 2006, which also coincided with an explosion that destroyed the main electricity lines between the two countries (Walsh 2006). The explosions were later revealed to have been the work of saboteurs, although both sides claimed that the other had been responsible and no ultimate proof was

[2] A netback price is, in this instance, the gross gas price for Russian gas in Europe netted back to Belarus by removing transport costs and export taxes to derive an equivalent price in Belarus.

established. Nevertheless, even if one acknowledges that the most likely reason for the cut-off was a Russian desire to punish Georgia for its shifting political stance and an attempt to persuade it to return to the Russian sphere of influence, the actual result was that Georgia responded by actively seeking to remove itself further from Russian control by searching for alternative sources of energy supply (Gas flowing to crisis hit Georgia 2006). Saakashvili announced that 80 % of gas imports would in future come from Azerbaijan, while he also signed an import contract with Iran, and although Georgia has subsequently recommenced gas imports from Russia, they are now part of a diversified gas portfolio with prices set on commercial terms (Saakashvili: Georgia, Azerbaijan Strike Five-Year Gas Deal 2008). Indeed Russia's bargaining power using its 'gas weapon' has diminished so much that it has needed to resort to alternative commercial measures to exert political pressure, such as restricting imports of Georgian wine, fruits and vegetables.

Another gas pipeline explosion was used by Gazprom to alter the dynamics of its relationship with Turkmenistan in 2009, at a time when the country was in the early years of the presidency of Gurbanguly Berdimuhamedov and therefore perceived as more susceptible to political pressure than under its previous and long-established first president, Saparmurat Nyazov (Gorst 2009). Throughout the post-Soviet era, Gazprom had controlled gas supply from Central Asia due to the fact that the Soviet pipeline system only allowed gas to flow from the region through Russia to Europe. As a result, Gazprom had been able to demand a low gas price, making a large profit on resale to the export market; at the same time, Russia had been able to exert significant political influence due to its dominance of the energy relationship, and was keen to extend that influence by encouraging Turkmenistan to allocate gas from its huge Galkynysh field to Russia.

However, two factors served to catalyse a shift in this relationship. Firstly, all the Central Asian countries, including Turkmenistan, started to court China and Europe directly for export sales via new pipelines. Although European countries had struggled to fund the infrastructure required, China began constructing a pipeline in mid-2008, which in turn forced Gazprom to offer a higher competitive gas price in order to retain its own, and Russia's, influence in the region.[3] The 2008–2009 economic crisis, and the subsequent decline in demand for energy across Europe and the FSU, meant that Gazprom over-contracted for Turkmen gas at the new higher price, and then attempted to get out of the deal. It is not clear exactly what happened next, but it appears

[3] http://www.cnpc.com.cn/en/FlowofnaturalgasfromCentralAsia/FlowofnaturalgasfromCentralAsia2.shtml, accessed on 16 August 2015.

that either the Russian side caused the gas pipeline to explode deliberately (as alleged by the Turkmen government) (Gurt and Auyezov 2009) or alternatively just reduced its offtake of gas from the line so dramatically that it exploded through operational problems; in either case, Gazprom seems to have tried to force Turkmenistan to reduce gas flows by using its control of the only existing export pipeline (Daly 2009).

Once again, however, the response was not compliance with Russian wishes but an increased drive to diversify away from sales to Gazprom. Once the pipeline had been repaired, a new agreement between the Turkmen authorities and Gazprom was reached, using the same high price (equivalent to a European netback price) but lower volumes, with the Turkmens selling the surplus to China and Iran while also continuing negotiations with the EU for possible sales to Europe via a trans-Caspian route (Socor 2012). Despite the fact that the EU has expressed its interest in purchasing gas from Turkmenistan on a number of occasions as part of its import diversification strategy, it has so far failed to reach any concrete agreement that can circumvent objections from Russia, which has used environmental issues as a pretext for preventing agreement over a Caspian gas pipeline (Gurt 2015). Nevertheless, even without sales to Europe, Turkmenistan now has a diversified portfolio of gas exports which in 2014 saw 25.5 bcm sold to China, 9 bcm sold to Russia and 6.5 bcm to Iran, with a further 0.5 bcm sold to other FSU countries (BP 2015). As a result, Russia's political influence in the country has declined significantly, with China now having much greater sway over Turkmen policy as it prepares to increase its gas imports from the country to 65 bcm by the early 2020s (Shaban 2015). Consequently, from both a political and commercial perspective, Russia appears to have lost out, having discovered that its 'gas weapon' (albeit as a dominant purchaser rather than supplier) has been undermined by the shifting balance of the global gas market.

6 Commercial Reality in Relations with Ukraine During 2014–2015 Crisis

This theme of commercial reality undermining political objectives can be seen again if we return to Ukraine and examine the role of gas in the 2014–2015 crisis. Following the agreement reached in 2010, Ukraine had been paying for its gas effectively at a European price but with a 30 % discount for the lease at Sevastopol, and although there were occasional disputes over outstanding debts from Naftogaz Ukrainy, the presence of Viktor Yanukovich as president of the country allowed the waters to be smoothed with Gazprom and the Kremlin (Watson and Tkachenko 2010). However, when he was removed by a popular uprising in February 2014, the political mood between the two countries changed completely, and while the main focus was on the annexation of Crimea in March 2014 and the beginning of an effective civil war in Eastern Ukraine later in the year, the issue of gas supply and gas transit again came to the fore because of the continuing dependency issues (which were particularly acute with the approach of winter).

The first shot in the 'gas war' was fired in April 2014 when Gazprom removed the price discount for the use of the port at Sevastopol (which had now been absorbed by Russia), increasing the gas price retroactively to a very high $485/mcm (Marchak and Rudnitsky 2014). While this act had a clear political dynamic, as Russia had just annexed the Crimea and taken over Sevastopol, Gazprom's next move bore all the hallmarks of previous disputes, namely the demand for repayment of gas debt (in this case $2.2 billion later rising to $5.4 billion) which it had allowed to accumulate over the previous 12 months. This familiar tactic allowed it to claim some moral high ground, although the Ukrainians found a commercial response by claiming that Naftogaz had been overcharged for gas since 2010 and making a $16 billion claim against Gazprom in a Swedish arbitration court. Gazprom responded by making an $11 billion claim against Naftogaz for the underpurchase of gas under the same contract, and has subsequently increased its claim to $29 billion (Gazprom's $29 bn claim against Ukraine's Naftogaz filed in Stockholm 2015).

Although these claims and counterclaims underlined the contractual nature of the commercial dispute, the most important element of the 2010 contract was the clause concerning Gazprom's right to demand prepayment for gas if Naftogaz fell into arrears. Gazprom could have exercised this during the second half of 2013 and also in the first quarter of 2014, when Naftogaz admitted to being in debt, but it chose to finally do so in June 2014, at a time when the political pressure was rising and the need for gas to be stored for the winter months was increasing. Naftogaz failed to meet the prepayment terms, as expected, and Gazprom therefore cut off gas supply in a move that was a clear political threat not only to Ukraine but also to the EU, which faced the possibility of another serious transit interruption if the lack of gas in Ukraine became acute (MacFarquhar 2014). This prompted frantic diplomatic activity, with European Commission Vice President Gunther Oettinger leading a round of negotiations that ultimately resulted in an agreement on a 'winter package' which included a staged repayment of Ukrainian debts to Gazprom, a lower gas price for Ukraine and prompt payment for new gas by Naftogaz through to March 2015 (European Commission 2014).

However, despite this agreement being reached, it is difficult to see how Russia made any political gains from the gas crisis. It did manage to drag the EU into the Russia–Ukraine dispute, establishing a tripartite negotiating balance that may be useful in future disputes, but in reality the political situation in Ukraine was not altered significantly and the country now appears more rather than less determined to move out of the sphere of Russian influence. Furthermore, from a commercial perspective, the overall outcome would appear to be a disaster for Gazprom in manifold ways. Firstly, one of its main gas sales markets, Ukraine, has shrunk dramatically in terms of both volumes and prices. In response to the commercial pressure from Gazprom, the Ukrainian authorities took two very obvious and logical steps, namely to reduce demand and to seek out alternative sources of gas supply. The former was achieved both by a physical rationing of supply and also by increasing prices, and overall Ukrainian gas demand has fallen from almost 50 bcm in 2012 to just over 38 bcm in 2014, a fall of almost a quarter in only two years (BP 2015). The latter became possible because countries neighbouring Ukraine were able to offer gas from the European gas market via 'reverse flow' through pipelines that had originally been designed to carry Russian gas to the West but which can now carry it, to an extent, in the opposite direction (Pirani 2014, pp. 5–6). Although Gazprom has tried to limit this trend, as the reverse flow gas is effectively Gazprom's gas sold in Europe and then resold to Ukraine, it is not able to legally limit onward sale of Russian gas under EU law, and in any case has found it too expensive to reduce gas flows to customers who are legally entitled to ask for the gas which they have been subsequently selling to Ukraine.

As a result, Russian exports to Ukraine, which have now been limited to a maximum of 50 % of total imports by the Ukraine government, have fallen by more than two-thirds from over 45 bcm in 2011 to only 15 bcm in 2014 (Gazprom 2015). Indeed, in order to limit its losses, Gazprom has had to compete on price with gas purchased on the European hubs, and Fig. 19.1 shows how the price for Russian gas to Ukraine has fallen in line with competing supplies over the past 12 months. As a result, Russian actions to cut off gas supply to Ukraine have forced a reaction which means that the value of any gas weapon that it owns has certainly been reduced, if not altogether undermined by the forces of global competition.

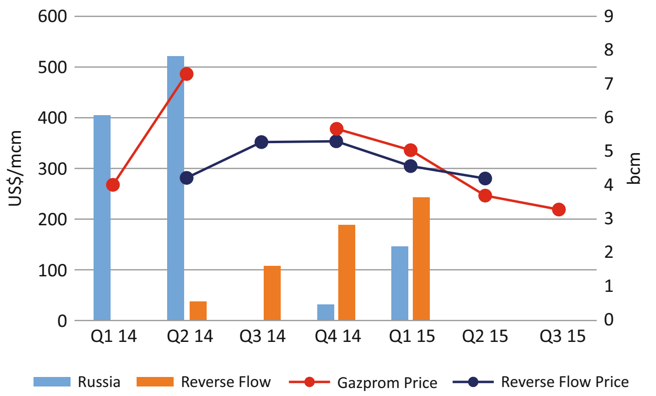

Fig. 19.1 Russian gas price and volumes to Ukraine compared with 'reverse flow' gas, 2014–2015 (*Source*: Pirani (Oxford Institute for Energy Studies))

7 A European Response to Russian Gas and Gazprom

From a European perspective, concerns over dependence on Russian gas have been increasing since the 2009 Ukraine crisis, when Gazprom's hard-won reputation for secure gas supply earned over 40 years was wiped out in a two-week interruption. Since then, it has been clear that, as exemplified in the case studies outlined above, diversification of supply, management of demand and the introduction of legislation to prevent monopolistic activity and to encourage a competitive marketplace are the keys to combating any possible weapon that Russia may have in the gas sector. The EU itself, and its individual member countries, have all provided clear illustrations of how the combination of these factors can create both a benefit for gas consumers and a defence against dominance by any one player.

The EU's response really started with the passing into law of its Third Energy Package (TEP) in 2011, which outlined the goal of creating a liberalised gas market in Europe via the unbundling of vertically integrated gas companies and the imposition of third-party access rules and publicised tariffs.[4] This has caused huge concern for Gazprom as it will mean a significant shift in its traditional business model, in particular threatening its pricing structure, which has always been based on a long-term oil-linked methodology, and its plans for access to customers via controlled infrastructure. Two particular examples

[4] For details, see https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation, accessed on 16 August 2015.

demonstrate how rigorous implementation of the new rules has underpinned the EU's determination to change its relationship with Russia in the gas sector. Firstly, Gazprom's use of the Nord Stream pipeline, discussed above, was interrupted by an EU Competition Commission ruling that the onshore pipeline connected to it in Germany (OPAL) could not be monopolised by Gazprom, as it insisted that the Russian company could utilise no more than 50 % of the pipeline's total capacity. Gazprom argued that it was the only conceivable user of the pipeline and should have access to all 36 bcm of capacity, but the EU remained firm and Gazprom's ability to use Nord Stream was cut by 18 billion cubic metres per annum (bcma), leading to a long-running legal dispute which appeared to have been resolved prior to the Ukraine crisis but which has since been deferred. Secondly, in 2012 the Directorate General for Competition, the competition regulator of the EU,[5] challenged Gazprom's commercial practices and pricing methodology in eight Central and East European countries, alleging that it was preventing competition and abusing its monopoly position by charging high oil-linked prices. The case is ongoing, with the EU having published a Statement of Objections outlining the charges against Gazprom, which then provided an initial response by the end of September 2015 (Fairless 2015). Nevertheless, it is clear that the Commission intends to make it very obvious that Gazprom cannot abuse its dominant position in any EU member countries and must start to price its gas in competition with other suppliers on the European hubs.

Furthermore, this increasing level of dispute between Gazprom and the EU has been taking place against a backdrop of declining European gas demand and increasing attempts to find alternative sources of gas supply. The most notable example of the latter issue is the planned arrival of 10 bcma of Azeri gas via the Trans-Anatolian Gas Pipeline and Trans-Adriatic Pipeline, which will cross Turkey and Greece before delivering gas to Italy and southern Europe from the end of this decade (Gorst 2015). In addition, the continuing growth of shale gas production in the USA has provided increasing hope of LNG exports arriving at Henry Hub-linked prices from 2016 (Vukmanovic 2014).[6] Meanwhile, European gas demand has declined as a result of the continuing effects of the 2008–2009 economic crisis and the rise in the use of renewable energy and cheap coal imports in a number of countries. This has led to gas consumption falling from 577 bcm in 2008 to 528 bcm in 2013,[7] with the outlook remaining relatively bleak as most forecasters do not see

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[5] http://ec.europa.eu/competition/index_en.html, sourced on 12 October 2015.

[6] Henry Hub is the benchmark price for US natural gas.

[7] Total for EU35 provided by Eurostat.

demand recovering to 2008 levels before the mid-2020s, at the earliest (e.g., Honore 2014; IEA 2014, p. 139).

The impact of lower gas demand and the arrival of competing sources of supply was seen very clearly in the case of Ukraine above, but another EU-based example of how Gazprom's competitive position is diminishing has been seen in Lithuania. Historically, the country has been entirely dependent on Russian gas supply, but the announcement that a floating regasification terminal would be opened at the end of 2014 had a dramatic impact on the country's bargaining power and allowed it to negotiate an immediate 20 % price discount from Gazprom while also signing an agreement to import LNG from Statoil to provide immediate diversification of supply (Milne 2014). It is interesting to note that, as in the case of Ukraine, Lithuania has not stopped buying Russian gas altogether, but has reduced its dependence and also ensured that it is now paying a competitive price. In a sense, although Lithuania is still *reliant* on Russian gas for a significant part of its gas supply, it is no longer *dependent*, as it has alternative supply options and a clear pricing benchmark in the global LNG market.

8 South Stream and Its Implications for Gazprom in Europe

In terms of gas infrastructure and perceptions of its use as a foundation for a potential Russian gas weapon, Gazprom's strategy of pursuing the South Stream gas pipeline project (which was planned to bring gas across the Black Sea from Russia to Bulgaria and then into neighbouring countries) was seen as a potential threat to Europe, despite ostensibly solving the security of transit risk posed by Ukraine. Firstly, Gazprom's plan was seen as undermining the EU's strategy to encourage supply diversification because it would have potentially tied more markets to Russian gas imports (Oliver and Farchy 2014). Secondly, and more explicitly, South Stream was perceived as a challenge to the TEP itself, because Gazprom had signed a series of individual intergovernmental agreements with countries in south-east Europe that would have provided exclusive access for South Stream gas in contradiction to the EU's third-party access rules (which prohibit exclusive deals and mandate freedom of access to all pipelines) (South Stream bilateral deals breach EU law, Commission says 2013). Essentially, the EU made it very clear that any South Stream gas flowing through new onshore pipelines across EU countries, such as Bulgaria, Hungary and Austria, would need to comply with TEP rules, although this decision largely ignored the fact that rules on access to new capacity would not be finalised until 2018. Gazprom continued a debate with the European Commission and some progress towards a resolution appeared to be made until all discussions were halted by the annexation of Crimea and the start of the conflict in Ukraine in February/March 2014 (Oliver and Farchy 2014).

At this point, all commercial negotiations on pipeline, supply and pricing issues were overwhelmed by political priorities on both sides, with Gazprom asserting that it would continue to build South Stream regardless of EU objections. Meanwhile, the Commission remained firm in its decision that the onshore section was illegal under TEP rules, and reinforced this by issuing a Statement of Objections against the Bulgarian procurement process for pipes, which brought construction to a halt in that country (Norman 2014). For Gazprom, a crunch point was reached in December 2014 when the pipeline was on the point of being laid, with one string of pipe having been purchased and already located at Varna on the Bulgarian Black Sea coast, while another string was on order and pipe-laying vessels had been contracted and were ready to begin operations. At this point, it became clear that a huge amount of money, already in shorter supply because of falling oil prices, could be wasted on a pipeline that might remain empty, or at least underutilised, for years, and the decision was made in early December 2014 to cancel the project (Korsunskaya 2014). In essence, the EU had made its point that the Russian gas weapon could be undermined by strong implementation of regulation that mandated suppliers to operate in an open and competitive marketplace.

However, far from implying a cessation of relations with Europe, the cancellation of South Stream looks to mark a turning point in Russia's gas export strategy and a reassessment of its efforts across all its export markets. Statements from Alexei Miller and his senior management colleagues suggest that Gazprom acknowledges the changes taking place in the European marketplace, and that it is beginning to develop a new strategy for the region (Henderson 2015, p. 2). It started by redirecting South Stream from Bulgaria to Turkey and by suggesting that it will create a new gas hub on the Greek–Turkey border where European customers can come and get their gas. Although this suggestion has already run into numerous potential legal difficulties and may never actually take place, the mere fact that Gazprom has been prepared to talk about trading its gas at a hub on the European border emphasises the shift in mindset within the company.

This change in strategy was further underlined by the announcement of gas auctions for Russian gas delivered via the Nord Stream pipeline in the Baltic Sea, with Gazprom effectively acknowledging that it needs to change its gas marketing strategy and play by EU rules (Farchy 2015). Furthermore, it underlines the fact that the Kremlin understands that Gazprom is now having to operate within a more competitive marketplace, and that if its major state-controlled gas company is to maintain its global status as an economic, as well as a political tool, then it will need to adapt to remain a viable commercial entity. In essence, a Gazprom that has been bankrupted in an attempt to achieve political objectives while ignoring new trends in the global gas market will serve no useful purpose to Putin or the Russian government.

Having said all this, and despite the EU's clear antipathy towards Russia and its desire to reduce dependency on its gas, Putin and Gazprom do have some reasons to be relatively confident in their position as major energy suppliers to both Europe and other emerging gas markets. Firstly, the contractual commitments between Gazprom and its European customers mean that gas exports are unlikely to decline much, if at all over the coming decade. Secondly, even if those contracts were to be renegotiated as a result of Gazprom's new strategy, there is every likelihood that the European requirement for Russian gas will increase, not decrease, over the next 10–20 years, as demand rebounds from its current lows and indigenous gas production from some of the continent's major producers (notably, the UK and the Netherlands) continues to fall. Europe's import requirement is likely to rise by as much as 100 bcm by 2030, and it is hard to see sufficient alternatives to Russian gas that could meet this demand (Stern et al. 2014, pp. 71–75). As a result, Gazprom has an innate confidence that demand for its gas in the West will not decline over the longer term, but rather that its bargaining position could get much stronger over time.

Thirdly, Gazprom has developed a clear diversification strategy involving the opening of a new market in the East, where demand is growing fast and imports are more urgently needed. The particular focus to date has been on the Chinese market, with the signing of one pipeline deal (Power of Siberia) completed in May 2014 and a second (Altai) reaching initial agreement in May 2015; although progress with both has been slower than expected, Russia could nevertheless be exporting as much as 68 bcma by the mid-2020s (Hornby 2014). Furthermore, although Gazprom's LNG plans would currently seem to be on hold due to the impact of lower prices and sanctions, in future Russia could also start to supply Pacific markets via sea, and additional sales to China could also take place via an existing pipeline in the Far East of Russia from Sakhalin Island.

As a result, it is somewhat ironic that a combination of the EU's actions to reduce its dependency on Russian gas, US and EU sanctions as a result of the Ukraine crisis, Russia's perception of EU legislative tactics and the outlook for European gas demand have finally spurred Gazprom into a commercially rational gas export strategy spanning West and East that the company has been contemplating for more than a decade. The result is that, even in a worst-case scenario in Europe where customers only buy Russian gas at the lower end of the take-or-pay range (assumed to be 70 % of contracted volumes in Fig. 19.2), Gazprom's exports to countries in Europe (not including the FSU) and Asia would only dip to a low of 120 bcm for the next two to three years before rebounding towards levels seen in 2013. In a more benign scenario, where European customers purchase 100 % of their contracted gas, the figures would be as much as 50 bcma higher, showing the potential upside for Gazprom if Russia is correct about the future need for its gas in the West.

In terms of the possible use of gas as a weapon, the potential reduction of Russia's reliance on sales to Western markets might again suggest that Europe should be worried about Gazprom using its new export diversity as an economic and political bargaining chip. Indeed, President Putin has been especially keen to characterise gas sales to China as a threat to Gazprom's traditional customers, especially as gas via the second eastern pipeline to China (the Altai route which runs from West Siberia to the western border of China) will be coming from the same source as exports to the West, allowing for potential arbitrage (Jiang 2015). However, a more realistic outcome is that, while any sense of a strategic energy partnership between Russia and the EU has disappeared, in reality commercial relations will remain strong. Russia must surely understand the political and economic risk of becoming too reliant on exports to a single powerful customer such as China, and indeed this

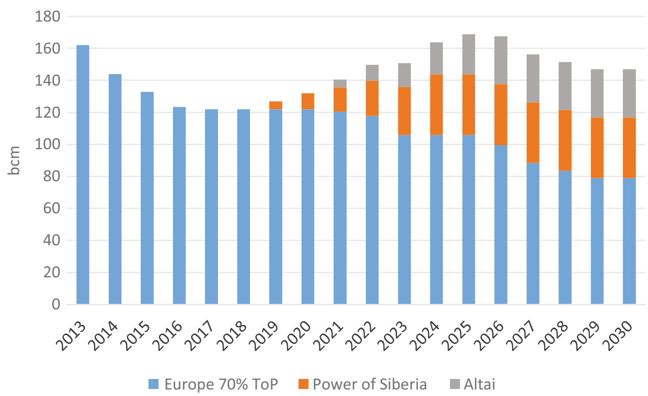

Fig. 19.2 Potential outlook for Russian gas exports to Europe and China (*Source*: Author's analysis)

is already becoming clear as negotiations over gas sales have been much longer and more complex than anticipated due to China's strong bargaining position. As a result, Gazprom will probably need to use its European sales options as a balancing item in the same way that sales to Asia have been used to make a geopolitical and commercial point to European leaders. Furthermore, total sales to Europe are likely to remain the biggest source of revenue for Gazprom, albeit that China could become the biggest single customer, and so, while the relationship between Russia and its customers in the West is likely to remain politically fractious for the foreseeable future, the mutual benefits of a rational commercial outcome in the energy sector are likely to prevent any significant breakdown in gas trade. Furthermore, if Gazprom does pursue a strategy of increased trading on hubs rather than delivery to end consumers, its powerful bargaining position as a low-cost producer with vast gas resources close to Europe could ultimately result in an expanding market share over the long term rather than the decline which currently seems to be the EU's preferred outcome.

9 Conclusion

It is clear that Russia has on occasion tried to use its position as a major gas supplier to countries in the FSU and in the EU as a tool to gain political leverage, and in that sense has attempted to use gas as a 'weapon'. However, it is equally clear that any power with which this 'weapon' has been armed has been based on commerce and contractual obligation, which Gazprom has often exploited to create the potential for dispute. Contracts have been left vague to allow for multiple interpretations, debts have been allowed to accrue so that repayment can be demanded at an opportune moment, high prices have been negotiated so that discounts can be offered to countries and governments prepared to grant Russia a political favour. As a result, the response to any gas threat can also be commercial and legal, as has been demonstrated by all the cases discussed above.

One more example can underline the point. Gazprom has been accused of selling its gas at very different prices across Europe, with the main issue that countries further from Russia are often charged a price lower than near neighbours despite the higher transport costs involved. This anomaly has been highlighted by the EU's investigation into Gazprom's activities in Europe, but the response from Gazprom has been that it is merely pricing its supply relative to the competing fuel in each country. If a country has no alternative gas supply, then it will pay a price relative to oil or coal which may well be higher than its neighbour which can access LNG from the global market. This is the action of a 'discriminating monopolist' in any market, and although a high gas price can of course provide political leverage through the opportunity to offer discounts, Gazprom's actions in charging different prices are no more or less than any company in any other sector would do (Kates and Luo 2014). Indeed, the EU itself has acknowledged that differential pricing is not an issue as far as it is concerned.[8]

The answer, as the EU has essentially acknowledged in its Energy Union strategy, is to break Gazprom's dominant position in individual markets by encouraging a strategy of supply diversity, competition and increased pipeline interconnection between individual markets to ensure that all have access to the cheapest supplies of gas. (Smith Stegen 2011, p.13). In this way, all European countries will ultimately be able to access gas from multiple sources and directions, ensuring that a more uniform price is paid by each of them depending upon cost of supply and transport distance. It is interesting to note that countries such as Poland and Croatia are following the lead of Lithuania in developing new regasification terminals to access the global gas market, while Europe's overall LNG regasification capacity will soon exceed 220 bcma, more than enough to replace all imports of Russian gas if necessary, on the condition that sufficient interconnecting pipelines are built to link the terminals to all the EU markets where the gas is needed.

As a result, the question of whether Russia has a potent gas weapon has a double-edged answer. If any country allows Gazprom to dominate its market, or accepts a discount in return for a commercial or political favour, or allows itself to build up a debt for non-payment or agrees a contract that is flexible and then tries to exploit that flexibility, then it clearly leaves itself open to manipulation by the Kremlin, which controls its state gas company. However, in this instance the country being threatened has arguably armed the Russian gas weapon itself, as there is a clear opportunity in each case to avoid dependency. Indeed, the EU is attempting to create a legislative and regulatory environment, with the introduction of the TEP and the Energy Union concept, within which it will be much harder for a 'discriminating monopolist' to operate. These new rules are already having an impact on Gazprom's strategy in Europe and are turning the continent's *dependence* on Russia into a more manageable *reliance* on a competitive source of supply. Furthermore, Gazprom's dependence on gas sales revenues from the region also highlights

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[8] For details, see http://europa.eu/rapid/press-release_MEMO-15-4829_en.htm, accessed on 16 August 2015.

the company's own reliance on maintaining exports, with this reciprocal relationship again undermining the concept of gas as a potent weapon.

However, perhaps the clearest example of how to deal with any potential threat from Russia is demonstrated by the example of China. The Kremlin initially viewed exports to the Chinese gas market as a perfect diversification away from its sales to Europe and as a huge commercial opportunity, while they also offered the potential to threaten European countries with future concern over security of supply. In reality, though, Russia appears to need China much more than China needs Russia, as the Chinese authorities have ensured that they have access to multiple sources of gas and appear to be adamant that Russia will not take too great a share of the market. Furthermore, this strong bargaining position has allowed them to negotiate for a very competitive gas price from Russia, and even to procrastinate over the exact timing of future sales thanks to the current weakness of global gas demand and an apparent excess of supply. While this has caused increasing frustration for Gazprom and the Kremlin, it has also emphasised just how little potency a commodity weapon can have as the market for it becomes more global. The fact that few concerns are ever raised about Russian oil, coal and uranium exports underlines this point, as all are traded on world markets where exports and prices are impacted by the broad economic forces of supply and demand, reducing security concerns. As the gas market becomes less regional and more global, as the governments of the major consuming countries apply regulation that creates greater competition, as interconnectivity increases and as supply options become increasingly diverse, any potency which Russia's gas weapon may have had will diminish in equal and opposite proportion.

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Energy, Coercive Diplomacy, and Sanctions

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Analysis of energy markets has long focused on the concern that fossil fuels, as inputs into a wide range of energy products and services and essential commodities for warfare, might be used as instruments of coercion. The potential relationship between energy and coercion stems from the ubiquity of energy use within industrialized economies, and the structure of supply and demand supply for a number of fuels—principally those derived from crude oil and used in the transportation sector or to support military operations. Because a government might be able to interrupt energy supplies to another state, and because that interruption could have serious consequences for the target, governments have used the threat or actual interruption of energy supplies to try to extract political and economic concessions—that is, energy is widely considered a potential instrument of coercion.

Analysts often trace the emergence of states' concerns about energy coercion to the Arab oil embargo of 1973–1974, which aimed to punish the USA and others for their support of Israel during the 1973 Yom Kippur War. National security fears linked to energy coercion extend much further back in history, however (Kelanic 2012; Clayton 2015; Stern 2016). Energy security concerns, defined as sensitivity to the potential for political–military manipulation of oil

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markets to achieve political goals, are also not limited to the USA but extend to other states, and fuels (Hughes 2014). Recently, for example, suspicion that Russia has used energy trade to intimidate Ukraine and other former Soviet republics expands concerns about coercion to the case of natural gas in Europe. This contrasts with European countries' relatively sanguine attitude about dependence on Russian energy supply in the 1980s (Drezner 1999; Stulberg 2007; Jentleson 1986).

In this chapter, we review the state of knowledge on the relationship between energy, coercion, and sanctions. We argue that concerns in the major energy-importing countries regarding the potential for coercion are largely misguided: evidence shows that the structure of energy markets make it difficult for governments or firms to use fossil fuels as instruments of coercion, or to enforce changes in target states' behavior through the imposition of sanctions.

There are nevertheless a number of important questions that are amenable to further research. First, while an earlier generation of research placed great emphasis on the vertically integrated supply chains of the major international oil companies (Sampson 1975; Yergin 1990), scholars have done much less work to understand the implications of the modern disintegrated global energy supply chain in which production, transportation, refining, and distribution are no longer handled by the same companies or dominated by the same countries (Hughes and Long 2015). Second, although the risks of coercion in energy markets historically focused on the political implications of market power enjoyed by energy exporters, recent sanctions efforts suggest that oil consumers may enjoy leverage vis-à-vis producers. While consumer bargaining power has been studied in the past (Kapstein 1990), for example, recent episodes like the US-backed effort to coerce Iran over its nuclear programs deserve further study. The effectiveness of sanctions against energy exporters remains poorly understood, including sanctions that target the financial activities that underpin their ability to settle trades in oil and gas. Third, as the literature on sanctions has moved to better understand their effects on particular interest groups within the targeted countries (Tostensen and Bull 2002), scholars interested in energy could profitably study the relationship between the energy sector and interest groups politics, both in targeted countries and in countries seeking to impose costs on others through the manipulation of energy markets.

In this chapter we focus most of our discussion on crude oil and petroleum products, for two reasons. First, oil has historically been the central focus of analysts' and policymakers' concerns about the relationship between energy, coercion, and sanctions. Second, the case of natural gas, which has more recently emerged as an important source of potential coercion, is discussed elsewhere in this volume.

The chapter proceeds as follows. We begin by describing the theoretical and historical foundations that led policymakers to perceive a link between energy, coercive diplomacy, and sanctions. We then describe how changes in the structure of energy markets in terms of both supply and demand have tended to make energy a poor instrument of coercion, with a small number of possible exceptions.

We propose that the evidence shows that the link between energy and national security is weak, when understood in terms of economic coercion. We also suggest that research into specific segments of the supply chain is warranted, as is analysis of the potential for monopsony power to be used in coercing energy producers. We conclude with some final thoughts, suggesting that recent scholarship shifting focus to the governance and regulation of energy markets, and away from energy and security, is a useful response to the weakened relationship between energy, coercive diplomacy, and economic sanctions, but scholars should clearly understand that this represents a shift to other important topics rather than an appropriate redefinition of energy security.

1 History of the Link Between Energy, Coercion, and Sanctions

Policymakers and analysts have historically linked national security and the supply of energy because adversaries might use the fuels required by militaries and civilian economies as instruments of coercion. Concern started early in the century and intensified as militaries (first navies and then ground and air forces) shifted to use oil as their primary fuel. The initial fear emphasized the potential decline in military effectiveness if oil-dependent forces could not sustain ready access to fuel in the face of enemy blockade or wartime attacks. The effect of energy supplies on the causes and conduct of World War II confirmed these links; the diplomacy leading up to Japan's decision to start the war in the Pacific with the conquest of the Dutch East Indies emphasized oil coercion, including the US sanctions on energy finance and physical oil exports to Japan (Trachtenberg 2006; Schuessler 2010; Barnhart 1988). The threat of such wartime disruption offered potential leverage during peacetime, too: countries anticipated their need for wartime energy consumption when they considered their ability (and the ability of their adversaries) to fulfill the threats and promises of coercive diplomacy (Milward 1977; Kelanic 2016).

As civilian economies increasingly came to depend on oil, notably in the 1930s and even more so after World War II, energy security concerns expanded to consider the possibility that a supply interruption could undermine civilian prosperity, adding another form of potential coercion to the repertoire of energy-linked offense and defense. Even before World War II, European policymakers and business leaders grew nervous that the USA, as the dominant producer of oil, could gain market power for US firms in European downstream markets, and they worried that such market power could be used to extract commercial or political gains (Nowell 1994). Later, the Eisenhower Administration justified its decision to impose first voluntary, and then mandatory, limits on oil imports (1957–1959) with reference to an alleged national security need to retain domestic production as protection against a possible attempt at international coercion (Bohi and Russell 1978). The post-1973 fears of an Organization of the Petroleum Exporting Countries (OPEC) 'oil weapon' were an even more intense version of this same dynamic (Samuels 1987; Bohi 1989).

2 Theory of the Link Between Energy, Coercion, and Sanctions

Assessing the utility of energy as a source of coercive leverage requires us to define the conditions under which coercion is likely to be successful and then ask whether these conditions have been met in energy markets. Although not a focus of this chapter, it is also important to note that identifying whether attempts at economic coercion have been successful or not is also a difficult empirical challenge (Hufbauer et al. 2007). Governments that use economic instruments for reasons of statecraft may do so for reasons other than to coerce others, notably to placate domestic interests or to make symbolic statements rather than to actually change target states' policies (Baldwin 1985). Without recognizing this, we may wrongly count instances when sanctions have been imposed, but the target state's behavior has not changed, as failures. Furthermore, any change of behavior by a state targeted by energy-related coercion, where it does occur, faces an important attribution problem: when behavior changes, how do we know it was the imposition of sanctions that led the state to this change and not something rooted in domestic politics or some other factor? Determining this is challenging, particularly given that the quality of information obtainable from a state targeted by economic sanctions, including sanctions focused in the energy sector, can be poor.

Regardless, it is generally believed that energy products lend themselves more than other products to the potential for coercion because of the structure of energy markets. Hirschmann (1980 [1945]) wrote the pioneering effort to define how the structure of economic markets can increase (or weaken) the ability of states to sanction and coerce one another. He argued that economic flows can be effective as an instrument of coercion if a trading partner is unable to dispense with the inputs from the state attempting coercion, and if the target state cannot obtain a substitute source of supply—that is, if the coercing state has market power over an important product that the target state needs. Hirschman recommended that states seeking to exploit their potential leverage take steps to develop a monopoly position in trade with the targeted state and to increase the costs of adjustment to alternative suppliers. His argument can be distilled into three factors: the degree of market power enjoyed by suppliers, the elasticity of demand for a product, and the importance of the product to policymakers in the targeted country (whether because of the product's role in the civilian economy or in the production of military power).

The case that energy products are important because of their potential for use as tools of coercion or sanctions rests on the claim they fulfill these conditions: geology ensures that market power is a problem in energy markets, although the degree of that problem varies on a fuel-by-fuel basis; demand for many energy products is comparatively inelastic; and many energy products are important to civilian economies and militaries. Below we discuss the logic inherent in each of these arguments, as well as the evidence associated with the claim that energy products, specifically oil, meet the conditions.

3 Supply Side

Concentration in the supply of energy products is at the core of states' concerns that energy might be an effective instrument of coercion. Natural resources are distributed unevenly around the globe, and this natural concentration is compounded by above-ground political and military issues: legal institutions and political risk in some countries do not facilitate reliable exploitation of their resource base, limiting global supply to a still smaller group of countries (Click and Weiner 2010).

Concern about unreliable foreign energy supplies has a long tradition, spurred by British and American wartime dependence on Venezuelan oil during World War II and the even earlier nationalization of the oil industry in Mexico (Painter 1986; Stoff 1980; Stern 2016). French fear of American supply dominance in the 1920s—and its attendant effect on French foreign and domestic energy policies—is another important case (Nowell 1994). During this period, however, a small number of vertically integrated oil majors headquartered in Europe and the USA dominated production, refining, and distribution of oil, meaning that the major consumers also had important influence on peacetime production and distribution decisions. This alleviated some of the potential danger of coercion against most of the great powers.

The nationalization of oil-producing assets in the Middle East and North Africa beginning around 1970 fragmented the international oil market at roughly the same time that US domestic oil production started to decline, which intensified consumer fears (Yergin 1990). Governments in Europe, the USA, and Japan responded to this change, significantly increasing investment in basic research in energy, subsidizing the deployment of substitutes for oil in the electricity sector, and changing the mix of fuel taxes to increase the incentives to consume alternatives to products derived from oil. Over the course of the 1980s, the developed, consuming countries generally succeeded in reducing the use of oil for non-transportation purposes and reducing the oil intensity of their economies (i.e., the fraction of gross domestic product [GDP] spent on oil), but their efforts to develop new sources of energy to replace oil and reduce the effective supply concentration generally failed (Blanchard and Jordi 2007). New sources of supply in the North Sea, Alaska, and West Africa along with production increases in the Soviet Union and Mexico constrained supply concentration to some extent: Saudi Arabia, in particular, cut oil production in the face of new supply from 10.3 million barrels per day (mb/d) in 1981 to 5.2 mb/d in 1986; when it reversed this strategy, prices fell markedly, leading to a long period of stagnation (BP 2014). By the 2000s, low prices had limited investment in supply diversification, and OPEC and especially Persian Gulf oil production seemed poised to dominate the global market, an apparent source of market power (Council on Foreign Relations 2006).

Yet OPEC, which formally organized producer governments, turned out to be extremely clumsy at managing supply and prices due to internal disagreements about key economic variables (like the ideal price and the elasticity of consumer demand) and preferred outcomes in international politics (Adelman 1980; Moran 1987). Even the apparent peak in OPEC power in the 1973 oil embargo did not lead to significant concessions from the embargo's targets (Licklider 1988). Supply concentration by itself did not allow OPEC to target specific countries for supply interruption, as the international distribution network shifted supply around to make sure that all consumers received the oil that they paid for (Yergin 1990). The integration of most energy markets globally means that reductions in supply are experienced by all market participants in the form of higher prices rather than as shortfalls in supply concentrated on single states or groups of states (Adelman 1984). Much of the actual economic damage during the time of the embargo may be better attributed to consumer governments' policy mistakes like US wage and price controls, rather than to the interruption of oil, supplies (Bohi 1989). Even highly celebrated international sanctions episodes that involved oil, like the campaign against South Africa's apartheid system, had much more effect in public relations than in the real economy, although they did manage to impose some costs on the target regime (Klinghoffer 1989a and b). Overall, the lasting effect of OPEC was to raise the baseline price of oil toward a higher cartel price, rather than to enable the successful coercion of oil consumers.

The fragmentation of the international oil market following the nationalizations of the 1970s has made it more difficult to target attempts at coercion by increasing the number of market participants. The implication of energy market integration is that there are reduced incentives for energy exporters to attempt to use natural resources as instruments of coercion because there is little ability to impose anything other than short-term adjustment costs on targeted states.

4 Demand Side

Sanctions and attempts at coercion are only likely to be successful if they inflict damage on the targeted state, and the damage inflicted is not only a function of the market power enjoyed by the producer but also a function of how much the targeted state depends on the interrupted supply. A recent meta-analysis of sanctions effectiveness employing data on sanctions threats in addition to sanctions imposition finds that many factors associated with sanctions success appear to be artifacts of idiosyncratic choices about data and measures. Nevertheless, the magnitude of costs paid by the target is consistently important across various models and specifications (Bapat et al. 2013).

Once again, energy products appear to be plausible targets for coercion, stemming from the fact that the availability of substitutes for many energy products is limited. This is most notable in the case of oil. Since the role of oil in electricity generation fell markedly in the advanced industrialized states after the 1970s, oil consumption is dominated today by the transportation sector of the civilian economy, and most of the distribution system and end-use vehicles are not equipped for fuel switching, because it would sacrifice too much in cost and performance (Levi 2013b). The International Monetary Fund (IMF) estimates that for a basket of developed and developing countries, a 10% increase in the price of oil would only reduce oil demand by 0.2% in the short run, meaning that consumers would pay the higher cost of the oil by restricting their other consumption and investment choices. Over time, consumers would adapt to the higher price, reducing their use of oil, but even after 20 years, the same 10% increase in oil prices would only reduce oil consumption by 0.7% (IMF 2011, pp. 94–95). Moreover, the civilian economy is not the only important kind of inelastic demand for oil. While military oil demand is a small fraction of total demand, it, too, is highly inelastic, and it is politically important (US Department of Defense 2013).

The ability to impose costs is one step in the causal chain that links attempted coercion or sanctions imposition to changes in behavior in the targeted state. Given the integration of energy markets, these costs are expressed as price shocks. Examining the costs of energy price shocks thus offers one approach to assessing the possible costs to consumer states of attempted sanctions or coercion, usually by macroeconomic modeling of the relationship between oil price volatility and economic performance. Perhaps the best-known claim is that all but one recession in the history of the USA in the oil age was preceded by a significant increase in oil prices (Hamilton 1983). But whether this correlation has causal significance—or is even very unique—is disputed. Other factors like central banks' interest rate policies confound the possible link between oil prices and macroeconomic performance (Segal 2011), for example, and other price series besides oil also correlate with recessions (Glaeser 2013). The general trend in economic studies appears to be toward findings that over time oil price volatility has had a smaller effect on macroeconomic performance, perhaps because oil plays a reduced role in the economy than it used to. For example, in the USA, primary energy consumption per real dollar of GDP declined 58% between 1950 and 2011, mainly following the 1973 oil shock (EIA 2013). This fact, combined with increased labor market flexibility, has substantially (but not completely) insulated US economic performance from oil price fluctuations (Blanchard and Jordi 2007). As a result, the manipulation of oil supply by producers, should it be attempted in the future, is likely to have a smaller effect on consumer economies than it would have had in the past.

Governments of major oil consumer economies have also taken policy steps to reduce their vulnerability to potential oil coercion. The USA created its Strategic Petroleum Reserve in 1975 (though it took several years to actually fill it with crude oil), and that reservoir of millions of barrels of oil under consumers' control can make up for months of any plausible supply disruption (Gholz and Press 2008). Other major consumers also created stockpiles, and they soon formalized procedures regulating the size and coordinated release of stockpiles in the international agreement to create the International Energy Agency (IEA). The IEA also monitors member states' energy policies and studies global oil markets to improve preparation to counteract coercion attempts (Keohane 1984; Kapstein 1990).

Meanwhile, the market itself also adapted to improve the way it responds to supply disruptions, inventing new financial instruments (such as the spot and futures markets) to allocate oil supplies (Clayton 2015). The combined result of all of these changes on the demand side of oil markets has been to make political manipulation more difficult, and responses to shocks more rapid (Gholz and Press 2010b).

5 Recent Extensions: Global Supply Chains and Energy Governance

In partial recognition of this weakening relationship between energy and coercion, recent literature extends the debate in two different directions. First, while the debate over the relationship between energy products, coercion, and sanctions has principally focused on the fuels themselves (e.g., oil), analysts have begun to focus instead on the coercive potential in different segments of the supply chains for energy products globally. The supply of energy products actually involves a series of discrete but linked markets, from extraction, to transportation, refining of resources into final products for use by consumers, and finally the distribution and sales of those products. Importantly, varying degrees of vertical integration and fragmentation across each of these stages means the number and nationality of firms can differ at each stage, suggesting that an analysis of the potential for sanctions or coercion in energy markets needs to incorporate the degree of market power in these discrete but linked markets (Hughes and Long 2015). Supply chain analyses also include the financial and insurance markets that facilitate trade (Feaver and Lorber 2010).

Studies of the potential for coercion in natural gas have long focused on the transportation link in the supply chain. They initially focused on the structure of pipelines during the Cold War, specifically on the potential for Europe's dependence on Soviet gas exports to encourage Finlandization (Jentleson 1986). In the contemporary world, those same pipelines have been at the center of fears of Russian coercive power over Ukraine and in other crises (Gholz and Press 2010a). Natural gas differs from oil because the bulk of gas tends to be distributed by pipeline rather than by liquefied natural gas carrier (ship), meaning that natural gas markets tend to be regionalized rather than global (Victor et al. 2006). They are vastly less flexible and are thus subject to coercion by manipulation of the transportation market segment. On the other hand, natural gas exporters are equally as dependent on pipelines for exports as importers are dependent on them for imports. The market power enjoyed by Russia over European markets, for example, is balanced against the dependence of Gazprom and Rosneft on European markets, for example, and the overall importance of revenues from gas exports to the Russian economy (Noel 2008).

The transportation stage of the oil supply chain has also drawn some analytical attention, especially regarding geopolitical tensions in and around the Persian Gulf. Roughly one in five barrels consumed daily passes through the Strait of Hormuz, making that chokepoint an obvious potential place to disrupt the global market. Talmadge (2008) examines the military balance between Iran and the USA in a potential conflict over the strait, concluding that the US power would ensure that any disruption to oil flowing through the Gulf would be short-lived. Gholz (2009a and b) reaches a similar conclusion, emphasizing the difficulty that Iran would have disrupting tanker traffic independent of the US military response. A more recent effort by Cordesman and Lin (2015, p. 75) finds that a coordinated attack by Iranian forces could close the Persian Gulf 'for a short while.'

Disrupting oil flow through the Strait of Hormuz would have a generalized effect on the world price paid for crude oil and products rather than a concentrated effect on any single state. Such a disruption's utility as an instrument of coercion targeted at any particular state would thus be limited. Indeed, as Cordesman and Lin (2015) note, the countries most likely to be harmed are those that use the Strait of Hormuz as a passageway for exports rather than major importers in the Asia-Pacific and elsewhere. That is, exporters are likely to absorb a greater share of the increase in transportation costs than importers—along the lines of what happened during the Iran–Iraq War in the 1980s (Navias and Hooton 1996).

The extent to which the potential for political–military leverage over global energy transportation extends beyond the Strait of Hormuz to other chokepoints like the Strait of Malacca is debatable (Gholz and Press 2013; Levi 2013a). The key variables in that discussion are the size of spare capacity in the commercial tanker market and the potential availability of alternative routes if key peacetime sea-lanes are blocked. At present, the USA is the sole state capable of imposing concentrated costs by interrupting oil transportation, because the US Navy dominates the sea lanes (Hughes and Long 2015). Only the USA, given the current distribution of power, can selectively blockade certain oil consumers, although a targeted blockade of, say, China, would present operational challenges (Mirski 2013).

Separate from the new focus on disaggregating energy supply chains, a second useful analytical change seeks to redefine the relationship between public policy and energy to a broader focus on energy regulation and governance (Goldthau 2012; Van de Graaf 2013a; Goldthau and Sitter 2015). The broadening definition of energy security—which began with a focus on issues associated with coercion but which has expanded to incorporate price volatility and environmental and human security—is emblematic of the redefinition of the relationship between energy and politics toward a focus on a broader set of trade, environmental, and justice issues. The shift to incorporate a wide range of disparate public policy issues under the heading of energy security is less useful, given the conceptual and measurement-related problems this entails. Indeed, despite the common inclusion of price in definitions of energy security, it is not clear how to convincingly incorporate price given that affordability varies both within and across states (Fattouh 2007).

6 Caveats

Thus far, we have concluded that the relationship between energy, coercion, and economic sanctions is weaker than it is often characterized. Nevertheless, a number of caveats are worthy of mention. First, if we accept that the risks of coercion can vary on a fuel basis, as well as on a market segment basis, then a comprehensive assessment of the risks of coercion should take into account each fuel and market segment, a comprehensive range of analyses that has not yet been accomplished.

Second, while the focus of much research into the relationship between energy and coercion focuses on the market power of oil- and gas-producing states, the potential monopsony power of large energy consuming states has received far less attention. Yet major producers like Iraq, Iran, and Russia have been the targets of sustained efforts at coercion. Sanctions against Saddam Hussein's Iraq and Putin's Russia do not appear to have convinced their targets to acquiesce to the sanctioners' demands, but powerful oil-related sanctions may have played a significant role in convincing Iran to agree to the Joint Comprehensive Plan of Action to control its nuclear program (Van de Graaf 2013b; Kalicki 2015).

Indeed, just as energy consumers have broadened the definition of energy security from its origin in military affairs to incorporate energy prices and other issues, energy producers have discussed energy security in terms of the need for reliable energy exports that fund their state budgets. Here, the rise of new energy users outside the Organization of Economic Development and Cooperation, notably China and India, might strongly affect the prospects for energy coercion. Governments in Europe, Japan, South Korea, and elsewhere have broadly supported the implementation of sanctions against Iran and Russia, which is not surprising given the formal military alliances binding many of them to the USA. As countries that are not allies of the USA consume an increasing proportion of global supplies of oil and gas, however, the monopsony power of the USA and its allies falls, potentially reducing the efficacy of buyer-motivated sanctions. This issue mirrors the broader discussion of the need for international cooperation in imposing effective sanctions (Martin 1994; Drezner 2000).

7 Avenues for Further Research

Given this, there remains significant scope for further research into the potential for energy coercion and sanctions effectiveness. Three areas, in particular, are likely to offer fruitful extensions of the considerable work on the problem of market power in energy, production, and on more recent efforts to understand the nature of maritime chokepoints. The first is the study of the financial and insurance markets used to settle trade in energy markets. Economic sanctions imposed on Russia and Iran, for example, incorporate a substantial focus on core energy-related technologies and financial services targeting energy firms in both countries. The costs imposed by these sanctions and the opportunities available to circumvent these efforts, however, remain understudied. Indeed, we suggest that while the majority of research on the relationship between energy, coercion, and sanctions has focused on the political implications of producer market power, reflecting the experience of the 1970s oil shocks, that focus has been too narrow to really understand the conditions under which sanctions and attempted coercion of energy producers are likely to be successful.

A second fruitful area of potential research focuses on the strategic value of oil and gas pipelines. Pipelines plausibly confer greater potential to impose concentrated costs on a target state, thus increasing the efficacy of sanctions because of the market power they confer to the sender state. Pipelines also entail a situation of 'bilateral monopoly,' however, in which they create mutual dependence between exporters and importers that needs to be fully studied as a specific example of interdependence.

Third, a complete understanding of energy coercion requires understanding the conditions under which it is likely to be attempted and the detailed political response to sanctions in target states—that is, a focus on the domestic political economy of energy security. While we argue here that energy products have a poor record as an instrument of coercion, political representatives in many states continue to present import dependence in energy products as a security threat. Scholars should investigate the domestic incentives for this continued securitization of energy. One possibility, for example, is that oil prices are a pocketbook issue for voters, meaning that fear of high gasoline prices provides a strong incentive to policymakers to implement policy responses. Alternatively, policymakers may see energy as a useful instrument for signaling resolve to domestic and international audiences (Kirshner 1997; Klare 2015). Work that examines the reasons why issues become securitized may be useful employed here. Separately, interest group politics might also explain the continuing attention to the possible risk of energy coercion: talk about energy security may simply be a way to justify spending on subsidies in such partial substitutes as biofuels or on subsidies for the domestic production of oil and gas.

8 Conclusion

The origin of government intervention in energy markets stems in part from concerns about the potential use of energy as a means of coercion in international politics. In this chapter, we reviewed the state of knowledge on the relationship between energy, sanctions, and coercion. We suggested that while the risk of coercion has justified a wide-ranging and long-standing interest among governments in the major oil importing countries in lessening oil supply risks, in particular, instances of effective sanctions and coercive episodes are surprisingly few. In fact, careful analysis of the supply and demand conditions in the markets for oil and other fuels suggests that the conditions necessary to enable successful sanctions—concentration of supply, inelastic and politically salient demand, and the ability to target sanctions at specific countries—are not present in the energy sector. While a number of other causes could also contribute to energy coercion's limited effectiveness, such as the costs of sanctions episodes for energy producers, the straightforward analysis using Hirschman's classical market power framework is an excellent place to start the explanation for the limits to energy coercion.

Indeed, history shows that recent sanctions efforts have focused on the coercion of energy producers rather than consumers. The possibility of sanctions being effective against energy producers, in turn, rests on the growing realization that the markets for fuels are best understood as a series of discrete but interrelated segments that depend on both physical processes like production, transportation, and refining and also financial markets that enable the settlement of trade.

None of this is to say that energy markets are or are likely to be depoliticized. Indeed, there are myriad reasons why energy markets and politics will remain deeply intertwined. The bulk of reserves for fossil fuels from which energy is drawn are managed by national oil companies, for example, that can seek to maximize social or political in addition to commercial goals. Imports and exports of fossil fuels can affect countries' terms of trade, as Japan's increase in import bill and shift into trade deficit following the March 11, 2011, earthquake, tsunami, and nuclear disasters show, making energy imports and exports an important trade issue. Billions of dollars of subsidies are applied in fossil fuel markets in both producer and consumer countries to shift the competitiveness of fuels, or producers, relative to others, and the size and provision of these subsidies are often politically contested. In many countries pollution—including the emission of greenhouse gases—is not included in the price of energy products, and attempts to price these pollutants are highly politicized. In addition, energy prices matter to voters, which can make them important in electoral politics. Much of this political contestation is informed by the capital intensiveness of the energy industry, meaning firms tend to be large and hence politically influential. Thus, the recent tendency towards using energy regulation and governance as a conceptual tool through which to understand the politics of energy markets is a useful shift, enabling discussion of these issues while recognizing changes in the structure of energy markets and those changes' implications for coercion. But energy governance and energy politics do not necessarily need to be discussed in the context of energy security: energy coercion is a surprisingly limited tool of international statecraft.

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21

The Resource Curse Puzzle Across Four Waves of Work

William Gochberg and Victor Menaldo

While some countries have developed robust economies and high standards of living, along with stable and democratic political systems, others languish in poverty and are bedeviled by endemic corruption, authoritarianism, and violence. What explains this variation? Many hypotheses have been offered to explain differences in economic and political development. The notion that there is a resource curse is one of the most counterintuitive and controversial.

Scholars and laypersons alike have claimed that precious metals and hydrocarbons have not translated, as might be expected, into strong economic growth, increased public spending, or better political institutions. Nations with large resource export sectors have instead been associated with stagnant growth, corruption and patronage, authoritarianism, and violent conflict.

Figure 21.1 helps to motivate a cursory appreciation of this resource curse puzzle. It maps the spatial variation in (logged) income from natural resources (in per capita terms) in 2006.

Consider the Great Arid Belt of Afro-Eurasia; it stretches from North Africa (the Sahara) to Eastern Central Eurasia (the Gobi). While this region contains the lion's share of the world's conventional hydrocarbons, it is also characterized by countries with astonishingly low levels of economic, political, and social development.

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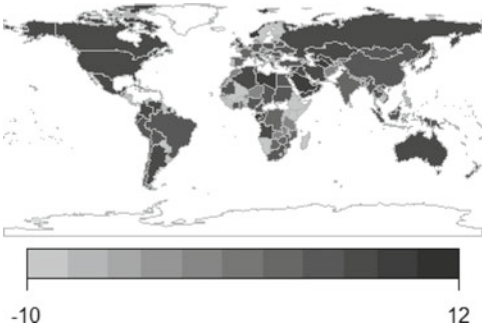

Fig. 21.1 Log per capita income from natural resources across the world (*Source*: Data from Haber and Menaldo (2011). *Note*: This data includes income from oil, natural gas, coal, and precious metals, such as zinc, copper, nickel, and bauxite. Materially similar patterns are obtained if the data is graphed for different years; if only oil income is graphed; or if only oil and natural gas income is graphed)

Or consider Latin America. While resource-rich countries such as Mexico, Ecuador, and Brazil have recently been racked by corruption scandals and economic crises, it is oil-dependent Venezuela that has been most troubled as of late. It has suffered from democratic backsliding since Hugo Chavez ushered in his self-styled socialist revolution at the turn of the century, and is now in the throes of triple-digit inflation, food shortages, and serious political and social unrest.

Next, consider sub-Saharan Africa, a bastion of civil war, dictatorship, and poverty. Oil-dependent Angola and South Sudan, and mineral dependent Congo, are just a few of the many countries in that region that have registered disappointing levels of economic, political, and social development since independence.

Finally, consider those resource-poor countries that have achieved marked success in economic and political development. This group includes countries such as Japan, Taiwan, and South Korea, all of whom have managed industrialization and consistent growth through the second half of the twentieth century despite their dearth of resource deposits.

The resource curse puzzle has had significant ripples beyond the academic world. As a greater number of countries made new petroleum discoveries in the aftermath of two oil supply shocks in the 1970s, on the heels of a pronounced upsurge in prices, policymakers began to fret. A general distrust of resource-led development became commonplace—a sentiment that continues today; partly because it has been widely disseminated by respected journalists (e.g., Burgis 2015; *The Economist* 2015; Hicks 2015).

Scholars have concocted theories to explain the correlation between various measures of natural resources and a number of outcomes associated with underdevelopment. Precisely which resources fall under the umbrella of the curse is an open question, however. Most authors do not include agricultural commodities, although some renewable commodities, such as timber, have been fingered as a reason for certain development pathologies (Ross 2001a). Several authors endow oil with a unique status; it has been attributed as the most powerful force behind the resource curse (for a full discussion of this point, see Ross 2014).

This review is structured to provide a roughly chronological overview on the resource curse literature. We have divided the literature into four waves of scholarship.[1] Table 21.1 provides a summary of these four waves in the resource curse literature.

Table 21.1 The four waves in the resource curse literature

Wave of scholarship	Notable contributions	Diagnosis	Concepts, theories, methods
First	Beblawi and Luciani (1987) Gelb (1988) Auty (1990)	Focus on the outcomes of resource dependence: low public goods provision and accountability	Rents Rentier state Rentier mentality MENA case studies Dependency theory Dutch disease
Second	Karl (1997) Ross (2001b)	Elites rely on resource extraction in order to avoid making concessions to masses in exchange for revenue	Case studies Fiscal contract Structure/agency
Third	Sachs and Warner (1995) Ross (2001b) Collier and Hoeffler (1998) Fearon and Laitin (2003)	Under certain scope conditions, resources may extend or exacerbate conflict, and may be detrimental to democracy	Large-n statistical modeling Greater focus on conflict and authoritarianism
Fourth	Dunning (2008) Ross (2012) Haber and Menaldo (2011) Menaldo (2016)	Conditional resource curse: institutions in place at time of resource discovery shape political and economic paths; alternatively, institutions curse and resource blessing	State of the art statistical methods and long-run historical case studies Testing of causal mechanisms

[1] There are several authors that focus on potential ways to 'treat' the resource curse, a topic that is not the main focus of this review. For those interested, Humphreys et al. (2007) is a useful starting point for exploring this literature. See also Darimani and Kebemba (2009) and Sala-i-Martin & Subramanian on how professionals in the policy world seek to address the so-called curse.

Early work on the resource curse was largely inductive, building from observations about countries that experienced economic and political dysfunction in the face of bountiful resource endowments. For the most part, these countries were located in the Middle East and North Africa (MENA). The first wave of scholars, to put it bluntly, was choosing cases on the dependent variable.

The second wave includes authors who, like their predecessors, drew on case studies. Yet, unlike the first wave of scholars, they built stronger theories that sought to establish causal mechanisms. These theories were most often centered on the fiscal contract model of state building that had appeared in the first wave as well.

The third wave saw scholars looking to establish the external validity of past claims about the resource curse using large-n data and statistical inference. The best of this work provided empirical tests of not only the reduced form relationship between natural resources and development outcomes, but also subjected the mechanisms posited to link variables together to empirical scrutiny.

The second and third waves of scholars that address the resource curse puzzle have two things in common. First, they have a greater degree of chronological overlap, extending through the 1990s into the early 2000s. Second, both waves offer more sophisticated theories with which to make sense of the economic and political effects made by natural resources. The third wave is also characterized by a marked improvement in the quantitative methods employed by some authors.

The current literature includes work that exhibits state of the art statistical models and a renewed focus on case studies that examine the very long run. Entries in the fourth wave share a strong focus on establishing causal inference. One group of fourth-wave work on the resource curse has attempted to advance our understanding of the conditions under which oil and minerals might exert a negative effect on political and economic development. A relatively more recent group of scholars argue against the prevailing wisdom altogether. They cast doubt on the very existence of a resource curse.

Menaldo (2016) is the most recent. His book challenges a lot of the received wisdom about the resource curse puzzle. The first is to challenge the belief that natural resources are an exogenous, randomly assigned variable. Second, to debunk the causal interpretation of the resource curse, the view that minerals and hydrocarbons lead to a host of undesirable outcomes, including the weakening of state capacity, authoritarianism, fewer public goods, economic stagnation, and civil war. Third, to demonstrate that oil and minerals are a blessing. While Menaldo concedes the fact that resource reliance is correlated with numerous pathologies, he rejects the idea that this relationship is causal.

His book demonstrates that, instead, legacies endemic to the developing world have impelled many countries to develop oil and minerals as a default sector, in lieu of cultivating modern and diversified economies. Bad institutions have also condemned nations to suffer from authoritarianism, economic stagnation, and state weakness—ills unduly attributed to resources.

Yet, Menaldo also argues that natural resources can play an integral role in stimulating state capacity, capitalism, industrialization, and democracy, even if resources are themselves often a symptom of underdevelopment. Oil rents do not displace ordinary government revenues, nor are they causally associated with fewer public goods, dictatorship, poor institutional quality, and barriers to capitalism. To the contrary, despite being cursed by their institutions, weak states are blessed by their resources.

1 The First Wave

The first scholars to suggest that there was a natural resource curse arrived at that claim in a mostly atheoretical and anecdotal manner. These were primarily area specialists who drew on observations of nations in the MENA.

Economists writing in the 1950s and 1960s had been bullish about resource wealth, and believed that they would stimulate economic development in low-income countries. Steeped in the neoclassical tradition, they argued that countries should be able to harness their comparative advantage; this meant exploiting their natural resources in order to grow and diversify their economies (Ross 2001b; see, e.g., Rosenstein-Rodan 1943; Watkins 1963).

Yet, despite this straightforward logic, resource bonanzas, including those associated with the skyrocketing price of oil in the 1970s, did not seem to translate into the developmental success throughout the MENA region that was expected by the most bullish theorists.

At first, scholars in the first wave paid little attention to political factors in order to explain persistent underdevelopment. The state was often assumed away, as an exogenous factor that played a negligible role in determining economic growth, in general, and resource-led development, in particular. Instead these scholars focused on economic and structural processes, such as the effect of primary commodity exports on other sectors of the economy, known as Dutch disease (discussed further below), and the theorized long-term decline in commodity prices. Dependency theorists should also be included in this group; they explained underdevelopment as the inevitable byproduct of the global value chain. Putatively, the core countries that manufactured finished products and imported cash crops, minerals, and oil earned superior terms of trade; peripheral countries that exported raw materials were on the losing end of this bargain.

In an attempt to move away from this passive view of the state, Beblawi and Luciani (1987) examined the means by which states financed themselves, and the consequences thereof.[2] Utilizing the concept developed by Hossein Mahdavy (1970), they characterized several MENA governments as 'rentier states': states that became dependent on externally generated rents from their extractive sectors, due to the fact that the marginal (and average) costs of resource extraction and production, especially oil, tend to be considerably lower than the prices commanded on global markets.

The external nature of these rents, the isolation of most extractive sectors from the greater economy, and the foreign ownership of many of the firms operating in these sectors, was of critical importance for these scholars. They argued that an abundance of external rents would allow a state to sustain itself without making the investments in bureaucratic capacity and public infrastructure that would otherwise be necessary to spur development. Internally generated rents, on the other hand, necessitated a productive class, and called upon an effective tax-collecting capacity if they were to be transformed by rulers into state revenues (Beblawi and Luciani 1987, p. 51).

The fiscal contract model, based primarily upon the feudal histories of European states, and drawing heavily on Tilly (1992), casts state building, and ultimately democracy, as a compromise between the ruling elite and the masses. As leaders find themselves increasingly in need of resources, they bargain with the masses, exchanging the provision of public goods such as collective security for tax revenues. In this story, political representation is the ultimate prize.

When states have external ways to acquiring revenues, such as through the collection of natural resource rents, this bargain is avoided, and the state's accountability to the masses is reduced. Rentier states are thus independent from their people, have resources with which to coerce and bribe, and at the same time are vulnerable to the interruption of their external sources of funding (Mahdavy 1970, pp. 466–467).

[2] This contrasts with those Marxists and dependency scholars who focused on class relations.

Proponents of the rentier state model also suggested the development of a pernicious 'rentier mentality' (Beblawi in Beblawi and Luciani 1987, p. 52; Yates 1996, p. 205). Early scholars argued that under a rentier state, the connection between hard work and economic productivity atrophied, not just for the state, but for the general public as well. The result was the cultivation of citizens who grew dependent on the state's distribution of rents. Yates (1996), for example, argued that the work ethic in Gabon deteriorated due to the sheer size of its rentier, 'allocative' state, breeding institutionalized corruption.

Though scholars did not clearly establish a causal link between living under a rentier state and the rentier 'mentality,' this line of reasoning at least provided an explanation for why rulers in resource-rich countries might act in ways that did not produce sustained, stable economic growth. While psychological explanations would arise again in the second wave of resource curse literature in the form of 'petromania' (Karl 1997), the first wave of work on the resource curse puzzle witnessed the heyday of this line of thinking.

Case studies of resource-dependent states by Auty (1990) and Gelb (1988) were highly influential as the literature matured during this time.[3] Both researchers were motivated by the two oil booms of the 1970s, neither of which seemed to result in the expected economic gains in oil states. They also shared a focus on boom and bust periods, Dutch disease (discussed further below), and the ability of economies to absorb windfall gains during periods of high resource prices. They observed that resource-dependent countries that experienced huge gains in revenue due to oil price shocks often failed to follow the countercyclical policies economists would advise as the most prudent; save a portion of revenue for bust periods in the future, and invest those savings in public goods.[4] States instead frequently overborrowed during boom periods, taking advantage of increased access to credit, and spent heavily on short-term projects rather than making long-term investments.

Auty (1990), in particular, also saw the absence of backward and forward economic linkages as an important explanation for why resource-dependent states failed to turn resource wealth into sustainable economic development. Forward linkages are created when investment in a project prompts further investment in later stages of production; backward linkages occur when a project requires investment in production facilities (Hirschman 1958). The isolation of extractive sectors from the rest of the economy precluded

[3] Michael Ross (2015) cites Auty as the first person to use the term 'resource curse' in print.

[4] See also Ross (2012, p. 206) on this point.

these potentially positive ripple effects. Gelb and Auty's work on resource-led development provided a foundation for future scholars to articulate and test hypotheses using cross-national and time-series data (Sachs and Warner 1995).

Some economists proposed various aspects of commodity wealth that might lead to substandard economic performance, without resorting to political explanations. These scholars investigated a number of hypotheses. First, the volatility of global commodity prices can lead to temporary unemployment and the underutilization of capital. Second, was Dutch disease, whereby inflows of foreign currency appreciate the value of the domestic currency in real terms, making non-commodity exports less competitive on world markets (Corden 1984; Corden and Neary 1982).[5] Third, a related effect of Dutch disease may be the loss of learning by doing, as the economy moves away from manufacturing to resource extraction; Matsuyama (1992), among several others, suggested that the learning that takes place in manufacturing (but not the resource sector) has important spillovers to other sectors of the economy (for reviews of these arguments, see Frankel 2010; van der Ploeg 2011).

This is where, arguably, the first wave's influence has been greatest. While the impact of the purely economic facet of resource volatility is difficult to separate from the political (discussed further in Sect. 4), Dutch disease has come to be viewed as an inescapable economic reality for the world's largest oil exporters, which have a lot of trouble sterilizing the large inflows of hard currency associated with big and unexpected windfalls associated with either supply or demand shocks.

2 The Second Wave

The second wave of work on the resource curse, produced during the 1990s into the early 2000s, saw the construction of theories drawing on the fiscal contract model of state building (mentioned above), which would form the main theoretical foundation for much of the further research on this topic. Authors also contributed to existing debates on the importance of the role of structure versus agency in policymaking, and drew upon the dependency school's explanation for the persistence of underdevelopment in many of the world's former colonies. In short, this wave of work added theoretical

[5] The first usage of this term is found in The Economist, 26 November 1977, p. 82, in reference to the decline in the Dutch manufacturing sector following the discovery of the Groningen gas field.

sophistication to the existing empirical groundwork of the resource curse (for a review of a selection of second-wave contributions, see Cooley 2001).

Building on the fiscal contract model, social scientists now had a more complete theory with which to explain the association between natural resources and economic stagnation. Later, during the third wave of scholarship, political scientists would expand their analyses to include authoritarianism and violent conflict as potential outcomes of resource dependence.

Terry Lynn Karl's (1997) book *The Paradox of Plenty* has at its heart the fiscal contract model of state building. When oil exports become the lifeblood of the economy, as they did in Venezuela over the second half of the twentieth century, this creates 'social classes, organized interests, and patterns of collective action, both domestic and foreign, that are linked directly to the state and that benefit from oil rents' (Karl 1997, p. 16). In petro-states, governments are fiscally dependent on oil rents, and distribute these rents as a substitution for the creation of a robust bureaucracy funded by taxes. Sudden increases in oil windfalls further exacerbate these chronic problems, leading to a perverse and puzzling twist of fate: steady decline and destabilization in the face of copious oil revenues (Karl 1997, p. 17).

The second wave saw some scholars framing their work as a response to existing explanations for disparities among countries' levels of development. Grappling with the powerful influence made by multinational companies in the extractive sectors of several former colonies, some approached the resource curse from the dependency school of thought. Girvan (1971) and Beckford (1972) had argued that the foreign ownership of primary product companies in the Caribbean meant that the local economic benefits would be isolated. The mechanism for this phenomenon was that typically the final, high-value stages of production were located outside of the countries where the primary products were produced. Most of the gains from trade, therefore, accrued to companies based in industrialized countries, rather than the poor countries providing the raw materials. This process was later putatively observed across a range of products, including agricultural plantations and mines by Richard Auty (1990, p. 13) as part of the second wave of resource curse scholarship. In this way, both Auty's and Gelb's work spill into the second wave from the first, as they began to formulate a general theory to explain the negative effects of resource dependence.

Also of concern for some second-wave scholars were questions of structure and agency. Karl (1997) questioned the deterministic tone of some of the earlier work on the political economy of natural resources. While acknowledging that commodity booms in some ways restrict the political choices available to elites, Karl averred that divergent developmental paths can still be traced to individual decisions made in these contexts. This argument is summarized nicely by Alexander Cooley: 'By overspending on projects of dubious economic merit during the boom cycle, policy makers in oil states find themselves constrained to right the development course in the medium and long terms by remaining locked into a network of relations with business elites, state-operated industries, and ubiquitous rent seeking' (Cooley 2001, p. 168).

Karl's work also rests in part on what Michael Ross (1999) terms a cognitive explanation for institutional breakdown in the face of a commodity boom (for a full discussion of cognitive explanations, see Ross 2001b, p. 29). Karl argued that in times of substantial windfalls from commodity exports, state elites experience a kind of 'petromania,' which leads to increased government spending on patronage and pork barrel projects, rather than spending on infrastructure and other public goods (Karl 1997, p. 67). This sort of explanation for the negative effects of resource wealth was rather ad hoc, and failed to fully explain the variance among resource wealthy countries in their reactions to exogenous commodity booms brought about by sharp increases in world market prices.

3 The Third Wave

The third group of social scientists to tackle the resource curse added methodological rigor in terms of improving upon statistical inference. These authors used global cross-sectional and panel data to establish the correlations between resource dependence and various negative outcomes that had been shown previously in case studies. The third wave also witnessed the blossoming of empirical studies seeking to understand the link between natural resources and authoritarianism, as well as civil conflict.

Sachs and Warner (1995) were two of the first to use large-n data to suggest a resource curse effect on economic growth. They examined the effect of 1971 ratios of primary product exports to gross domestic product (GDP) across countries on GDP growth over the next 20 years. After controlling for other factors such as initial GDP, inequality, investment rates, terms of trade volatility, bureaucratic effectiveness, and trade openness, they found that there remained a significant and negative relationship between resource dependence and economic growth. Sachs and Warner used a broad definition of natural resources that included agricultural products; the majority of work that has followed has focused on a more narrow range of products, and typically authors attribute the most significant and robust effects to oil and other hydrocarbons.

Michael Ross (2001b) estimated a generalized linear model to test whether oil has an effect on regime type, utilizing panel data ranging from 1971 to 1997. Using the export values of mineral-based fuels and nonfuel ores and metals as a fraction of GDP as his primary independent variable, Ross argued that oil wealth has its most detrimental effect on democracy in oil-poor and low-income countries. He then suggested that food and nonfood agricultural exports do not have the same effect, which he took as support for the claim that it is externally generated rents that matter most when it comes to the resource curse.

Ross's article has been influential not only because it was one of the first to rigorously test claims about oil's relationship with democracy, but also because he attempted to establish the causal mechanisms at work. He tested three possible mechanisms: a rentier effect, which implies that oil-rich governments are less accountable to the population; a repression effect, whereby oil wealth enables states to bolster their internal security; and a modernization effect, which is the idea that structural changes generally associated with democracy such as urbanization and education do not tend to accompany an oil-based development trajectory. While Ross found suggestive evidence for the rentier effect, he uncovered weak or mixed evidence for the other two mechanisms.

Paul Collier and Anke Hoeffler (1998) were two of the first to suggest that natural resource wealth might be used to predict incidence of civil conflict (see also Collier 2000). They argued that these resources were used by rebels as a source of revenue, financing their operations and raising the chances of an outbreak in violence. Fearon and Laitin (2003) and Fearon (2005) would counter by showing that Collier and Hoeffler's evidence was fragile in the face of better data. Instead, they argued for understanding oil as a potential prize for rebels if victorious; they further argued that weak state capacity due to oil exportation was a second reason for the association between oil and conflict (see also, de Soysa 2000; Le Billon 2001). Collier and Hoeffler (2002) later refined their argument, suggesting that natural resources increased the risk of conflict most strongly at lower levels of abundance, while at higher levels they likely provided governments with enough revenue to suppress rebellion.

These articles represent only a small portion of the scholarly work on natural resources and conflict that has emerged since the turn of the century. Other authors have examined, for example, the impact of resources other than oil (Fearon 2004; Lujala et al. 2005; Ross 2006), whether the discovery of resources can spark conflict (Lei and Michaels 2014), and have produced more careful analyses of the mechanisms linking resources and conflict (Homer-Dixon 2010; Humphreys 2005; Collier and Hoeffler 2004). Ross

(2012) offers the latest addition to this conversation, arguing that oil-rich countries are twice as likely to descend into civil conflict as other nations, although oil is almost never the only factor at play determining conflict.

4 The Fourth Wave

The latest wave of scholars to examine the resource curse has brought to bear the most advanced statistical methods, refined theories, and a concern for establishing causality. They have produced compelling and nuanced interpretations of the economic and political effects of resource endowments. At the same time, there has arisen a group of scholars who doubt the validity of the causal claims that have been made about the effect of natural resource wealth, and in particular oil. While still in the minority, this subgroup has produced theory and evidence that calls into question much of the accepted wisdom regarding the resource curse.

Several authors in the fourth wave hold a conditional view of the resource curse; in other words, the negative effects of resource dependence only emerge under certain scope conditions. This view is a reaction to the results of some of the more rigorous methodological work of the third wave, which indicated that there were many countries that seemed to escape the negative consequences of developing their extractive sectors (e.g., Canada or Norway). The exceptions to the resource curse pointed authors toward the conditions under which resource dependence appears to have a causal effect, conditions that include geographic and temporal factors as well as institutional variables.

An important regional exception to the resource curse appears to be South America, where countries such as Chile have, by all accounts, successfully managed to translate oil booms into greater social spending and economic growth without descending into authoritarianism. Thad Dunning (2008) argues that the explanation for this puzzle lies in the degree of income inequality in the region. He avers that oil's nefarious effects on democratic institutions, caused by conflict over the distribution of rents, are counteracted by its indirect democratizing effects. Increased resource rents lower the redistributive costs of democracy, reducing elites' anxiety about the potential losses awaiting them if they cede political power to the masses. Dunning suggests that this theory can also help to elucidate other anomalies outside of Latin America, such as surprisingly democratic Botswana, which relies heavily on revenues from diamond mining (Dunning 2008, p. 258).

Michael Ross' (2012) book *The Oil Curse* is the most advanced articulation of the conditional resource curse logic. Using regression and survival analyses, he suggests that certain distinctive features of oil have caused negative outcomes when it comes to the longevity of authoritarian regimes, the tendency of weak democracies to backslide to authoritarianism, the involvement of women in the economy, and the duration of civil conflicts.[6] Oil revenues' source, size, volatility, and their secrecy make them especially likely to lead to negative outcomes in these areas. In terms of the conditionality of the resource curse, Ross argues that it depends on whether the state monopolizes the oil sector. He therefore claims that it is most powerful since the late 1970s, a period during which developing countries around the world nationalized their extractive sectors. Ross has argued that studies that are critical of the resource curse, such as Haber and Menaldo (2011), fail to find evidence for it because they do not examine the right time period (see Andersen and Ross 2014).[7]

As a whole, most scholars of the fourth wave have come to the conclusion that the resource curse is dependent upon the political and economic institutions that are in place at the time of the discovery of oil (see Frankel 2010). States with strong institutions and reliable sources of revenue will tend to handle newfound resource wealth well, while weak states will mismanage it, become overly dependent on it, and siphon off rents to elites rather than invest them in public goods. This has also become the go-to way to make sense of why countries such as Canada, Norway, and Australia are prosperous while countries such as Papua New Guinea and Myanmar are not in popular takes on the resource curse (*The Economist* 2015).

Also typical: The fourth-wave scholarship on the resource curse is the departure from the fiscal contract model of state building that undergirded earlier work on this topic. Recent entries that abandon or modify that approach include Dunning (2008), Menaldo (2016), and Ross (2012). Some shortcomings of the old approach enumerated by Menaldo include the problematic

[6] Ross retreats somewhat from earlier claims made by him and others about oil's negative impacts on economic growth, however. He argues that dependence on oil does not lead to negative growth, but instead that oil states are decidedly average in this category. This is itself a puzzle for Ross, given strong priors about how a resource windfall should negatively impact a national economy. Ross argues that oil may have an indirect slowing influence on growth by restricting economic opportunities for women. When women are kept out of the workforce, birth rates increase, resulting in slower per capita growth overall. Further, politicians are unlikely to enact policies to counteract oil's volatile economic impact, both because of public pressure and because of selection of oil industry-friendly elites into office.

[7] Menaldo (2016) responds to this argument, however. He shows that, once oil income per capita is instrumented with giant oil field discoveries and measures of regional oil stocks, and oil exploration efforts are adequately controlled for, the post-1980s period yields no more evidence for a curse than any other period for which there are data. In fact, across both periods there is strong evidence of a resource blessing.

view of elites as a unitary group, a lack of information asymmetries between elites and the masses, as well as no consideration of opportunism among elites or collective action problems among the citizenry. The net effect of addressing these shortcomings is the production of new theories that are focused more on intra-elite politics and less on bargaining between elites and the masses.

5 But Is There Really a Resource Curse?

As of late, an emerging set of authors question the very logic and evidence of the resource curse (e.g., Brunnschweiler and Bulte 2008, 2009; Haber and Menaldo 2011; Lederman and Maloney 2007; Menaldo 2016). They argue that it is institutions that are at the root of the problems we observe in resource-dependent countries. A crucial insight that these critics offer is that resource extraction, including even oil exploration, should not be seen as an exogenous, randomly assigned variable (e.g., Brunnschweiler and Bulte 2008; Haber et al. 2003; Menaldo 2016). Because that is the case, underlying institutions that are usually omitted from empirical analyses could actually jointly determine both the natural resources themselves and the pathologies perhaps mistakenly attributed to them.

Menaldo (2016) begins by fleshing out a series of puzzles that challenge the resource curse. He documents strong, prima facie evidence that natural resources, especially oil, do not harm countries' ability to generate revenues, grow their economies, or become and stay democratic.

The first puzzle is the salutary role that natural resources have played throughout European and North American history. Mineral wealth helped secure the consolidation of powerful empires and states with impressive territorial reach in both European countries and their colonial offshoots. The industrial revolutions that were unleashed during the nineteenth and twentieth centuries, and which lifted millions from penury into plentitude, were fueled by coal, hard rock minerals, and eventually oil.

The second is that the first global oil shock, which occurred in 1973, provides a quasi-natural experiment that roundly rejects the resource curse thesis. After Arab oil producers imposed an embargo on the Western allies of Israel during the Yom Kippur War, this ushered in a huge increase in the oil price, amounting to an unprecedented structural break in the world oil market. Countries that were not significant oil exporting countries before 1973 became so after the shock; and on the back of their newfound bounty, they improved their state capacity, level of democracy, and economic development.

The third puzzle is about the MENA, a region of the world that is often held up as the poster child of the resource curse. There, countries were underdeveloped well before oil was discovered. Moreover, oil-rich countries such as Iran and Saudi Arabia are not radically different today than oil-poor Morocco and Jordan. Indeed, if oil is purported to be the fundamental cause of underdevelopment in oil-rich countries, then it is puzzling that the differences between the oil-rich and oil-poor countries tend, if anything, to favor countries such as Qatar and the United Arab Emirates: they look much more attractive today than Yemen or Syria.

Drawing on a political economy literature called neo-mercantilism and a literature on institutional origins called the factor endowment approach, Menaldo then tries to explain why all societies do not simply adopt good institutions.[8] He concocts an institutions curse theory to address this question, which paves the way for an endogenous explanation of resource reliance and crony capitalism. He explores the critical role played by commitment problems and transaction costs in conditioning elites' strategies of power acquisition and maintenance. In turn, these strategies deeply affect present investments that culminate in future fiscal transaction costs and levels of state capacity. When elites are unable to make credible commitments to respect and enforce property rights, and when the fiscal transaction costs associated with taxing the economy are too high, incumbents turn to strategies that can generate rents in ways that procure political loyalty and generate easy-to-tax revenues. Natural resource extraction is just one potential strategy for elites to pursue, with oil in particular being especially lucrative. This comes at a steep, long-run cost; however, it further promotes the cartelization of property rights at the expense of the majority, enervates state capacity, and fuels underdevelopment.

Armed with this institutions curse theory, and eschewing the fiscal contract approach to state building and development, Menaldo then challenges the view that there is a causal relationship running from oil to political and economic underdevelopment. He seeks to empirically identify what determines a hydrocarbons sector in the first place, and argues and finds that revenue-starved states with low capacity are more likely to launch oil exploration efforts, goose the production of extant wells, export oil to a higher degree, tax it more heavily, and attract higher levels of capital in hydrocarbons. This is

[8] The factor endowment approach entails exploiting variation in climate, soil quality, the size of the native population, and disease in order to explain contemporary variation in political and economic institutions. This is useful for addressing questions of the direction of the causal arrow between institutions and dependent variables such as economic growth and democracy. The approach has been used in political science for the last two decades, perhaps most prominently by Acemoglu et al. (2001).

because they can often call on several tools to raise revenues on the oil sector years before the first oil well is drilled. This includes signing bonuses, equity stakes, and acreage fees, just to name three of these.

While National Oil Companies have increasingly shouldered more of the heavy lifting to bring new oil industries to fruition, private investors continue to play a prominent role. International Oil Companies (IOCs) exploit huge advantages in power, money, and information to protect their property rights in host countries across the developing world. Moreover, IOCs increasingly engage in regulatory arbitrage to sidestep stringent environmental regulations in their home countries, as well as higher taxes. Table 21.2 reproduces the logic of this theoretical framework, identifying the demand- and supply-side reasons why the rulers of weak states and IOCs both construct big and valuable natural resource sectors in developing countries.

In Menaldo (2016), a series of statistical analyses yield results that support the claims outlined above. This is the case after controlling for geological endowments, oil prices, and production costs. Weak states are more likely to court capital in the oil sector, explore for oil, extract it at high rates, export it, and tax it, no matter how he operationalizes oil, or state capacity, and across a host of specifications that address endogeneity bias.

Menaldo also systematically explores if there is actually a resource blessing instead of a curse. He reevaluates the relationship between oil and a host of political and economic outcomes across the globe since 1930 after isolating the exogenous variation in fuel income as instrumented by geological endowments, and after controlling for exploratory efforts. These outcomes include non-resource public revenues; regime type; the quality of a country's institutions; the government's ability to credibly commit to its promises; and the size and sophistication of the market economy.

Across the board, Menaldo finds evidence for a resource blessing. This is even after exploring the effects of oil on democracy in the post-1980 period, in the wake of a wave of oil firm nationalizations. He also adduces considerable evidence for the mechanisms that explain a positive association between resources and a country's political economy in Latin America over the long run.

Finally, Menaldo (2016) also attempts to understand what explains the political instability that buffeted the MENA during the Arab Spring. The region's monarchies largely elided turmoil and violence. The 'republics' did not. He shows that this has also been the case historically. The association between political stability and monarchy is not driven by oil wealth. Nor does oil explain why monarchies have better institutions, provide more public

Table 21.2 Demand and Supply Side Reasons for Oil in the Developing World

	Fiscal matters	Political risk	Business risk	Regulatory arbitrage
Why weak states are attractive	Weak states have few alternative revenue sources. They suffer from a scarcity of foreign exchange. Coaxing oil into production and taxing, it is relatively easier than other activities that require secure property rights that are broadly. distributed and enforced	Political risk is high across non-oil economic activities because property rights are generally insecure and policies are volatile. This is especially the case for capital intensive endeavors outside of energy and minerals, such as innovation, that depends on intellectual property rights or retained profits and high levels of collateral.	Host governments can mitigate this risk by offering generous profit recovery concessions in production sharing contracts.	Host governments can relax health, safety, and environmental regulations. Often times agencies deputized to regulate externalities are underfunded and staffed or corrupt. They also tend to externalize the costs associated with health, safety, and environmental externalities on to marginalized communities that are dis-enfranchised or co-opt potential protests with clientelism.
Why IOCs can defend themselves in weak states	Private, foreign firms will pay taxes but can get a relatively good deal. They use informational advantages, strong bargaining leverage based on outside options, and vulnerability of host governments to their expertise, capital, and oil rents to drive good deals. They also use transfer pricing to avoid the most onerous tax burdens.	Private firms can rely on informational advantages, such as withholding key technical and geological expertise to protect their rights and their interests. Can rely on international arbitration and the enforcement of their rights by other governments, which can seize the property of governments that renege on deals. They can also purchase political risk insurance, which is subsidized.	Private firms can hedge against risks associated with any one oil play by diversifying their exposure at the global level. They can ramp down investments in marginal or risky fields during price downturns by idling drilling and exploration.	Private firms will use the threat of exiting jurisdictions in which regulations turn against them. They will also be on the ground floor during the crafting of land use and energy legislation, and even fiscal policy, to make sure their interests are represented. They will also strategically use corporate social responsibility initiatives at the local level to avoid regulatory costs at the national level that would proscribe externalities.

Source: Menaldo (2016)

goods, and have higher levels of educational attainment and faster economic growth.

Instead, to help understand why there is a correlation between monarchy and these outcomes in the MENA, Menaldo introduces a theory about how an invented, yet historically rooted, political culture can solve a ruler's credible commitment problem. By securing elites' rights and interests, it bolsters their support of the regime. While he illustrates the evolution of monarchic political cultures over the history of the MENA, Menaldo documents the geographic and biogeographic underpinnings of monarchy, arguing that extreme aridity and pastoral nomadism centered on camel herding sustained a tribal social structure. This unique equilibrium held despite millennia of imperialism, Islam, and European colonialism.

The resource curse literature has played an important role in our understanding of the political economy of development, as well as authoritarianism, democracy, and violent conflict. As we have described, the scholarship has grown increasingly sophisticated over time, both in terms of theory and in the methods employed by researchers. While the exact nature of the association between natural resources and various ill outcomes has been elaborated with some nuance since the early case studies that sparked the literature, many analyses have been plagued by incomplete data and omitted variables.

The latest wave of scholars has brought a critical eye to these problems, and suggested that the resource curse may indeed be simply a matter of correlation rather than causation, albeit a compelling one.

Important questions do remain. The association between resources and conflict has held up the best to scrutiny, been shown to exist across a range of resources, and may take different forms depending on whether one is looking at the onset or the duration of war. The precise relationship between the two requires additional analysis, as does the question of whether this association too is one characterized by an omitted variable of institutions. And if the institutions curse does hold up to further investigation, then important work must be done to see how states can put themselves in a position to harness their resources effectively to promote development.

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Part VI

Energy Justice and Political Ecology

Primary editor: Benjamin K. Sovacool

22

The Political Ecology and Justice of Energy

Benjamin K. Sovacool

1 Introduction

A tropical hydroelectric dam is constructed in Malaysia to generate electricity to be consumed by a series of aluminum smelters that will serve to pollute a biodiversity hotspot—and forcibly relocate thousands of indigenous peoples (Sovacool and Bulan 2011). A nuclear waste repository is erected in the UK which will further marginalize, disempower, and threaten the public health of rural communities (Blowers and Leroy 1994). An oil pipeline running between Chad and Cameroon generates revenue used by the Chadian government to start a civil war (Kardon 2008). The owners of a series of wind farms in Mexico appropriate land without community consent and refuse to equitably distribute income from the project to property owners (Oceransky 2010). The smoke and toxic ash from a refinery fire in Texas create unfavorable living conditions and long-term health consequences—missed paychecks and mounting hospital bills push an already weakened community further into crisis (Sovacool et al. 2014).

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Although there are many interpretations of political economy and international political economy—loosely defined as interactions between the government, or the 'state,' and the private sector, or 'the market' (Gilpin 1987; Van de Graaf et al., Chap. 1, this volume)—in one sense each of the above examples fits within its domain. For one conceptualization of political economy is that it involves the study of global struggle, or the processes by which some actors benefit from particular systems or processes at the exclusion of others (Wolff and Resnick 1987). It investigates, in other words, the winners and losers of energy systems and practices. This somewhat liberal or radical notion of political economy sits very closely with two other streams of thought seldom discussed by political scientists or political economists: political ecology and energy justice.

Political ecology, a term likely unfamiliar to many readers, may seem like an odd fit for a Handbook dealing with political economy. And yet it remains closely related, as international political ecology, in its broadest sense, also focuses on the influence of power relations and structural inequalities, but with a closer link to human processes which degrade the natural environment (Wolf 1972). Biersack and Greenberg (2006) argue that political ecology refers to the 'culture of production, distribution, and exchange' within the socio-environmental system. Watts (2000) suggests that political ecology deals with 'access and control over resources and their implications for environmental health and sustainable livelihoods.' Bryant and Bailey (1997: 28–29) write that political ecologists generally accept the idea that 'costs and benefits associated with environmental change are for the most part distributed among actors unequally' which serves to reinforce or reduce existing social and economic inequity. Robbins (2004: 20) adds that political ecology research 'tends to reveal winners and losers, hidden costs, and the differential power that produces social and environmental outcomes.'

Indeed, there is an obvious overlap between international political economy and political ecology:

> *[Political ecology] is political economy (not 'economics') in the sense that it sees the creation and distribution of wealth as a process involving both regulation by extra-economic institutions (notably the national state and its ancillary bodies) and social struggle—struggle between different actors over their size of the economic pie (e.g. capitalists and workers), and/or with those contesting the wider implications of economic activity on ostensibly non-economic grounds (such as 'deep ecologists' protesting against airport expansions and road building programs). As this last bracketed example implies, political economy—even if its many practitioners have not always acknowledged it—is simultaneously and necessarily political ecology (Castree* 2010*: 1739).*

Castree, in other words, argues strongly that political ecology can be regarded as a subset of political economy. Political ecology, which also emphasizes inequality, can be approximated with the Radical (or Marxist) school of thought in IPE discussed in Chap. 1 as well.

A second relevant, related domain of inquiry is often termed with various prefixes to justice: environmental, climate, or energy 'justice.' Environmental justice is concerned with the distribution of environmental hazards and access to all natural resources; it includes equal protection from burdens, meaningful involvement in decisions, and fair treatment in access to the benefits (Low and Gleeson 1998; Schlosberg 1999; Byrne 2002; Bowen and Wells 2002). Walker (2012) defines environmental justice's two central issues as how some consume key environmental resources at the expense of others and how decision-making is unequally influenced. Climate and energy justice are closely linked, and refer to the fairness, virtue, or equity dimensions of actions and decisions concerning greenhouse gases and energy production and use (Arnold 2011; Bickerstaff et al. 2013; Sovacool and Dworkin 2015; Heffron et al. 2015; Fuller and McCauley 2016). This set of literature revolves around the notion of fairness to present generations, given that some people have disproportionate access to the benefits of energy or a more resilient community, and fairness to future generations, given that we will leave them with the legacy of pollution and a potentially unstable climate (Sovacool 2013).

With this seamless connectivity between political economy, ecology, and justice laid bare, this Section of the Handbook is divided into five constituent parts that offer both a novel and rich way of evaluating energy systems: the political ecology of petroleum conflict, tyranny and dispossession, global production networks (GPN), enclosure and exclusion, and energy justice and equity. Table 22.1 offers a summary of the key topics, foci, disciplines, concepts, and authors behind these approaches.

2 The Political Ecology of Petroleum Conflict

As Michael Klare (Chap. 17, this volume) has masterfully demonstrated in his section, over at least the last two decades, economists and political scientists have published extensively on the concept of the 'resource curse.' Although Auty (1993) was the first to label the phenomenon the resource curse, history provides a number of examples in which resource poor states outperformed resource endowed ones. The Netherlands outperformed Spain in the seventeenth century, despite gold and silver flowing into Spain and Switzerland

Table 22.1 Conceptual overview of energy political ecology and energy justice

	Political ecology and conflict	Tyranny, dispossession, and peripheralization	Global production networks	Enclosure and exclusion	Energy justice
Primary focus	Conflict over natural resources	Knowing sacrifice of one group over another more powerful group	Activities and structures that transform labor, nature, and capital into commodities and services	Power regimes, processes, or ideologies that enclose upon resources or exclude agents from access	Fairness and equity in energy decisions and practices
Related academic disciplines	Resource economics, geopolitics, political geography, political science, economic geography	Human geography, ecology, political geography, sociology, peasant studies	Human geography, ecology, political geography, economic geography, environmental studies	Human geography, ecology, political geography	Environmental sociology, law, jurisprudence, philosophy, ethics, energy policy
Key concepts or terms	Resource curse, intrastate conflict, interstate war	Human rights, externalities, systemic or catastrophic risk, energy accidents, accumulation by dispossession, new imperialism, peripheralization, resistance	Value, power, embeddedness, commodity chains, global supply networks, *filieres*	Territoriality, geographic imaginaries, fencing, boundary checkpoints	Procedural justice, distributive justice, cosmopolitan justice, justice as recognition

Selected authors	Michael Watts, Richard Auty, Terry Lynn Karl, Jeffrey Sachs, Jeffrey Colgan, Vaclav Smil, Michael L. Ross	David Harvey, Paul Robbins, Bill Cooke, Uma Kothari, Andy Blowers, Pieter Leroy, Jim Glassman, Matthew Sparke, Noel Castree, Majia Nadesan, Martin Pasqualetti	Gavin Bridge, Neil M. Coe, Peter Dicken, Martin Hess, Jennifer Bair, Gary Gereffi, Guy Leung, Dustin Mulvaney	James McCarthy, Paul Robbins, Saturnino M. Borras, Arielle Hesse, Jennifer Baka, Kirby Calvert	Karen Bickerstaff, Gordon Walker, Harriet Bulkeley, Michael Dworkin, Benjamin Sovacool, Raphael Heffron, Darren McCauley, Kirsten Jenkins, Mark Cooper

Source: Månsson (2014)

and Japan rushed ahead of mineral rich Russia (Sachs and Warner 1995: 2). As Davis (1995) details, these resource curse arguments were given modern force by Argentinian economist, Raúl Prebisch,[1] the father of *dependencia* or *dependency theory*. Commodity-exporting states in Latin America saw their economies devastated by collapsing world prices during the late 1920s and the 1930s. Furthermore, in much of Latin America there was great resentment toward and fear of the 'colossus of the north and antipathy to what were seen as exploitative American corporations operating in the Latin arena' (Yergin and Stanislaw 2002: 232). Prebisch, originally trained in neoclassical economics, argued that poor states would become poorer while the rich became richer. To break this cycle, Prebisch and his followers argued, Latin American states needed to isolate themselves from wealthy northern states, turning from international trade in commodities to creating their own industrial sectors, a policy that became known as import substitution industrialization. Several other states that had turned to oil to dramatically boost their economies—Venezuela, Mexico, and Nigeria—were seen as victims of the resource curse when oil prices collapsed (Sachs and Warner 2001).

According to proponents of the curse theory, countries with an abundance of natural resources paradoxically have lower growth rates than those with few resources. In addition, some scholars find that resource abundance further curses citizens with authoritarian governments, high income inequality and gender inequality, uneven regional economic development, and domestic and international violence (Gochberg and Menaldo, Chap. 21, this volume). The underlying assumption, although not always overtly stated and perhaps in some poorly developed studies not even considered, must be that these states would be better off—would not suffer so many of these ills—if they had fewer resources. Unable to rely on the easy money that comes from resources, the state would have to build up its capacity in other ways, such as through higher education and better healthcare systems, and create more diverse economies.

A connected theme is that energy production and its associated economic value can be a catalyst for conflict and war or exacerbate wars already ongoing. Månsson (2014) has developed a compelling typology linking different energy systems with a variety of conflicts and wars. As he notes in Fig. 22.1, sometimes the end goal of a conflict is primarily for the participants to improve their own security by securing some part of the energy system, that is, energy is an objective in a conflict, such as the Iraqi invasion of Kuwait in the early 1990s. In a second category, an energy system is a means of initiating a conflict related to something else, such as Russia's use of its fossil fuel exports

[1] For his points on Prebisch, Davis cites Hunt (1989).

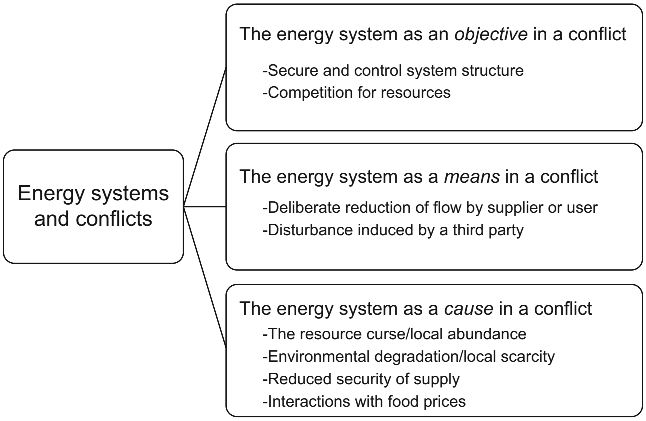

Fig. 22.1 Energy systems as objectives, means, and causes of conflict

to get concessions in other political areas from countries such as Belarus and Ukraine. In a third situation, an energy system is partly the root cause of insecurity, as it has destabilized a society and thereby contributed to, or exacerbated, insecurity, such as rapid environmental degradation creating refugees or leading to social movements that try to topple governments, such as those ongoing with indigenous people in North America and Asia. Månsson then goes on to describe a fair number of actual conflicts that meet his typology, with dozens of examples including major wars but also border disputes, suppliers such as Organization of the Petroleum Exporting Countries (OPEC) using their 'oil weapon,' and local attacks from terrorists and saboteurs in places such as Nigeria.

Colgan (2013) offers a similar typology of 'causal pathways' between oil and international conflict depicted in Table 22.2 (in modified form). Colgan's (2010) work has shown that 'petro-states' where revenues from oil exports constitute at least 10% of GDP have a 'above average propensity to engage in militarized interstate disputes.' He found that 'petro-states' engaged in military conflict at a rate about 80% higher than non-petrostates over the period of 1965–2001. His explanation was that revolutionary leaders are able to rely on oil export revenues to consolidate power and provoke international conflict. Thus, the international trade of oil as currently structured places large amounts of money into a political system ill equipped to use it responsibly (Colgan 2014).

An abundance of empirical evidence seems to support the theoretical arguments for how energy resources or systems can contribute to conflict. Energy

Table 22.2 Causal pathways between oil and international conflict

Dimension	Pathway	Causal mechanism	Example(s)
External and international: geopolitics and resources	Resource wars	Oil reserves raising the payoff of territorial conquest	Iraq–Kuwait, 1990; Chaco War; Japan, 1941
	Risk of market domination	Threat of conquest to ally or key territory	USA–Iraq, 1991
	Oil industry grievance	Presence of foreign workers creates grievances for state or non-state actors	Al-Qaida; Iran hostage crisis
Internal and domestic: politics in producing countries	Petro-aggression	Oil reduces the accountability of leaders, lowering the risk of instigating wars	Iraq–Iran; Libya–Chad; Egypt
	Petro-insurgency	Oil income provides finances for actors to wage war	Iran–Hezbollah; Saudi Arabia–Afghanistan
	Externalization of civil wars	Oil creates conditions for civil war that then lead to foreign intervention or spillover	Libya–NATO; Angola–Cuba; Sudan–Chad
Internal and domestic: access concerns in consuming countries	Transit route	Efforts to secure transit routes create a security dilemma	Sudan; South China Sea; Strait of Hormuz
	Obstacle to multilateralism	Importers attempt to curry favor with petrostates to prevent multilateral cooperation	USA–China friction over Iran; Sudan

resources were factors, if not actual causes, in the Korean War (North Korea is the coal-rich part of the peninsula), the Vietnam War (waged by France until 1954, the USA after 1964, at stake were Vietnamese oil and gas reserves), the Soviet occupation of Afghanistan (which had significant energy and mineral resources), and the first Gulf War (explicitly about oil, Iraqi occupation of Kuwait) (Smil 2004). The conflict between India and Pakistan, Eritrea and Ethiopia, China and India, and also civil wars such as those in Sri Lanka, Uganda, Angola, and Columbia were all related to energy resources in some way (ibid.). O'Leary (2004) has identified ten serious civil wars and conflicts from 1990 to 1999 directly fueled by natural resources, many of them related to energy: oil funded five separate civil wars in Angola, East Timor/Indonesia, the Kurkuk region of Iraq, Southern Sudan, and the Xinjiang province of China; and natural gas enabled a conflict in Aceh, Indonesia. Nyman (2015) has found that even more difficult to reach, offshore oil and gas resources can intensify conflict. Looking at more than a half century of data related to the determinants of militarized interstate disputes over maritime claims with oil, she concluded that 'areas with oil and gas resources were more likely to see conflict after the extraction of those resources was an accomplished feat. Once those previously unreachable resources could be extracted, it became more important to states to claim them as their own.' Ross (2008) has also documented numerous cases of where oil revenues have directly exacerbated conflicts around the world. He noted that raising money in petroleum-rich countries can be easy for insurgents and terrorist groups, who can steal and sell it on the black market, as they did in Iraq and Nigeria. Such groups can extort money from oil companies working in remote areas, as they did in Colombia and Sudan. They can find business partners to fund them in exchange for future consideration if they seize power, which happened in Equatorial Guinea and the Republic of the Congo. As he concluded, 'oil wealth often wreaks havoc on a country's economy and politics, makes it easier for insurgents to fund their rebellions, and aggravates ethnic grievances' (Ross 2008: 2).

There are other, less direct ways that energy resources can influence, cause, or intensify conflicts. Watts has suggested that newfound oil wealth within OPEC has largely backed a global arms race—with countries in the Middle East spending roughly $45 billion a year on weapons per year and every 1% increase in oil revenues corresponding with a 3.3 increase in arms imports (Watts 2005). As he concluded, 'the reconfiguration of the global oil industry has produced close alignments between oil, finance, and weapons of war, and it has resulted in a close association between oil security as a strategic concern and various types of conflict.' Smil (2004, p. 378) adds that wars represent the most concentrated and devastating releases of energy, that military operations need mobilization of energy for resources, and that a common consequence of war is disruption of energy services (Smil 2004).

Unfortunately, breaking out of the resource curse or energy-fueled conflict once it starts can be exceedingly difficult. As Watts (Chap. 23, this volume) explores in his contribution to the Handbook, Nigeria has become a 'fragile and conflicted state' condemned to embark up a 'post-conflict transition' wrought with unstable political alliances and high levels of violence and political conflict. Nigeria, though certainly more functional today than it has been over its recent history, has only seen state apparatuses garner the loyalty of powerful groups and individuals, and direct benefits to particular constituencies while enabling extraordinary illicit wealth to be accumulated and secured, with impunity, over time. Watts' chapter does more, however, than merely trace the genesis of oil insurgency and conflict in Nigeria; he also introduces the three concepts of provision pacts, dispossession, and the politics of ressentiment to explain how oil development can germinate—and structurally reinforce—conflict. Oil revenues created in Nigeria a *provision pact*, political order shaped through patronage rather than taxes. The capture of oil rents by the state resulted in *dispossession* through a series of laws and statutory monopolies (more on this comes below in Sect. 3 of this chapter on 'Tyranny, Dispossession, and Peripheralization'). Oil nationalization lastly led to *ressentiment*, a process where local property systems and land rights were subjugated to the needs of the state and its elites. The fact that oil companies, as cosignatories to joint ventures with state, were in turn compelled to pay rent to oil-bearing communities converted what should have been a public asset into a perpetually contested resource prone to violent struggle.

3 Tyranny, Dispossession, and Peripheralization

The notions of 'dispossession' and 'accumulation by dispossession' affiliated with capitalism, or that of 'tyranny' associated with unfair decision-making processes, are also central themes in political ecology research. 'Dispossession' has its roots at least going back to Karl Marx, who held that the capitalist system is constantly striving for profits and capital accumulation in a competitive market economy so that labor becomes 'dispossessed' and treated as a thing, a commodity, subject to the same pricing mechanisms (Gilpin 1987, pp. 36–38). Harvey (2004) has drawn from this classical concept to create his own modern idea of 'accumulation by dispossession,' defined as the 'centralization of wealth and power in the hands of a few by dispossessing the public of their wealth or land.' Accumulation by dispossession can take a variety of forms, including the privatization of land and forcible relocation of people residing there, the establishment of property rights or suppression of rights to the commons, and the process of appropriating assets such as natural resources or land (Harvey 2003 and 2006). Cooke and Kothari (2001) frame their investigation of exclusion using the language of 'tyranny,' arguing that decision-making processes themselves can become tyrannical and exclusionary. One way this tyrannical exclusion can occur is by multilateral or international agencies and funders dominating discussions and decisions being made about energy.

Dispossession and tyranny can have many causal mechanisms (White et al. 2012). The most direct is simply stealing or 'grabbing' land. When an area already owned or in possession of a group is taken over by others, it is known as land seizure. When a group is prevented from acquiring or accessing land to which it is entitled, it is known as land denial (Adnan 2013). Ex situ displacement or dispossession is a process whereby people are directly and forcibly removed from their land; in situ displacement or dispossession is when struggles for or regulation of land indirectly leads to expulsion, such as through higher prices or changes in the law (Feldman and Geisler 2011). Bernstein (2010) has also developed a typology of land dispossession presented in Table 22.3. Sometimes, farmers or peasants are displaced by local elites that own property or agrarian capital; or, they are displaced by their neighbors who begin to accumulate wealth and differentiate themselves by class. In other times, dispossession can be more a national and international phenomena, with pressures coming from political elites in urban areas or even transnational flows of capital. The point is that a single community or agent can face multiple pressures for land dispossession simultaneously on multiple fronts, actors, and scales. Moving on from Bernstein, in still other cases, energy or climate policies can convince corporate actors to invest in solutions that are land-intensive, such as genetically engineered crops or the growing of feedstocks, which then displace people from their land. In others, land and natural capital might be directly appropriated for environmental ends, such as placing restrictions on logging in an old-growth tropical forest. In still others, national or corporate 'land deals' may legally set aside land for other uses such as economic development or the creation of jobs.

A related, localized aspect of dispossession or tyranny has been characterized as 'social peripheralization,' which refers to how some places exhibit certain characteristics that make 'peripheral communities' ideal targets for the

Table 22.3 A schematic typology of land dispossession

Type	Main class agents
Dispossession of small farmers/'peasants'	Landed property, agrarian capital
Accumulation from below/class differentiation	Rich peasants, emergent capitalist farmers
Dispossession by indigenous classes of capital and politically powerful groups	Indigenous urban classes of capital, local or national political elites
Dispossession by international banks and foreign governments	International capital and states

siting of nuclear power plants, nuclear waste storage facilities, or other noxious energy infrastructure. According to social scientists Andy Blowers and Pieter Leroy (1994), peripheral communities tend to be:

- *Remote*, either geographically separated from population centers or relatively inaccessible;
- *Economically marginal*, with most communities being homogeneous in terms of their social and demographic background and dependent on a single industry as a dominant employer;
- *Politically powerless*, with most key political decisions being made elsewhere, often in metropolitan centers;
- *Culturally defensive*, with residents expressing ambivalent or ambiguous attitudes toward energy, combined with feelings of isolation and a fatalistic acceptance of energy related activities;
- *Environmentally degraded*, meaning residents tend to occupy previously polluted land or are close to places where radioactive risks are already present.

In essence, the local process of peripheralization suggests that dangerous energy facilities will tend to migrate to countries and communities that lack the political, social, and economic strength to oppose them (Solomon et al. 1987).

In their contribution to the Handbook, Nadesan and Pasqualetti (Chap. 24, this volume) reframe and broaden dispossession around the idea of 'sustained abnegation of basic human rights, which are encoded in national and constitutions and international agreements, including the Universal Declaration of Human Rights, the Declaration of the United Nations Conference on the Human Environment, the Millennium Declaration, and the Convention on the Rights of the Child.' They argue that dispossession in the context of energy supply and use stems from unwillingness to mitigate known and significant risks to human rights encoded in routine operations, including extractive processes, common refining techniques, and modes of transportation and energy utilization. They then proceed to focus on both catastrophic, high-impact but low-occurrence instances of dispossession alongside more systematic, chronic, and common ones. They modify the concept of dispossession with critical social theory to reveal multiple conditions of sustained energy injustice found in Western civilizations as its powerful energy complexes knowingly deny the scope and severity of externalized costs, thereby discouraging public awareness of needed change for a sustainable future. They include detailed case studies of the 2010 Gulf of Mexico British Petroleum (BP) oil spill and the

2011 Fukushima nuclear crisis—catastrophic examples—alongside analysis of more common forms of dispossession including lack of energy access and energy poverty.

4 Global Production Networks

At its most broad level, the GPN approach attempts to help explain how global industries are organized and governed, and how they relate to economic development (Coe et al. 2008a: 267–269). GPN research grew out of the value chain and global commodity chain analyses from the 1980s and 1990s, especially Gereffi's description of global commodity chains, being conducted in the disciplines of strategic management, economic sociology, and development studies (Gereffi 1994; Gereffi et al. 2005).

In short, the GPN approach affords a better look at the cultural, political, and institutional implications of how networked firms operate (Hess and Yeung 2006). What results is a multi-actor, multi-scalar analysis that often uncovers three central foci: *value*, *power*, and *embeddedness* (Coe et al. 2004; Henderson et al. 2002). GPNs are constantly trying to create *value*, in the case of the Baku–Tbilisi–Ceyhan (BTC) pipeline, as an example, trying to enhance the value of the oil fields of BP and other multinational oil companies in the Caspian Sea, creating a transport corridor for their product. GPNs are ceaselessly circulating *power*, in the case of the BTC influenced primarily by BP but also backed by institutional and collective forms of hegemony flowing out of national governments and multilateral development banks. GPNs participate in the process of *embeddedness* by solidifying social and spatial arrangements to give them maximum advantage, locking these relations into place for a fixed period of time, in the case of the BTC through the use of host government agreements.

Application of the GPN framework to energy systems or projects involves investigating five separate aspects of energy conversion and use (Bridge 2008; Sovacool 2012). These include:

- The networks of actors and firms involved in energy production and the construction and operation of energy infrastructure;
- The distribution of power within those networks and relational attributes within the network;
- The significance of laborers and consumers;

- The institutions, including governmental ministries, corporations, non-governmental organizations, and civil society groups that influence the network;
- The economic, political, sociocultural, and environmental implications of production and production-related projects.

Thus, the GPN provides a way of analyzing the 'complex actions and interactions of a variety of institutions and interest groups—economic, political, social, cultural—which operate at multi-scalar levels and territorialities through dynamic and asymmetrical power relationships to produce specific geographic outcomes' (Coe et al. 2008b).

Regarding oil and energy production specifically, GPN can conceptually help 'establish the structure of the hydrocarbon commodity chain' and explore the ways that 'the materiality of oil' exerts an influence on the development opportunities associated with energy production and use (Bridge 2008). It provides a way to understand not just oil exploration and distribution, but also consumption, labor relations, and environmental damage. In the language of Bridge (2008), GPN analyses have the potential to show how 'at the end of the chain hydrocarbons are de-commodified: through their consumption, dissociation and disposal they accumulate in the natural environment as, for example, urban air pollution, pesticide residues, plastics in landfills or rising atmospheric stocks of carbon dioxide.' Naturally, such GPN analysis can result in quite complex descriptions. Figure 22.2 provides one Bridge depicted of the global oil industry.

In his contribution to the Handbook, Mulvaney (Chap. 25, this volume) employs the GPN approach to explain how energy systems and supply chains interact with economic development and the socio-ecological transformation of natural resources. The chapter describes elemental concepts utilized in the GPN literature such as those used in global commodity chains, global value chains, and supply chain research. The concept of *global value chains* aims to capture the activities that give rise to global production systems. Firms construct value over space through sourcing and contracting arrangements. *Filieres* explores the chain of activities related to the production of raw materials into final export products. *Filieres* usually follow the commodity beyond its useful life, as opposed to other analyses which may stop at the factory gate or site of production. There are several clusters of research (sometimes overlapping) that describe their unit of analysis of the *global commodity chain*. The chapter also details the goals, objectives, and debates within the GPN literature. Three case studies related to energy and global production systems—solar photovoltaics, shale gas, and salmon aquaculture—are detailed illustrating what can be learned from the GPN approach.

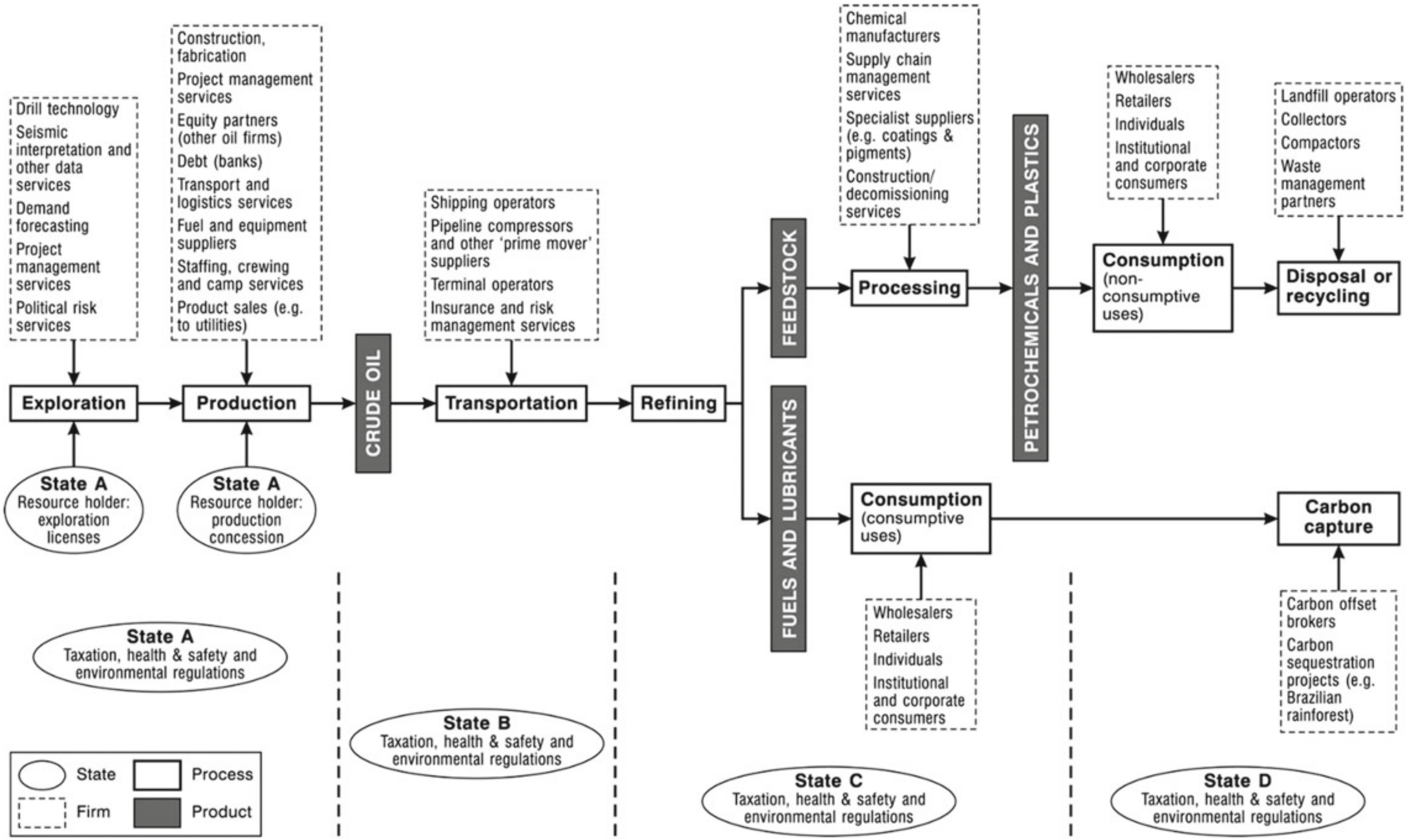

Fig. 22.2 A global production network for oil

5 Enclosure and Exclusion

'Enclosure' refers to when an energy project or process transfers a public asset into private hands, or expands the role of a private actor into a formerly public sphere. It relates in part to how private institutions, especially corporate actors, intensify their efforts to penetrate into more remote or peripheral areas from which they can derive revenue (McCarthy 2009). It can involve the incorporation of energy systems into the act of 'territorial accumulation' and the 'continuous self-expansion of capital within the global system' (Hoogvelt 1987, p. 3). In this way energy systems can expand the reach of capital as it 'stretches' the reach of the market to encompass remote areas, and 'deepens' capitalism by allowing it to penetrate into the provision of yet more goods and services (Prudham 2009). As Harvey (2004) writes, 'the corporatization and privatization of hitherto public assets … constitute a new wave of "enclosing the commons."' In short, energy projects become 'enclosed' as part of the strategy of accumulation for capitalism (Harvey 2003, p. 148). The 'enclosure' of energy provides 'another moment for the rapid creation and capture of value' by the global marketplace and those it serves (Bridge 2008).

'Exclusion' often occurs in tandem with enclosure (Heynen and Robbins 2005), and it refers to when an energy project excludes or displaces a particular group of stakeholders, or limits access to resources. Exclusion amounts to a strategy of containment, a way to prevent and manage other actors from interfering with one's interests (Few et al. 2007). The process of exclusion enables resources to be appropriated or consolidated by state authorities, private firms, or social elites (Robbins 2012, pp. 22–23). In other cases, relevant community-based organizations or individuals may be excluded from the decision-making process. The process of exclusion, paradoxically, can also create dependence, making displaced communities dependent on those that exclude them as relations of production and consumption become cemented in ways that perpetuate their subordinate status (Marini 2005).

One recent study focusing not on climate change mitigation, but on climate change adaptation—responding to the impacts of climate change—investigated eight adaptation projects in both developed and developing countries. If found that enclosure and exclusion operated in tandem with 'encroachment' and 'entrenchment' across all eight projects (Sovacool et al. 2015). Encroachment is when adaptation projects intruded on biodiversity areas or other land uses areas with predisposed, predefined uses. Entrenchment is when adaptation projects disempowered women and minorities, or worsened wealth inequality within a community. Table 22.4 offers an overview of these cases.

In their contribution to the Handbook, Hesse et al. (Chap. 26, this volume) explore enclosure and exclusion within emerging forms of energy extraction to illustrate five intersecting mechanisms that enable expressions of territoriality:

- Rationalities of the State: This track examines power regimes through political–economic ideologies, capitalist relations, and processes of primitive accumulation and dispossession;
- Rationalities of Science and Technology: Scientific and technical logics legitimatize the management and control of land and its resources, rendering territory a 'political technology';
- Geographic Imaginaries: Discourses and practices which normalize ideas of land and its inhabitants;
- (State) Violence: Conflict and violence decisively produce and maintain enclosures and exclusions;
- (Material) Infrastructure: Physical infrastructure can provide a mechanism by which enclosures are bounded and exclusion is defined and maintained.

Their chapter then investigates two case studies. The first case study examines shale gas extraction in the USA. Enclosure and exclusion facilitate extrac-

Table 22.4 Enclosure, exclusion, encroachment, and entrenchment in climate change adaptation

Process	Dimension	Description	Examples
Enclosure	Economic	Acquiring resources or authority: transferring public assets into private hands, or expanding the role of private agents in the public sector	Wonthaggi Desalination Plant in Australia, disaster recovery in Honduras
Exclusion	Political	Marginalizing stakeholders: limiting access to decision-making processes and fora	Coastal protection in Norway, sea barriers in Alaska
Encroachment	Ecological	Damaging the environment: intruding on biodiversity-rich areas or other areas with predisposed land uses, or interfering with ecosystem services	Marine Protected Areas in Tanzania, climate-proofing infrastructure in the Maldives
Entrenchment	Social	Worsening inequality: aggravating the disempowerment of women or minorities and/or worsening concentrations of wealth	Livelihood diversification in Burkina Faso, disaster relief in Kenya

tion through the coordination of historically contingent surface and subsurface ownership rights, extractive technologies, and the materiality of shale gas. The second case study analyzes enclosure and exclusion within recent biofuel promotion in India. Efforts have called for restricting cultivation to lands labeled 'marginal' or 'wastelands,' rendering the commons 'empty,' and 'making space' for biofuel plantations. Showing how mechanisms of enclosure and exclusion intersect, the chapter offers frameworks to contend with the spatial (re)configurations of power within emerging forms of energy extraction.

6 Energy Justice

Four central tenets of modern justice theory are most commonly applied to the energy domain: distributive justice, procedural justice, cosmopolitan justice, and justice as recognition. Some research has synthesized these into the emergent concept of 'energy justice.'

Theories of distributive justice date back to the Greeks and are prominently associated with the work of modern political philosophers John Rawls (1999; 1970; 1987) and Ronald Dworkin (1981a; 1981b; 2000). Such theories concern themselves with how social goods and bads are allocated among society. Distributive justice deals intently with three aspects of distribution: What goods, such as wealth, power, respect, food, or clothing, are to be distributed? Between what entities are they to be distributed (*e.g.*, living or future generations, members of a political community or all humankind)? And what is the proper mode of distribution—is it based on need, merit, utility, entitlement, property rights, or something else?

The distributive aspect of energy justice is in part about the distribution of energy services as a social good, but it is also, perhaps even more importantly, about how the harms of energy production and use are allocated as a bad. The proximity of some energy infrastructures to communities has resulted in serious health inequalities (Holifield 2012). In addition, modern forms of energy (tons of coal, barrels of oil, cubic meters of natural gas, nuclear fuel rods) have become a prerequisite today for the production and acquisition of a surprisingly large number of goods. The industrialized economy—which now reaches into almost every corner of the globe—is entirely dependent on the energy services provided by modern energy systems: manufactured goods, basic infrastructure, resource extraction, industrial agriculture, medicine, tourism, and international trade all require large inputs of energy. Another side to distributive justice is that people who have no or limited access to energy services will generally have fewer educational opportunities, less access to fertile land and other natural resources, poorer health, negligible political representation, limited economic opportunities, and inadequate access to health services.

Procedural justice emphasizes an entirely different aspect of justice: principles of 'due process,' 'representative justice,' and 'justice as public participation' (Ash 2010; Barry 1995; Adger et al. 2006; Salazar and Alper 2011). Generally, these ideas center on these interrelated justice issues: Who gets to decide and set rules and laws, which parties and interests are recognized in decision-making? By what process do they make such decisions? How impartial or fair are the institutions, instruments, and objectives involved? Procedural theories of justice are all oriented with process—with the fairness and transparency of decisions, the adequacy of legal protections, and the legitimacy and inclusivity of institutions involved in decision-making (Weston 2008; Weston and Bach 2008). Put another way, procedural justice deals with recognition (who is recognized), participation (who gets to participate), and power (how is power distributed in decision-making forums) (Paavola et al. 2006).

Such ideas are perhaps best applied to energy systems with the idea of free prior informed consent, or FPIC, and how it relates to the siting or licensing of energy infrastructure (Goodland 2004; UNPFII 2005). FPIC refers to 'a consultative process whereby a potentially affected community engages in an open and informed dialogue with individuals or other persons interested in pursuing activities in the area or areas occupied or traditionally used by the affected community' (Anton and Shelton 2011, p. 431). 'Freely given' implies that no coercion, intimidation, or manipulation has occurred so that potentially affected people offer their consent autonomously. 'Prior' implies that consent has been sought sufficiently in advance of any meaningful decision to proceed with a project. 'Fully informed' means that information about the project is provided that covers its nature, size, pace, reversibility, and scope; expected costs and benefits; the locality of areas to be affected; personnel and revenues likely to be involved; and procedures for resolving conflicts, should they occur. 'Consent' means communities have authority over whether a project commences. It is distinct from 'consultation'—the act of merely discussing a project with a community—because it gives communities the ability to 'say no' (Finer et al. 2008). FPIC must involve proper representation of communities (including marginalized groups) and true power sharing (Colchester and Ferrari 2007; UN 2005).

Cosmopolitan justice theorists argue that justice principles—such as those from distributive and procedural justice—must apply universally to all human beings in all nations. Cosmopolitan theories of justice acknowledge that all ethnic groups belong to a single community based on a collective morality. Cosmopolitanism implies that 'duties of justice are global in scope, and these duties require adherence to general principles including respect for civil and democratic rights and substantial socioeconomic egalitarianism' (Moellendorf 2002, p. 171). Put another way, cosmopolitan justice accepts that all human beings have equal moral worth and that our responsibilities to others do not stop at borders. Scholars such as Charles Beitz (1979; 1983; 1999), David Held (2003; 2004; 2010; Brown and Held 2010), Thomas Pogge (1992), Amartya Sen (1984; 1993; 1999), Martha Nussbaum (2011), Peter Singer (2002), Gillian Brock (2009), and Paul G. Harris (2011) have taken up modern manifestations of these ideals. When applied to justice, cosmopolitanism holds that ethical responsibilities apply everywhere and to all moral agents capable of understanding and acting on them, not only to members of one community or another.

In their contribution to the Handbook, Jenkins et al. (Chap. 27, this volume) introduce a fourth dimension: justice as recognition. Sometimes also known as the injustice of misrecognition, the term originates from Nancy Fraser's *Social Justice in the Age of Identity Politics*. Justice as recognition advocates both for tolerance and states that individuals must be fairly represented, that they must be free from physical threats and that they must be offered complete and equal political rights. They show that justice as recognition manifests itself not only as a failure to recognize a class of energy users or stakeholders, but also as misrecognizing—a distortion of people's views that may appear demeaning or contemptible. From this perspective, recognition justice scholarship challenges the predominantly accepted discourse of distribution and procedure, suggesting a terminology of distributive versus post-distributive (or recognition) aspects of justice. Jenkins et al. then use the lens of energy justice to assess three case studies of nuclear waste in Canada, nuclear reactors in the UK, and uranium mines in Australia. This comparative assessment allows them to identify both winners and losers with regard to energy justice throughout the nuclear energy system. Most interestingly, their political economy focus on energy justice itself highlights the key areas for conflicts and trade-offs among the core tenets of justice as a conceptual and decision-making tool.

Drawing from these divergent strands of thought—justice as distribution, procedure, cosmopolitanism, and recognition—'energy justice' has been defined as a global energy system that fairly disseminates both the benefits and costs of energy services, and one that has representative and impartial energy decision-making (Sovacool and Dworkin 2014; Sovacool 2013). It involves the following key elements:

- Costs, or how the hazards and externalities of the energy system are disseminated throughout society;
- Benefits, or how access to modern energy systems and services is distributed throughout society;
- Procedures, or ensuring that energy decision-making respects due process and representation.

Applying these three elements to real-world problems, this conceptualization of energy justice has elements of distributive justice, for it demands that we seriously consider whether it is fair that one quarter of humanity has no access to electricity, and another quarter has less than a tenth of what those of us in industrializing countries had a decade ago. It asks that we decide whether it is fair to deplete hundreds of millions of years of energy resources in a few generations, or to reap the benefits of greenhouse gas emissions, such as economic development, today at the expense of those not yet born tomorrow. It has elements of procedural justice, for it demands that we provide meaningful involvement and access to the decision-making process. It ensures the availability of information about energy, a condition of recognition, participation and informed consent. It subscribes to the notion of participatory governance as a mechanism of fostering comprehensive stakeholder inclusion and transparency as it seeks to represent and recognize minorities in decision-making, at all stages of the energy process, from agenda setting and formulation to siting and evaluation. It requires us to provide access to legal processes for challenging violations of energy rights. This lastly has elements of cosmopolitan justice, for it denies any such limits to where energy justice ought to apply, such as community boundaries to the scope of responsibilities, and instead argues that justice principles hold regardless of space and time, apply across cultures, and apply ahead to future generations.

To operationalize the somewhat lofty moral elements of energy justice as outlined above, some research has formulated an energy justice framework based on eight principles that can be applied readily to empirical problems (Sovacool 2013; Sovacool et al. 2016). Table 22.5 offers a summary of this framework.

Interestingly, in his contribution to the Handbook, Cooper (Chap. 28, this volume) uses tenets from energy justice—namely, the framework above, and a 2015 Encyclical from Pope Francis—to argue that energy is a prime or basic commodity that is essential to economic and social development. Energy use is one of the central factors that define the modes of production. Without energy justice, there can be no social justice. After building a stronger analytic and empirical base for confronting energy poverty from within the theory

Table 22.5 Energy justice decision-making framework

Principle	Description	Practical Applications
Availability	People deserve sufficient energy resources of high quality	Investments in energy supply and energy efficiency
Affordability	All people, including the poor, should pay no more than 10% of their income for energy services	Fuel poverty eradication efforts
Due process	Countries should respect due process and human rights in their production and use of energy	Social and Environmental Impact Assessments
Transparency and accountability	All people should have access to high quality information about energy and the environment and fair, transparent, and accountable forms of energy decision-making	The Extractive Industry Transparency Initiative, Independent Accountability Mechanisms and international accounting standards (IFRS)
Sustainability	Energy resources should not be depleted too quickly	Natural Resource Funds designed to save for future generations
Intragenerational equity	All people have a right to fairly access energy services	The UN's Sustainable Energy for All Initiative
Intergenerational equity	Future generations have a right to enjoy a good life undisturbed by the damage our energy systems inflict on the world today	Promoting environmentally friendly, non-depletable forms of low-carbon energy such as renewables or efficiency
Responsibility	All nations have a responsibility to protect the natural environment and minimize energy-related environmental threats	United Nations Framework Convention on Climate Change and the Green Climate Fund

of distributive justice, his chapter elaborates on the nature and implementation of policies to achieve energy justice in two ways. First, more precise and comprehensive definitions and measurements of energy justice are articulated. Second, the chapter holds that the claim that there is a fundamental conflict between progressive policies and economic efficiency is overblown and, in general, false. Using a welfare economics framework, his chapter argues that correcting market failures and targeting subsidies with progressive policies can advance the cause of energy justice.

7 Conclusion and Implications

To be sure, the concepts and tools offered by political ecology and justice theory are complex and diverse. Some overlap with others and each has their own particular themes, assumptions, vocabulary, and leading authors. Despite this variation, however, such concepts suggest at least two significant conclusions for energy and climate research and practice as well as International Political Economy.

The first conclusion is the most direct and simple: we need to think about energy technology and systems as more than simply hardware, as beyond a black box. Put another way, we need to reframe or repoliticize what energy systems are. They are not merely devices for distributing barrels of oil, conduits for cubic meters of natural gas, mechanisms for moving coal, or intricate socio-technical systems delivering electricity, mobility, heat, and so forth. Instead, energy systems can also be mechanisms of resource extraction that transfer wealth from developing countries to developed ones, and systems of segregation that separate negative externalities from energy production from the positive attributes of energy consumption. They can also be, symbols of capitalism and the expansion of wealth, and components of large plans to promote economic stability and guaranteed returns on investment in the wake of economic and political crises. Assessments of energy systems that ignore these (sometimes hidden) social and political dimensions threaten to make them appear natural.

An implication of this conclusion is that energy projects not only mark the physical landscape and contribute to the production and distribution of energy services. They can also transfer what were once customary public resources into private hands, concentrate political power, facilitate human rights abuses, become intertwined in national discourses of revitalization or national security, and validate distinct approaches to economic and social development. This conclusion implies that even 'banal' forms of infrastructure such as pipelines, refineries, solar energy manufacturing facilities, and parts of the nuclear fuel cycle such as uranium mines and storage facilities, can possess great 'interpretive flexibility' (Sovacool 2011), and as such they affirm that discussions concerning 'energy' must not continually be limited to technical and scientific experts.

The second conclusion is that conflict and struggle are part and parcel of the process of the diffusion of new energy technologies and the formulation of energy policies. Energy systems can become a flashpoint for competing interests, generating their own sets of winners and losers—even when they might produce a net social gain. Many of these conflicts involve those seeking to enclose resources or exclude stakeholders from access. Energy planning and policymaking become what one study called 'a tradeoff between the present and the future, but also a tradeoff between winners and losers at any given time' (Ruhl 2012). As such, analysts need to become more rigorous about questioning the underlying assumptions behind a given intervention, more open to the possibility that a project can inequitably distribute benefits, and more accepting that there will *always* be losers.

This conclusion highlights that energy analysis and planning is not merely a technical process of proper modeling, disciplinary rigor, infrastructural refinement, or climate hardening. Energy system interventions are about more than technology and economic development; they are about political power, social cohesion, and even ethical and moral concerns over equity, due process, and justice. Brown has written that 'climate change requires us to challenge and re-configure ideas about development and to consider alternative strategies … sustainable adaptation is an oxymoron unless it specifically deals with fundamental problems in the dominant paradigm of unsustainable development' (Brown 2011). In tandem, the concepts introduced in this chapter, and the chapters to come in this section of the Handbook, suggest that energy systems should be reconceived as a political, deliberative challenge involving the satisfaction of competing preferences; a social dilemma pitting, at times, the climatic and development goals of energy security or improved resilience against the pressing needs of marginalized and vulnerable populations; and a moral quandary revolving around how energy burdens and benefits are fairly, or unfairly, disseminated. No matter how noble the intentions of engineers and planners, or how well interventions or new energy systems are designed, they have their own inescapable underlying political ecology and ramifications for justice. Perhaps more personally, even readers convinced they may be 'winners' of the existing energy system today could find themselves—or their future kin—'losers' tomorrow.

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23

The Political Ecology of Oil and Gas in West Africa's Gulf of Guinea: State, Petroleum, and Conflict in Nigeria

Michael Watts

1 Introduction

The Gulf of Guinea, embracing much of coastal western and central Africa, emerged in the wake of September 11 as not only one of the world's major oil-producing regions but an oil zone of great strategic interest to the USA and the European Union. The Gulf is currently the major oil-producing region in sub-Saharan Africa and home of the continent's dominant petrostates: Nigeria and Angola. The Gulf of Guinea, currently producing around five million barrels of oil per day (bpd) out of the total of nine million barrels produced in sub-Saharan Africa, emerged as a focus of strategic investment in the 1980s as Middle East conflicts propelled major North Atlantic consumers into diversifying their supplies. By January 2002, the USA had established an African Oil Policy Initiative Group composed of members of the administration, Congress, the State Department, and oil companies recommending to the Bush Administration that the Gulf of Guinea be elevated to the status of a zone of vital interest and that Washington create a command structure for US forces in the region and examine the possibility of establishing a military base there. Ten years ago, oil and gas investments in the Gulf of Guinea were made to service the US market. Now, in sharp contrast to industry expectations, that market has largely disappeared and the USA itself as a result of the shale boom

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aims to be self-sufficient by 2010; Angola, Nigeria, and Equatorial Guinea are now exporting to Europe and Asia. It is quite remarkable that Angolan and Nigerian oil exports to the USA would have plummeted so dramatically and that India would so soon become the second largest importer of African oil after China. As new oil and gas discoveries are announced—Ghana, Togo, Benin, Côte d'Ivoire, Congo-Brazzaville, and Cameroon and Gabon are hoping to enhance their productive capability— the entire region, notwithstanding falling oil prices and Saudi Arabia's aggressive strategy to push American shale producers out of business, remains attractive to the trans-Atlantic and BRIC oil companies.

As the star of the Gulf of Guinea has risen as an oil producer, it has simultaneously become the poster child for the very worst of what is popularly called the 'resource curse': massive state deficits and dysfunctions, unprecedented waste and ecological harms, large-scale oil theft, illicit economies of various sorts, horrifying economic inequality and forms of political exclusion, deplorable human development profiles, piracy and maritime insecurity comparable to Somalia, and a sad history of political instability and violence (Soares de Oliveira 2015; Hicks 2015). A report published by the International Crisis Group in 2012 (ICG 2012) pointed to the region as 'the new danger zone'. A recent story in the *New Yorker* (Spectre 2015) on the 'grotesque inequality' in the Luanda, the oil hub and capital of Angola, noted that 'rent is sixteen thousand dollars a month, a bottle of Coke can sell for ten dollars, and Range Rovers cost twice their sticker price'; melons might costs $200 each, while the annual income of the urban poor in the city is $2 per day (Spectre 2015, p. 32). The Gulf of Guinea, and oil states like Angola and Nigeria in particular, is exemplary—even limit cases—of the abject failure of oil-based secular national development.

The purpose of this chapter is to explore the dynamics of the largest oil producer in the Gulf of Guinea—Nigeria—and to offer a political–ecological analysis of the country's development experience. Nigeria, like Angola, customarily features in a showcase of the catastrophic failures an archtypical petro-state (Collier 2007). Nigeria is the largest economy in Africa—the Lagos economy alone is probably greater than that of Kenya—and annual economic growth appears to have averaged 7–8 % in the past decade. But the stark reality, however, is that income and human developmental poverty rates remain chronically high, at more than 60 % of the population, much higher than surrounding countries like Niger and Benin. As oil seeped indelibly into the country's political, economic, and social lifeblood, petro-rents severed public taxation from state revenue and fed what Slater (2010) in another setting calls a 'provisioning pact' (a political settlement predicated on the distribution of oil rents). Just as struggles to control the accumulation of oil rents contributed to rapid centralizing of power, the ferocious battle over sharing oil revenues drove societal fragmentation, splintering, and dispersion in what was always a fractious and competitive multi-ethnic federal system. As parsed in one International Monetary Fund (IMF) report, Nigeria's oil revenues have 'not significantly added to the standard of living of the average Nigerian' (Sala-i-Martin and Subramanian 2003, p. 4). Inevitably, these failures and seemingly intractable structural impediments cast a long shadow over the optimistic assessments of Nigeria's short-term future. Nigeria, like Angola and Equatorial Guinea, became a poster child for the class of developmental failures dubbed 'fragile and conflicted states' (WDR 2011).

A declensionist narrative of this sort is, of course, a quite familiar Nigerian story (Smith 2007; Adunbi 2015). The main beneficiaries of a political economy constructed around oil rents are a diverse and fractious class populated by politicians, civil servants, military officers, and business interests, who constitute a form of elite cartel. The construction of Nigeria's elite cartel—perhaps the most durable feature of the country's state building in the petroleum era—is the product of an exclusionary political settlement which—while opting for redistribution rather than growth (Ajakaiyi et al. 2011, pp. 245, 249)—limited most gains to a narrow stratum of notables from specific regions and segments of the population. Political settlements of this sort have been profoundly shaped by the ways in which oil was inserted into a multi-ethnic federal system and has direct implications for long-term legitimacy, political stability, and forms of public authority. The oil-producing region, the Niger Delta, is a particularly condensed and explosive concatenation of the sociospatial fragmentation, state dysfunction, and the rise of a raft of non-state armed groups (Watts 2005, 2007, 2012; Obi and Rustaad 2011) and yet at the same time amidst ecological degradation and other social problems has proven to be a durable state able to withstand and absorb all manner of tensions and struggles thrown up by what I shall call the logics of oil development.

But the inventory of institutional failures of 'oil development'—the fragile and conflicted state narrative—must not blind us to the fact that the combination of oil and nation building has produced a durable and expanded federal system (including the slow national rebuilding after the Biafran war), a multi-party partial democratization (albeit retaining an authoritarian and often violent cast), and important forms of institution building (increasing separation of powers, more autonomy of the judiciary, a gradual improvement in electoral processes, and a proliferation of civil society organizations).

The state *has* been informalized for particular purposes, vested with certain capabilities, and made 'functional' (networks, pacts, coalitions) in particular ways (Lewis 2011; Joseph 1987; Adebanwi and Obadare 2010). In other words, its institutional capabilities are asymmetric (Porter and Watts 2016). Clearly, the state *has not* been vested with the capabilities required for fully representational politics, to promote economically productive or socially equitable investments, or deliver public goods—justice, security, services, and livelihoods—effectively and democratically. At the same time, the state has grown the capacity of security and control, through both public and private institutions, to co-opt elites while redirecting and patronizing popular discontent, to secure oil installations and infrastructure, and to provide the political infrastructure for the system to reproduce itself and withstand shocks. The state apparatuses are an effective instrument to garner the loyalty of powerful groups and individuals, and direct benefits to particular constituencies while enabling extraordinary illicit wealth to be accumulated and secured, with impunity, over time.

2 A Brief History of Nigerian Petroleum Development: Broken Promises and Shattered Dreams

The first barrels of Nigerian crude oil destined for the world market departed from Port Harcourt harbor almost exactly fifty years ago, on February 17, 1958. To navigate its way through the shallows of the Bonny River, the 18,000-ton tanker *Hemifusus* left from the Port Harcourt dockside half-full. A shuttle tanker accompanied the *Hemifusus* to Bonny Bar, eight miles from the coast, where another 9000 tons was pumped into the hold. The oil on board had been discovered in the central Niger Delta in 1956 at Oloibiri, a small, remote creek community near Yenagoa—now the capital of Bayelsa State—located 90 km to the west of Port Harcourt. Wildcatters had begun drilling in 1951 in the northern and eastern reaches of what was then called Eastern Nigeria, and, finally on August 3, 1956, discovered oil in commercial quantities in tertiary deposits at 12,000 feet. In its first year of operations, Oloibiri produced 5000 barrels of heavy ('sour') crude oil each day. A year later, the first crude oil pipeline connecting Oloibiri to Kugbo Bay, seven miles distant, came on line. Two hundred ton barges shuttled the oil to two storage tanks in Port Harcourt; from there it was then shipped to the Shell Haven refinery at the mouth of the river Thames. Within a few weeks of its arrival, Nigerian gasoline was fueling automobiles in and around London, the new symbols of post-war British prosperity. The Nigerian oil industry had been born.

When the first helicopters landed in Oloibiri in 1956 near St. Michael's Church to the astonishment of local residents, few could have predicted what was to follow. A camp was quickly built for workers; prefabricated houses, electricity, water, and a new road followed. Shell–BP (as it then was) sunk seventeen more wells in Oloibiri and the field came to yield, during its lifetime, over twenty million barrels of crude oil before oil operations came to a close twenty years after the first discovery. Poverty and capped wellheads are all that remain now.

In the decade that followed, the Nigerian oil industry grew quickly in scale and complexity. A giant field was quickly discovered at Bomu in Ogoniland, west of Port Harcourt in 1958, and Shell–BP, which had acquired forty-six oil mining leases covering 15,000 sq. miles, rapidly expanded its operations across the oil basin. Ten years of feverish activity saw the opening of the Bonny tanker terminal in April 1961, the extension of the pipeline system including the completion of the Trans Niger Pipeline in 1965 connecting the oil fields in the western Delta near Ughelli to the Bonny export terminal, and the coming on stream of twelve 'giant' oil fields including the first offshore discovery at Okan near Escravos in 1964. Oil tankers lined the Cawthorne Channel like participants in a local regatta, plying the same waterways that, in the distant past, housed slave ships and palm oil hulks. By 1967, 300 miles of pipelines had been constructed, and one and half million feet of wells sunk; output had ballooned to 275,000 bpd. By the first oil boom in 1973, Nigerian oil crude production was comparable to the present day (2.4 million bpd), accounting for more than 3.5 % of world output. Nigeria the oil nation had arrived. Despite the slide into a bloody civil war—the Biafra War 1967–1970—fought on and around its oil fields, the Niger Delta had come of age. Nigeria emerged as a theater of major significance in the global search for low-cost, high-quality oil. Current Nigeria produces roughly 2.4 million bpd and is the thirteenth largest oil producer. In 2014, oil represented about 15.8 % of GDP, 75 % of government revenues, and over 95 % of exports (World Bank 2014). The decline in world oil prices since early 2014 has meant that Nigerian oil receipts have by 2015 crashed by over 60 %.

A rusting sign sits next to the 'Christmas tree'—the capped wellhead—at Oloibiri. Well No. 1. It reads: Drilled June 1956. Depth: 12,000 feet (37,000 m). It is a monument to an exploit-and-abandon culture, just as Oloibiri itself is an exemplar all of the ills and failed promises of the fairy tale of oil. In the 1960s, the town had a population of 10,000; it is now a wretched backwater, a sort of rural slum home to barely 1000 souls who might as well live in another century. No running water, no electricity, no roads, and no functioning primary school; the creeks have been so heavily dredged, canalized, and polluted that traditional rural livelihoods have been eviscerated. In the last few years the town has been rocked by youth violence; the Aso Rock armed 'cult group' dethroned the traditional ruler amidst allegations of corruption and half-finished community development projects. As if to mock the sad fact that Oloibiri is now a sort of fossil, the piece of detritus cast off by the oil industry, a gaudy plaque dating from a Presidential visit in 2001 sits next to Well No. 1. It is a foundation stone for the Oloibiri Oil and Gas Research Institute, and for a museum and library, an homage to Oloibiri, and the early history of oil. Noble ideas. But the ground has not been broken, and never will. Regularly defaced, the plaque is policed by touts looking for a commission from erstwhile visitors who want to record where it all began, the ground zero of Nigeria's oil age.

Commodities have since come to define the modern history of Nigeria and the oil fields of the Niger Delta. The delta was the 'Oil Rivers' long before it became a global supplier in the world oil and gas market. Bonny Island near the shores of the Bight of Biafra was a slave port by the seventeenth century and later became a prosperous city-state exporting 25,000 tons of palm oil each year to a surging British industrial economy. One hundred and fifty years later, it is home to a massive export terminal and one of the world's largest liquefied natural gas complexes. The great hulks of the Royal Niger Company moored in the estuaries of the Niger Delta in the nineteenth century—serving as consulate, treasury, hospital, prison, and residence—were forerunners of the oil barges, the offshore platforms, and the massive Floating Production Storage and Off-loading (FPSO) vessels that now populate the delta mangroves and Nigeria's coastal waters.

The complexity, diversity, and magnificence of the Niger Delta are best appreciated from the air. Satellite imagery reveals a massive wedge of green, cross-cut by a bewildering maze of channels, creeks, tributaries, estuaries, and islands. It is a vast sediment pile laid down over sixty million years, an enormous, and strikingly symmetrical, semicircular arcuate delta. A total of 28,000 sq. miles in all, it protrudes 150 miles into the Atlantic Ocean along the West African littoral. It is one of the world's largest deltas, comparable in grandeur and scale to the Mississippi, the Ganges, and the Mekong. In the delta's most northern reaches, the river Niger splits into the Nun and Forcados Rivers, which in turn branch and empty into the ocean through a series of inlets and estuaries that punctuate roughly twenty rainforest barrier islands—most ten to twelve miles long and two to three miles wide with maximum elevations of 10–12 feet—that rim the seaward edge. At the eastern extremity, marking one boundary of the delta, is the Benin River; 300 km to the west is the other frontier, the river Imo.

Behind the barrier islands lies a remarkable ecology. Mangrove forests—mostly red mangroves with their distinctive prop roots—occupy a coastal zone up to 40 km wide in an inter-tidal brackish zone of creeks and tidal channels. The third largest mangrove forest in the world, it is shaped by the interaction between the estuarine discharge of freshwater and the tidal movement of saline water. In Baylesa, Delta, and Rivers States, mangrove and associated coastal vegetation may account for between one-third and one-half of the total land surface. Behind the mangroves is a vast freshwater forest, one of the largest remaining swamp forests in Africa and a zone of very considerable biodiversity and ecological fragility. Accounting for almost half of the region, swamp forests actually consist of two distinct environments: an upper delta flood forest zone in which a diverse array of swamp and cane forests are inundated during the flood period, and a lowland tidal freshwater zone, permanently swampy and traversed by narrow muddy channels. In the non-riverine interior, lowland rainforest predominates, but large-scale clearance and long-term human occupancy have produced a mosaic of cropped and fallow areas and derived savanna in which grasses and shrubs have permanently replaced the forest canopy. The ecological gradient from the coast to the interior corresponds to a descent in rainfall distribution: in coastal communities like Akassa and Bonny—two of the wettest places on the continent—annual rainfall may be over 4000 mm.

In political terms, the Niger Delta consists of nine of the thirty-six states within the Nigerian Federation and 185 Local Government Councils, occupying a surface area of about 112,110 sq. km—12 % of Nigeria's territory. In 2007, the population of this region was estimated to be twenty-eight million, the overwhelming proportion of which is rural and poor. There are at least forty different ethnic groups occupying the Niger Delta, speaking perhaps 250 languages and dialects. The riverine Ijaw are the most numerous—by some estimations fourteen million strong—but the general picture is one of extraordinary ethnic diversity, a mosaic of heterogeneous and often fractious communities held together by a robust sense of being 'delta people'. To say that the delta is composed of ethnic communities with robust local cultural identities—as Ijaws, Ogonis, Ikwerre, Itsekeri, Urhobo, Isoko, Andoni, Efik, Ibibio, and so on—begs the very important question of what ethnicity means, its shifting political significance and why the language of the 1950s—'ethnic minorities'—has now been replaced by a new lexicon: 'ethnic nationalities' and 'oil minorities'.

The core oil states of the Niger Delta—Bayelsa, Rivers, Delta, and Akwa Ibom—cover 45,000 sq. km, account for half of the regional population and for more than three-quarters of onshore oil production. There are 13,329 settlements in the Niger Delta region, 95 % of which have less than 5000 inhabitants. In the riverine zone, the vast majority of people live in dispersed and often quite isolated villages and hamlets—clusters of compounds housing 100–500 people and accessible only along the maze of creeks and tributaries. Here almost 90 % of the rural inhabitants fall below the $2 per day poverty line, dependent largely upon aquatic resources and petty trading for their livelihoods. The upland interior has a more developed agricultural economy—largely tuber based—and can be very densely settled, sometimes over 800 per sq. km. It consists of a patchwork quilt of rotational farmlands, rubber and palm oil estates, derived savanna, and stretches of secondary forest. Overall, the population is young and dirt poor: 60 % of the population is less than thirty years old and almost 40 % are between the ages of fifteen and twenty-nine.

The impact of over half a century of oil and gas exploitation in Nigeria is profound across the oil fields of the Niger Delta (Okonta and Douglas 2003). For the vast majority, oil has brought only misery, violence, and a dying ecosystem. A United Nations report (UNDP 2005) on human development in the delta was unflinching in its assessment: the 'appalling development situation' reflects the shameful fact that after a half century of oil development, 'the vast resources from an international industry have barely touched pervasive local poverty'. Figure 23.1 shows workers cleaning up an oil spill from an abandoned Shell Petroleum Development Company oil well in Oloibiri, Niger Delta, on July 19, 2004. By conservative oil industry estimates, there were almost 7000 oil spills between 1970 and 2000, more than one each day (the real figure might be twice or three times that number), many of them illustrated in Fig. 23.2.

A back of the envelope calculation suggests that an equivalent of one gallon of oil has been spilled for every 100 sq. meters of the Niger Delta. Gas flaring—the explosions of white light that dot the nighttime horizons as you fly into the oil cities of Warri or Port Harcourt—is declining. But associated gas—natural gas founded in dissolved in crude oil or as a cap above the oil reservoir and released in the extrusion process—still produces seventy million metric tons of carbon emissions a year, that is to say a substantial proportion of worldwide greenhouse gas. Two independent studies completed in 1997 reveal total petroleum hydrocarbons in Ogoni streams at 360 and 680 times the European Community permissible levels. Canalization dredging, large-scale effluent release, mangrove clearance, massive pollution of surface, and groundwater, these are the hallmarks of a half century of oil and gas extraction—all qualified, it needs to be said, but the fact that no serious

Fig. 23.1 Workers clean up an oil spill from an abandoned Shell oil well in Oloibiri, Niger Delta, on July 19, 2004 (*Note*: Wellhead 14 was closed in 1977 but has been leaking for years, and in June of 2004, it finally released an oil spill of over 20,000 barrels of crude oil. *Source*: Photo courtesy of Ed Kashi, used with permission)

scientific inventory has ever been conducted because environmental impact assessments by the companies and the government regulatory agencies are practically national secrets. Human-induced erosion rates at Escravos, Bonny, and Imo can be in excess of 60–70 feet per year. Global climate change and rises in sea level is likely to make the problem much worse. A World Wildlife Fund report released in 2006 simply referred to the Niger Delta as one of the most polluted places on the face of the earth.

Today, Nigeria is the fifth largest exporter of crude oil in the world. Roughly, two-thirds of production is onshore, the remainder is derived offshore from the continental shelf in both shallow and deep water. The Nigerian government expects proven reserves (in 2015 estimated to be 37 billion barrels) and is expected to grow to 40 billion by 2020. Nigeria contains the largest natural gas reserves in Africa (176 trillion cubic feet) and is a global player in the production of liquefied natural gas (LNG). Virtually, every inch of the Niger Delta has been touched by the industry footprint through its operations or indirectly through neglect. Over 6000 wells have been sunk, roughly one well for every 10 sq. km quadrant in the core oil states. There are 606 oil fields (355 onshore) and 1500 'host communities' with some sort of oil or gas facility or infrastructure. There are 7000 km of pipelines, 275 flow stations, 10 gas plants, 14 exports

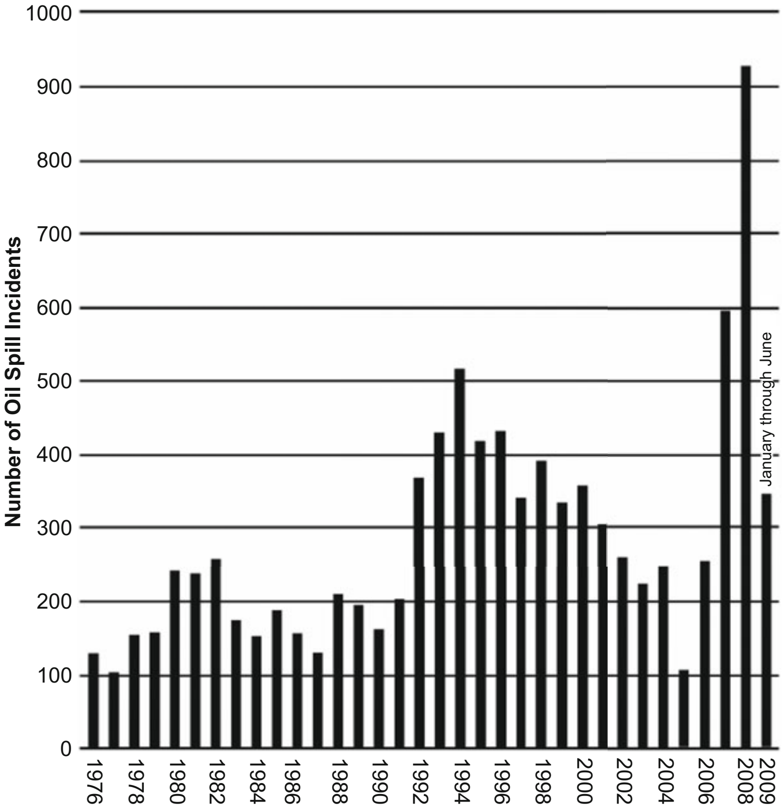

Fig. 23.2 Oil spill incidents in the Niger Delta, 1976–2009 (*Source*: Nigerian National Petroleum Company, Annual Statistical Bulletin, 1997–2010)

terminals (5 onshore at Qua Iboe, Pennington, Forcados, Ecravos, Brasss and Bonny, and nine FPSOs), 4 refineries, and a massive LNG and gas supply complex. The six-train Bonny LNG facility produces twenty-two million tons each year, with a new plant in train at Brass expected to have two trains. The national oil company (NNPC) and its joint venture partners (Shell, Exxon, Mobil, Agip, and TOTAL) directly employ an estimated 100,000 people.

3 The Political Ecology of Oil Development: From 'Petro-development' to Oil Insurgency

Nigeria is archetypical oil nation. Oil has seeped deeply and indelibly into the political economy of Nigeria. Nigeria is an oil state, driven by two cardinal principles: how to capture oil rents and how to sow the oil revenues? Like other OPEC countries—by most estimates the thirteen OPEC members will pocket over $700 billion in oil revenues in 2007 alone—when oil prices are robust, Nigeria is awash in petro-dollars. What this oil wealth has wrought, and is likely to bring, is another question entirely. To compile an inventory of the achievements of Nigerian petro-development is a salutary if dismal, exercise: 85 % of oil revenues accrue to 1 % of the population. According to former World Bank President Paul Wolfowitz, at least $400 billion oil revenues accrued since 1960 have simply 'gone missing'. Nigerian anti-corruption czar Nuhu Ribadu claimed that in 2003, 70 % of the country's oil wealth was stolen or wasted; by 2005, it was 'only' 40 %. By most conservative estimates, almost $130 billion was lost in capital flight between 1970 and 1996. Over the period 1965–2004, the per capita income fell from $250 to $212, while income distribution deteriorated markedly. Between 1970 and 2000, the number of people subsisting on less than one dollar a day in Nigeria grew from 36 % to more than 70 %, from nineteen million to a staggering ninety million. Over the last decade, gross domestic productivity (GDP) per capita and life expectancy have, according to World Bank estimates, both fallen. Per capita GDP in PPP (purchasing power parity) terms fell 40 % from $1215 in 1980 to $706 in 2000. Over the same period, income poverty rose from 28.1 % to 65.5 %, and other indicators of welfare—notably, access to education and health—also declined.[1] According to the United Nations Development Program (UNDP 2014), Nigeria's rank in terms of the Human Development Index (HDI)—a composite measure of life expectancy, income, and educational attainment—is number 158, below Haiti and Congo; over the last thirty years, the trend line of the HDI index has been upward, but barely. To suggest, as the IMF has (Sala-i-Martin and Subramanian 2003), that $600 billion dollars have contributed to decline in the standard of living—that most Nigerians are poorer today than they were in the late colonial period—is mind-boggling, and at the same time, there is a gigantic failure of leadership and governance. Nigeria has become a model failure. After the discovery of oil in Mongolia, a local leader pronounced: 'we do not want to become another Nigeria'.

[1] In the wake of the 'rebasing' of the Nigeria national accounts data, there is a debate over numbers, poverty rates, human development trends, and so on (see World Bank 2014). The fact remains that unemployment is massively underestimated while the aggregate picture of income and HDIs of poverty during the period of oil-led development has been disastrous. The total poverty head count rose from 27.2 % in 1980 to 65.6 % in 1996, and recent figures from the Central Bank of Nigeria show that, between 1980 and 2000, the share of the population subsisting on less than one dollar a day grew from 36 % to more than 70 % (from nineteen million to a staggering ninety million people). In half of Nigeria's thirty-six states, the estimated poverty head count (and indices of multidimensional poverty) increased between 2004 and 2010; in some northern states, the figure is close to 80 %.

Perhaps there is no better metaphor for this oil-fueled venality than the stunning fact that huge quantities of oil are simply stolen every day. Currently around 100,000 and 200,000 barrel of oil have been stolen daily (perhaps 10–15 % of national output), organized by a syndicate of 'bunkerers' linking low-level youth operatives and thugs in the creeks to the highest levels of the Nigerian military and political classes and to the oil companies themselves. The Managing Director of Chevron Nigeria, Jay Prior, once observed that he had 'run companies that have had less production than is being bunkered in [Nigeria]'. The stolen oil, siphoned from the manifolds and flowstations, shipped onto barges and transported to tankers offshore, is a multi-billion business run *through* the state (Katsouris and Sayne 2013; Garuba 2015).

By the early 2000s, in the wake of the return to civilian rule in Nigeria after three decades of military rule, the contradictions, conflicts, and tensions within a society built around the failures of oil development were leading some commentators to speculate that the country might 'end up like Somalia'. And indeed in late 2005, an insurgent group (MEND, the Movement for the Emancipation of the Niger Delta) exploded out of the creeks of the western Niger Delta promising to close down the oil industry. Within a matter of days, close to one-third of national output was shut-in; global oil markets were roiled. Figure 23.3 depicts an explosion near the Ogoniland village of Kpean, where an oil wellhead that had been leaking for weeks has turned into a raging inferno on August 22, 2006.

The situation rapidly deteriorated as MEND launched ever more audacious and well-organized attacks on oil infrastructure and on government security forces. According to a report released in late 2008—prepared by a forty-three-person government commission and entitled *The Report of the Technical Committee of the Niger Delta*—in the first nine months of 2008, the Nigerian government lost a staggering $23.7 billion in oil revenues due to militant attacks and sabotage. By May 2009, oil production had fallen by over a million barrels per day, a decline of roughly 40 % from the average national output five years earlier. On May 13, 2009, federal troops launched a full-scale counterinsurgency against what the government saw as violent organized criminals who had crippled the oil and gas industry. The militants in return launched ferocious reprisal attacks, gutting Chevon's Okan manifold which controls 80 % of the company' shipments of oil. Over a two-month period from mid-May to mid-July, twelve attacks were launched against Nigeria's $120 billion oil infrastructure. A total of 124 of Nigeria's 300 operating oil fields were shut by mid-July 2009. Late in the night of July 12, 2009, 15 MEND gunboats launched a devastating assault on Atlas Cove, a major oil facility in Lagos, the economic heart of the country, 300 miles from the Niger Delta oil fields.

Fig. 23.3 Explosion of an oil wellhead near the village of Kpean, August 2006 (*Note*: The local youths keep watch, waiting for Shell to come and put the fire out. This is an environmental disaster for the local people, as it affects their crops, their water, and air. Even though Shell has not been allowed to pump oil from its 125 wells in Ogoniland since 1993, they still have wells that are leaking and often unattended or maintained. This lack of action, which pollutes the lands and forces farmers and fishermen out of work, makes relations between the local communities and Shell very fractious. This Shell oil well is more than thirty years old, and this scenario is typical of the kinds of ongoing problems with the oil works of the Niger Delta. *Source*: Photo courtesy of Ed Kashi, used with permission)

MEND is typically seen as an Ijaw phenomenon (Nwajiaku 2012) but operates as something of a franchise among fragmented and heterogeneous militant groups,[2] and as a consequence, the attacks attributable to MEND remains a source of debate. What can be said is this: at least 300 individuals were abducted between 2006 and 2009, there were over 300 armed assaults between 2007 and 2010, and, according to the Nigerian National Petroleum Company, over 13,000 pipeline vandalizations between 2006 and 2011. Since 2006, conflict deaths, by some estimates, run to 1500 per year; perhaps as many as 100,000 people have been internally displaced. Faced with the prospect of a long-drawn out insurgency—by July of 2009, the conflicts

[2] By 2005, there was a dizzying, often bewildering, array of militants, militias, and so-called cults: the Grand Alliance, Niger Delta Coastal Guerrillas, South–South Liberation Movement, Movement for the Sovereign State of the Niger Delta, the Meinbutus, the November 1895 Movement, ELIMOTU, the Arogbo Freedom Fighters, Iduwini Volunteer Force, the NDPSF, the Coalition for Militant Action, the Greenlanders, Deebam, Bush Boys, KKK, and Black Braziers, Icelanders, and a raft of other so-called cults. Over fifty operating military camps were dotted around the creeks.

had reduced oil production to less than one million bpd—the government announced an amnesty on June 24, 2009. Over 26,000 militants and their commanders signed on all of whom were included in a demobilization, disarmament, and rehabilitation (DDR) program that officially ended in 2015. How can one understand, then, how the optimism and expectation of post-colonial oil wealth led to environmental destruction, immiseration and massive state failures, and violent insurgent politics from within the oil fields?

4 The Logics of Oil: Provisioning Pacts, Dispossession, and the Politics of Ressentiment

The means by which oil development proved to be a pathway to insurgency arises from the intersection of a profound crisis of authority and rule on the one hand, and the politics of dispossession on the other. These different force fields I argue are rooted in, and arise from, what Slater (2010) calls the 'ordering of power' in authoritarian Leviathans, and the creation of political pacts arising from deep crises of contentious politics. Oil plays a key role here not as a simple 'resource curse' but rather through the capacity of the state to exercise a statutory monopoly over oil and gas resources—what following Lieven (2012) I call a regime of dispossession—and to capture, centralize, and distribute rents in a highly contested, multi-ethnic federalist structure. Oil revenues (and not direct taxes) provides the basis of what Slater calls a 'provisioning pact' (patronage through non-tax revenues), a political order that is shaped however by the conditions antecedent to both the discovery of oil in commercial quantities (1958) and prior to the establishment of the authoritarian Leviathan itself (for my purposes in 1970 at the end of the civil war). Oil, assuming commercial significance in the late 1950s as I previously showed, is inserted into a ready-existing late colonial and early post-colonial political order that shapes, and is shaped by, the political economy of the oil complex.

Two logics underwrote the provisioning pact, each of which substantiated a dual politics of dispossession and *ressentiment* (McGovern 2012).[3] The first was the capture of oil rents by the state through a series of laws and statutory monopolies (the 1969 Petroleum Law being the foundation stone). In effect,

[3] Resentment provided an 'overarching idiom for peoples discussions of what happen to them especially their disappointments but also their hopes for the future' (McGovern 2012, p. 93). The reference point for dispossession is of course the work instigated by Harvey's account of primitive accumulation and accumulation by dispossession (Harvey 2005).

the conversion of oil into a national resource conferred two legacies: first, it became the basis of claims making. That is, citizens could, in virtue of its national character, plausibly claim their share of this national cake as a citizenship right. It also flew in the phase of robust traditions of customary rule and land rights. The logic of indigeneity and the authorization of communities' forms of rule in effect institutionalized a parallel system of governance associated with chieftaincy in the south or Caliphal rule in the north. Its life was further prolonged as indigeneity as a category enshrined in the Nigerian constitution; in a multi-ethnic polity, indigenes looked to customary institutions as a source of legitimacy and authority and nowhere more so than around question of access to and control over land Okonta 2008. Oil nationalization trampled on local property systems and land rights and complicated the already tense relations between first settlers (indigenes) and newcomers (later settlers). That is to say, the historical complexities of waves of settlement and in migration, all were typically surrounded by considerable juridical and legal ambiguity (Richards 1996).

For the Nigeria delta and its sixty ethno-linguistic groups, the raft of oil laws inevitably was construed locally as expropriation and dispossession—the loss of 'our oil'. Indeed the founding statement of the Kaiama Declaration, the Ikwerre Rescue Charter, and the Ogoni Bill of Rights all acknowledged this profound expropriation and loss. These claims were inevitably expressed in ethnic terms ('our land', 'our oil') and marked the emergence of so-called oil minorities (a post-colonial invention) not only as a political category but also as an entity with strong territorial claims. The fact that oil companies, as co-signatories to joint ventures with state, were in turn compelled to pay rent—always vague and indeterminate—to oil-bearing communities (which typically meant undisclosed cash payments to chiefs, councils of elders, and ruling big houses), converted an already contested arena of land rights into a charnel house of violent struggles over 'who owns the oil' and on what basis (lineage, clan, ethnicity, first settlers). The resentments over corrupt chiefs and elders, over oil spills and lack of corporate accountability, the massive ecological footprint of the industry, of ineffective local government, and community squabbles over territorial boundaries often adjudicated by remote and corrupt commissions all ran deep. This points to the second logic of the provisioning pact.

The history of the political and institutional mechanisms by which revenues were to be allocated with a federal system—both vertically (from federal center to state and local government) and horizontally (the metrics by which the value of the allocations were to be determined)—contains much of what post-Independence Nigeria has been about: How the provisioning pact works and what are its driving forces (Lewis and Watts 2015)? Suffice to say that the sources of public revenue in Nigeria are proceeds from the sale of crude oil, taxes, levies, fines, tolls, penalties, and they accrue in general to the Federation Account. The Federation Account excludes the derivation payments by which a percentage (currently 13 %) of revenues from resources flow directly to their states of origin (enhanced derivation necessarily benefits the oil-producing states). The balance of the total federally collected revenues are paid into the Federation Account which is currently roughly 60 % of the total, down from over 90 %in 1970. Oil revenues are the main source of public revenue, accounting for about 80–85 % of the total. In the period 2001–2011, oil revenues averaged 27 % of GDP while tax revenues averaged 6.4 %. In 1992, the vertical allocation system—the proportion of revenues allocated to differing tiers of government—was changed to 48.5 %, 24 %, and 20 % for federal, state, and local government, respectively. The current vertical allocation—adopted by then Minister of Finance, Dr. Ngozi Okonjo-Iweala in March 2004 is 52.68 %, 26.72 %, and 20.60 % for federal, state, and local government, respectively. Local governments and states rely overwhelmingly (over 70 % for local governments, over 50 % for the states) for their revenues on the Federation Account—that is to say, the dependence on centralized oil revenues have been at the expense of other forms of internal revenue generation. These figures confirm, of course, the centralizing effect of capturing oil rents but the details, hammered out in a raft of revenue commissions over half a century, are the subject of intense contestation and controversy.

The broad contours of the revenue allocation process are clear (Lewis and Watts 2015). The federal center captured a disproportionately large share of the revenues; the states and local governments depend heavily on statutory allocations. Since the 1960s, the principles of allocation in effect demolished the principle of derivation, reducing it from 50 % to roughly 1 % between the mid-1960s and mid-1980s. Fiscal centralization reflected a calculus by which monies for developmental purposes redirected away from the centers of oil production to non-oil ethnic majority states. The federal center became a hunting ground for contracts and rents of various kinds, what Saro-Wiwa called 'brigandage'. Derivation politics (and the loss or disappearance of revenues cascading within the federal allocation system) inevitably became an axis of contention between the delta and the federal center and laid the basis form what became in the 1990s the delta's clamor for 'resource control'. Since Obasanjo's return to power in 1999, the federal center has tried to balance the growing agitation, and growing militancy, over derivation from within the delta against the array of political forces rooted in the hegemony of powerful northern and southern political interests. Abuja drew a line in the sand in its refusal to meet the delta's demands of 25 % derivation or more during the 2005 National conference and in the struggle over offshore oil resources (a Supreme Court decision affirmed Federal control over oil resources in 2002). But the debates over a just derivation and the revenue-sharing process continues unabated.

The capture and distribution of oil rents which marked the long military years between 1967 and the late 1990s were no less central in the gradual return to electoral politics in the Fourth Republic in 1999. In this case, it underwrote serial electoral fraud and thuggery and the proliferation of ethno-religious violence across the country. The lethal combination of failed development and violent democracy has unleashed three new decentralizations: first, the decentralization of corruption (associated with in the case of the delta the vast increase in revenue flows associated with the increase of derivation to 13 %) particularly to the lower tiers of government; second, the democratization of the means of violence (or the extent to which the state monopoly of the violence means of destruction has been undercut by the widespread deployment of arms locally by militia and other militant groups) (HRW 2007); and third, the rise (in part associated with changing revenue allocation) of enormous power and wealth at the level of the state governors and politicians (Godfathers in local parlance) who become not only counterweights to the federal center but machine politicians in their own right (HRW 2005).

In the Niger Delta, geographical proximity to the oil resource, an all too intimate connection with transnational oil companies, and not least the devastating ecological footprint of the oil complex, conjured up a politics of resentment over fiscal allocation principles, but also a demand for community rights, the need for accountability among local governments, and how redress might be sought from the violations perpetrated by the security forces (UNDP 2005). The failure of local government, the failure of transnational capital, the failure of security forces, and the failures of customary rule (the chiefs pocketing so-called community rents) populate one large universe of abjection, all draped in the overarching language of dispossession. Accumulation by dispossession as Harvey (2005) calls it, generates a state-focused discourse directed to the illegitimate extra-economic coercion by the state, and to the complicity of oil companies that were increasingly, in light of the absence of anything like functional local government, came to be construed by host communities across the delta as an arm of the state. Often cross-class in character (chiefs, elites, graduates, unemployed youth all adopted the rhetoric of resource control), the militant expression of dispossession politics assumes a variety of idioms (identity, citizenship, personhood, religiosity, belonging) and are channeled into a variety of more or less organized forms of resistance (Lieven 2012). In many cases, the resentments were directed toward a violent assertion of autochthony, that is the often exclusionary attachments and belongings of individuals and groups to particular places and identities, sometimes directed at strangers or non-indigenes, sometimes against state predators (Geschiere 2009).

The illegitimacy, indeed the ethical and moral bankruptcy, of these multiple and overlapping networks of customary, religious, and modern governance created a vast space of alienation and exclusion, a world in which the armies of impoverished youth were neither citizens nor subjects, a social landscape in which the politics of resentment could fester (Gore and Pratten 2003; Peters 2012; Argenti 2007). Contempt became (and remains) the ruling ideology. These floating populations—the lumpenproletariat, Qu'ranic students and land-poor peasants in the north, the unemployed youth in the Niger Delta detached from the old gerontocratic order, each unable to fulfill the norms of personal advancement through marriage, patronage, and work—occupied a social moratorium (Vigh 2006). Youth occupied a social space of massively constricted possibility, a world in which economic recession and the dreadful logic of provisioning and self-interest reduced millions to the level of unfulfilled citizenship, what Murray Last (2007) refers to as material, social, and political insecurity.

5 Political Ecology of Oil: Does Oil Produce Conflict?

The conditions produced by the logics of the oil provisioning pact are of course widespread if not endemic across the continent—the recognition of a continental youth crisis is a case in point—but insurgencies remain an exception rather than the rule. Organized militancy and the rise of non-state armed groups in the oil fields of Nigeria may did not spring fully formed from within the rich loam of exclusion, dispossession, and truncated aspirations. Insurgency is a social achievement as McGovern (2012, p. 205) calls it, and this is where the organization and dynamics of conflict and militancy—the making of forms of solidarity, modes of organization, ideological formation, and the like—comes into play (Hoffman 2011).

MEND and other non-state armed actors in the delta (MEND was preceded by groups such as Niger Delta Vigilante, the Niger Delta Militant Force Squad, the Niger Delta Strike Force) are not the product of single causes, any more than are their goals and missions are singular and uniform. If each is in some way expressive of a structural crisis of youth that is deeply embedded in what I earlier called the multiple crises of legitimacy and authority, then one might claim plausibly that there is a powerful thread linking youth militancy to a political order that, as Hoffman (2011, p. 67) says, 'denies them recognized forms of authority'. But this crisis has many forms and many discourses: a crisis of identity, of rights, of social exclusion, of masculinity, of the spirit, of employment, and so on. In the delta, MEND is one of a raft of violent groups (and political conflicts) on the oil fields in both rural and urban settings engendered by disputes of oil property, struggles over corrupt chieftainship, violence among and between youth groups and security forces over access to oil company contracts and rents, inter-ethnic battles over electoral wards, local government boundaries and territorial authority (including oil-bearing lands), violent exchanges over bunkering territories by competing militias, vigilante groups offering protection services, and the deployment of young men by politicians for electoral thuggery. There is often a traffic in youth across and between these sites of conflict which point to the overlap between nationalist sentiment, economic exclusion, religious ideology, gender such that existentially 'these forces are interchangeable … the dividing line between them effectively erased' (Hoffman 2011, p. 34). If these spheres are not readily separable in practice, this is because the life of youth is deeply multivalent, embedded in multiple and contradictory forces shaping contemporary global capitalism and the post-colonial condition.

What, then were driving forces and wider force fields that shaped the insurgency? MEND emerged in the western delta in the creeks south of Warri, a major petro-city of the region (see Watts 2006, 2010, 2014; Nwajiaku 2012; Ikelegbe 2006; Ukiwo 2007; Courson 2009; Obi and Rustaad 2011; Adunbi 2015) The political agenda of MEND was not clear in the weeks of late December 2005 except that it self-identified as a 'guerilla movement' whose 'decisions, like its fighters, are fluid'. In fact, in a press release by email, PR man Jomo claimed that MEND was apolitical and its fighters 'were not communists … or revolutionaries. [They] are just very bitter men' (Bergen Risks 2007). But in spite of a welter of email denials—calling an Oporoza-based Ijaw militant group the Federated Niger Delta Ijaw Communities a tribal assembly, claiming to have co-opted other militant groups in the eastern delta, rejecting any connection with oil bunkering (theft), and claiming that it was not an Ijaw militia group—there was in fact a clear political platform. In a signed statement by field commander Tamuno Godswill in early February, MEND's demands were clearly outlined: the release of three key Ijaw prisoners, the immediate and unconditional demilitarization of the Niger Delta, and the immediate payment of $1.5 billion compensation from Shell approved by the Nigerian National Assembly covering four decades of environmental degradation. In an interview with Karl Maier on February 21, 2006, Jomo made it clear that

MEND had 'no intention of breaking up Nigeria' but had no intention of dealing directly with government which 'knows nothing about rights or justice'. Resource control meant that the states would 'directly manage' oil. Other communiqués reiterated that these demands were not pecuniary and 'we shall receive no money from any quarters' (*Vanguard*, February 4, 2006).

The emergence of MEND in 2005 represents a moment in a longer arc of political mobilization. Saro-Wiwa's role in the mobilization of the Ogoni movement and the Ogoni Bill of Rights was key in the early 1990s, but so too were the earlier localized women's protest and flow station occupations in the 1980s. These dispersed but foundational movements reached a watershed with the 1998 Kaiama declaration which founded the Ijaw Youth Congress (IYC)—an Ijaw youth group that grew out of their frustrations with more conservative Ijaw elders and their organizations (most especially the Ijaw National Congress)—and the proliferation of other 'oil minority' movements after 1995. Kaiama marked a massive cross-delta (and cross-ethnic) mobilization through mobile parliaments and youth organizing, and an explicit strategy to diversify tactics associated with the struggle. The question of militancy was always an object of debate within IYC—and indeed it preceded IYC since the so-called first Egbesu war in which Bayelsa State youth took on security forces occurred in the late Abacha years. A second Egbesu war emerged in 1999 from the deliberate attempts of the state to suppress the political project expressed at Kaiama. Militants in turn, as they had in the first war, occupied flow stations and provided protection for oil companies, the proceeds of which were invested in arms.

But IYC also helped spawned its own offspring—the Niger Delta People's Volunteer Force (NDPVF) of Asari Dokubo was one, and arguably the most important—and drew into its ranks all manner of disaffected youth groups in such places at Okrika, Eleme, and Nembe in a shifting set of alliances in which the borders between criminality, Mafia-like vigilante groups, and politically organized insurgents was difficult to discern. These militants were not in any obvious sense—as some have argued for Sierra Leone—a predominantly urban lumpen class raised on a diet of drugs, rap, and alienation, without intellectuals and without ideology. As survey data show (Watts 2011), many were of rural and small town backgrounds who were the casualties of exclusions from the chieftainship and lineage systems of the Ijaw, as much as local government and the labor market, many of whom were hounded and bombed by the military task forces for their trouble.

MEND's genesis reflected a complex regional geography and complex linkages and differing political histories among the states and between eastern and western regions of the delta. The emergence of the group shifted the struggle dramatically to the western Delta—the so-called Warri axis. Here a similar set of grievances and struggles were playing out wrapped up with the complex ethnic politics of Warri, city the failures of the companies to provide meaning benefits to host communities, and the militancy of women most famously against Chevon in Ugborodu in 2003. As Ukiwo (2007) has shown, Ijaw marginalization stemmed from a long history of struggle over trade during the nineteenth century in which Itsekeri peoples emerged as a comprador class to the European trading houses (and thereby cutting off the Ijaw). The Western Ijaw built up a reputation as 'truculent' and 'pirates' and actively resisted colonial rule until the 1920s when they were located into a new Western Ijaw Division cut out of the Warri Division. By the 1940s, the Gbaramantu clan—which is central to MEND's political dynamics and one of sixty clans in the Ijaw diaspora across the delta—was involved directly in claims over land (with the Itsekeri) and by the 1970s, in the wake of the establishment of oil operations by Chevron and Shell in the mid-1960s, violent conflicts had occurred over the oil-bearing lands near Ugborodo. It was from this axis that MEND dramatically emerged in late 2005. MEND had grown from an earlier history of militant youth groups—the Egbesu Boys of Africa, the Meinbutu Boys, Feibagha Ogbo, Dolphin Obo, Torudigha Ogbo—in the Warri region dating back to the early 1990s and before (Courson 2009). These Ijaw fighters were war hardened during the inter-ethnic violence of the Warri crisis in the late 1990s, but in contrast to the east, Ijaw militants were not co-opted by a state ggovernment (Fig. 23.4).

Conversely, in the eastern region around Port Harcourt, militant groups were co-opted by powerful regional politicians and often deployed for electoral violence. Here the militants were funded, armed, and shaped by political Godfathers anxious to both dampen the youthful energy of the IYC and to redirect it to political ends during the election cycle. In Rivers State, Governor Odili aggressively drew in youth leaders into the rent-seeking circuit offering payments and contracts to 'purchase peace'. In the post-1999 period, the obviously way was for politicians to deploy them as political thugs to deliver votes or disrupt elections as happened in the Okrika area in 2003. When these groups began to fall out with the political class and fought among themselves often over payment—this was the heart of the violent battles between two militant groups led by Asari Dokubo and Ateke in 2003–2004—insurgent sentiments were channeled into criminal enterprises like oil theft. As a consequence, the horizons of militant groups talking resource control were in practice often local and pecuniary. Groups became fragmented and splintered—new commanders and militias sprouted—without any identifiable trans-delta leadership or political direction, and with none of the coherence and military might of MEND in the west.

Fig. 23.4 Militants with MEND brandish their weapons in the creeks of the Niger Delta on June 3, 2006 (*Note*: Here they check a former Nigerian Army floating barracks that they had destroyed in March of 2006. A total of fourteen soldiers died in that attack, and due to acts like this by MEND, 20 % of Nigeria's oil output has been cut. *Source*: Photo courtesy of Ed Kashi, used with permission)

The challenge for MEND and the Western Ijaw was whether it could provide a Delta-wide centralized leadership among militant groups fractured by clan, lineage, and ethnicity around an ideology of resource control. Solidarity and leadership was provided by charismatic leaders like Chief Government Ekpemupolo, alias Tomopolo, but equally important was the role of indigenous religious practices, not the dominant Pentecostalism but the local spirit world and the Egbesu cult. Egbesu (in a manner strikingly similar to the complex meanings of the word jihad for northern Muslims) invoked an indigenous sense of warriorhood but also of truth and moral purity in a disordered world (Golden 2012). Over three decades and more, the Egbesu (the powerful Ijaw god of war and justice) and its cosmological order was revived in the political mobilization of the Ijaw.

6 Conclusion: Oil Peace or Business as Usual?

My political ecology of oil development in Nigeria has emphasized that the relations between oil and failed development and conflict—the contours of what is customarily called the resource curse—is complex. There is nothing intrinsic to oil which causes people to rebel or states to fail (Ross 2012). Oil—like other resources—is inserted into an already existing political economy: in Nigeria, a complex multi-ethnic federal system. This insertion was political in two senses: first, oil was nationalized and oil revenues could be captured by, and centralized within, the state; and second, there was a political mechanism to distribute state oil revenues (revenue allocation) which in Nigeria took the form of a highly contentious and often fraudulent process of fiscal federalism. I have in this sense less emphasized the curse of the resource as such than the centrality of Nigeria's petrostate as a form of political settlement through which there is a particular 'ordering of power' (Slater 2010). Nigeria's provisioning system, could secure elite privileges for long periods through military rule and a robust security state, and did not require an impost on business elites to finance security or services to reproduce labor. Rather, the provisioning pact redirected political contest to the subnational level, and fragmenting forms of public authority—secular, religious, chiefly, and so on. If these competing forces competed for near-term spoils, and were unstable and always uncertain about their ability to contain the politics of dissent or conflict (the 'crises of authority'), they were nevertheless in toto durable because of the twin capabilities of centrally governed coercion (the security and military forces) and patrimonial rent seeking (through fiscal federal arrangements). The provisioning pact tends to produce conditions of 'ungovernability'—the insurgency and the raft of other conflicts—while at the same time elite sanction of investments in coercive and patrimonial capability produce a durable system, albeit insecure, unjust, and violent.

This leads finally then to the political ecology of the amnesty signed in 2009. What sort of peace has been achieved? The government struck an amnesty in which over 26,000 militants signed up for a multiple year program of training and red education. In return for acceptance of amnesty, the federal government pledged its commitment to institute programs to rehabilitate and reintegrate ex-militants under a DDR. Three DDR phases were developed: disarmament (removing the weapons and destroying them), demobilization (to extinguish the belief of the ex-militants in violence and to provide them a more powerful alternative non-violence), and reintegration (the socioeconomic process of becoming a civilian). The Disarmament phase spanned a period of sixty days (60) August 6–October 4, 2009. This period witnessed surrender and documentation of small arms, ammunition, explosives, and light and heavy weapons. The reintegration activities lasted five years and are now formally ended.

The vision of the Amnesty program was to transform the youths from militancy to gainful employment, and the Niger Delta from abject poverty and deprivation to a region populated with modern cities with leading edge environmental management practices, economic prosperity, skilled, and healthy and harmonious region. But on many practical fronts it can only be read as a failure. All known militant groups in the Niger Delta were purportedly successfully disarmed but it is clear that the arms represented a small proportion of the arms circulating in the delta. In addition, there have been a number of challenges in administering the program including the slow-paced process in deployment of ex-militants offshore as a result of complexities in funds transfer and immigration matters, the random emergence of groups queuing up for benefits associated with the amnesty process, a lack of adequate and specialized training centers in Nigeria, low availability of jobs after training, low level of involvement of oil and gas companies in the program and reconciling those ex-militants who have been outlawed by their communities and villages and justice issues. More crucially it has been acknowledged that the federal government paid $40 million to four Niger Delta 'warlords'—the militant commanders so-called, Dokubo Asari, General Ateke Tom, General Ebikabowei Boyloaf Victor Ben, and General Government Tompolo Ekpumopolo—to guard the country's oil pipelines points to the fact that the amnesty and DDR will leave its own legacy. Where all of these monies end up is anyone's guess.

In short, the amnesty appears as another form of the instrumentalization of the state resources as a way of purchasing consent. This is, in sum, the provisioning pact in action once more, attempting to co-opt and contain by showering money at disgruntled militants and their leaders, all the while sowing the seeds of further conflicts as both struggle with local authorities and among themselves over 'access to the loot'. This is a very fragile peace and one which turned after 2009 on having a delta native (the Ijaw Goodluck Jonathan) in the Presidency and oil prices running at $100 barrel. Now the President is a northern Muslim (Muhammedu Buhari), a former military man, and oil prices have crashed and state revenues fallen by two-thirds. Fundamentally, the question must be: can the provisioning pact hold?

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24

Dispossession, Justice, and a Sustainable Energy Future

Majia Nadesan and Martin Pasqualetti

Access to modern energy services underpins civilized life, reinforcing the viability of complex systems and buffering humans from the vagaries of nature. It has been thus throughout history. Coal helped Western societies achieve global dominance at the end of the nineteenth century, and oil contributed mightily to twentieth-century advances by stimulating the creation of the complex web of technical infrastructure and geopolitical arrangements that make contemporary global society possible.

Yet, the intricate energy systems upon which global civilization depend also encode potential catastrophic environmental, health, and security risks, such as climate change, increased incidents of cancer and reproductive problems, and military conflicts. At the same time, energy infrastructures are marred by vast inequalities in access, both within and across nations. The World Health Organization (2006) illustrates these inequalities with the help of an 'energy ladder' (see Fig. 24.1).

Although WHO's energy ladder has been critiqued for being overly simplistic in some contexts (Masera et al. 2000; Hiemstra-van der Horst and

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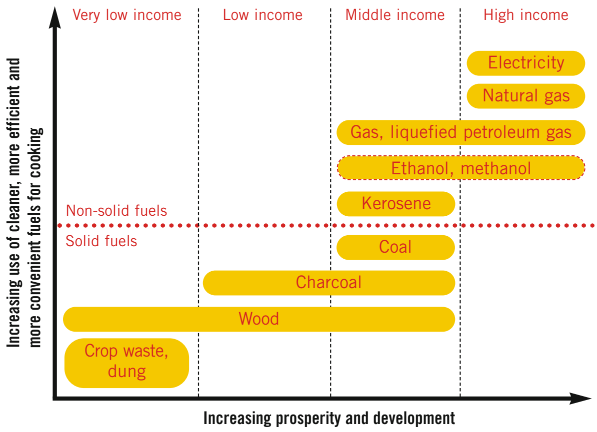

Fig. 24.1 The World Health Organization's energy ladder (*Source*: http://www.who.int/indoorair/publications/fuelforlife/en/)

Hovorka 2008), it emphasizes a progression of human energy trajectories and it also points to *existing* energy inequalities for those who have limited access to quality fuels even into the twenty-first century. The explanation for this circumstance, taken as a whole, rests on a contemporary global energy infrastructure that simultaneously overproduces energy for those living in the developed world, while it underproduces for many in the developing world. The simultaneous conditions of energy abundance and energy poverty reflect and perpetuate global disparities among nations that were established in part by 'carbon colonialism' pursued by energy-hungry states and Western fossil fuel industries (Nafeez 2014) across the twentieth century, although political disparities have surfaced with alternative energy resources as well, as we discuss later.

We propose that the solution to the gross inequalities of contemporary energy distribution and availability is not simply to move people and societies up the energy ladder. While it could avail them of the benefits of electricity, the energy ladder is often burdened with significant negative externalities, such as long-term health and environmental costs (Wilkinson et al. 2007). Externalities distort markets because they hide the true costs of production and distribution. Instead, rather than doing whatever it takes to move people up the ladder, what is needed is the promotion of alternative energy forms with fewer externalities.

Alternative energy admittedly confronts the inertia of built infrastructures and presents significant economic costs, but these challenges are more political rather than technological. Change is always challenging for complex systems, but inertia is compounded by key institutions and authorities that benefit from maintaining the carbon and nuclear 'complexes' that dominate contemporary mass energy production (Rose 1996).[1] The transnational oil industry and organizations that work closely with it together comprise a complex, defined roughly by shared commitments to particular worldviews and bodies of knowledge, common extractive technologies, common supply chains and industry-related transactions (including market transactions, such as carbon derivatives), and overlapping ownership in many instances. The transnational nuclear industry can also be regarded as a complex, or assemblage, as developed in Gabrielle Hecht's (2012) *Being Nuclear*. Institutional complexes tend to reproduce the elements of their systems, to the extent that their decision-making criteria promote institutional profitability, and/or continuity, and the interests of key actors over other considerations.

Although the daunting ecological, health, and social risks associated with carbon and nuclear fuels have been theoretically conceptualized and empirically studied, their formalization in research has not resulted in the mitigation of real-world risks their use entails. This chapter examines the significant and often under-recognized risks though the lens of 'dispossession'. Dispossession most basically refers to the sustained abnegation of basic human rights, which are encoded in national laws, constitutions, and international agreements, including the Universal Declaration of Human Rights, the Declaration of the United Nations (UN) Conference on the Human Environment, the Millennium Declaration, and the Convention on the Rights of the Child. Dispossession occurs as one group's basic human rights to livelihoods, health, and happiness are knowingly sacrificed by another more powerful group in the pursuit of profit and/or control. Dispossession in the context of carbon and nuclear production stems from unwillingness to mitigate known and significant risks to human rights encoded in routine operations, including extractive processes, common refining techniques, and modes of transportation and energy utilization.

This chapter examines dispossession deriving from oil production and nuclear power generation, focusing in particular upon two case examples—the 2010 BP oil spill and the 2011 Fukushima nuclear crisis. These extreme disasters in advanced industrial economies belie the premise of safe and inexpensive energy for those at the top of the energy ladder. The disasters illustrate that the relentless focus on profitability leads to recklessness, regulatory

[1] Social theorist Nikolas Rose considers a 'complex' to be composed of interdependent institutions, forms of knowledge, technology, procedures/practices/habits, and modes of judgment (pp. 37–38).

capture, and overproduction of forms of energy whose chemical and radiological properties pose significant health and ecological risks. Further, we also address the social justice issues stemming from the abnegation of rights to livelihoods, health, and happiness for those individuals located near the bottom of the energy ladder, exploring how carbon and nuclear energy complexes that overproduce for the world's wealthiest disregard the needs of the world's poorest who remain largely dependent upon diminishing solid fuels. We recommend that rather than seeking to 'move' individuals up the WHO's energy ladder, social entrepreneurs, non-governmental organizations, and (inter)governmental organizations should promote development of sustainable technologies that free individuals and societies from carbon and nuclear externalities.

1 Catastrophic Risk and Energy Dispossession

Ulrich Beck argues in his 1992 *Risk Society: Towards a New Modernity* that catastrophic risk has become an integral product of modern industrial society:

> [T]he historically unprecedented possibility, brought about by our own decisions, of the destruction of all life on this planet … distinguishes our epoch not only from the early phase of the Industrial Revolution but also from all other cultures and social forms, no matter how diverse and contradictory. If a fire breaks out, the fire brigade comes; if a traffic accident occurs, the insurance pays. This interplay between before and after, between security in the here-and-now and security in the future because one took precautions even for the worst imaginable case, has been revoked in the age of nuclear, chemical and genetic technology. (Beck 1992, pp. 22–23)

Risk has become catastrophic because today's technological disasters threaten viable futures for entire group of individuals. Indeed, today's catastrophic risks include a potential planetary extinction event engineered through human technology, coupled with disregard for eco-system integrity.

According to Beck, modernity is characterized not only by catastrophic risk, but also by concomitant social awareness of risk, as generated in scientific reports, policy analyses, public debate, and the like. Yet, although modernity is 'reflexive' in its capacity to represent catastrophic structural risk, modern institutions too often fail to redress them for a wide array of reasons ranging from systems inertia to powerful conflicts of interests. Accordingly, Beck observed in his work on reflexive modernization that the 'continuity of autotomized modernization processes … are blind and deaf to their own effects and threats. Cumulatively and latently, the latter produce threats which call into question and eventually destroy the foundations of industrial society' (Beck 1994, pp. 5–6). Institutions are not always innocent of their risks and may actively work to obscure public understanding of the externalities produced by their routine operations and/or catastrophic failures. For example, a study by Robert Brulle (2014), published in *Climate Change*, described a complex network of organizations and funding apparatuses aimed in an organized fashion at misdirecting public discussion and understanding of carbon-influenced climate change. Powerful sectional interests in entrenched and interconnected institutions, such as those found in energy, increase the likelihood of catastrophic failures. Sociologists Charles Perrow (2011) argues that intense concentrations of wealth, energy, and decision-making power amplify risks for a variety of reasons, including concentrated power's direct influence over vast networks of interdependent entities, its inclination toward blindness to logics other than its own, and its capacities to deploy vast resources against perceived opposition.

We argue that failures by industry, political leaders, and other authorities to address known catastrophic risks deriving from routine operations and accidents constitute an inadvertent politics of dispossession that not only violates basic human rights encoded in political documents, but also threatens long-term human sustainability. In opposition to this politics of dispossession, we propose immediate reforms and, more importantly, alternative energy technologies developed within a paradigm of social justice that seeks full transparency in supply-chain externalities and full inclusion for impacted communities in dialogue about energy futures. The social justice energy paradigm has already been launched but its dissemination is slowed by institutional entrenchment.

The carbon and nuclear complexes are globally entrenched. About 80% of the commercial energy infrastructures in the world are based on our use of carbon fuels, with a lesser emphasis on nuclear. Other energy technologies—including solar and wind—are growing in importance, but have not substantially altered the world's carbon dependence despite the catastrophic risks. These risks are preset in the carbon supply chains and production processes, and include the costs to health and environment from extraction, refining, transportation, processing, and utilization that will be reviewed in this chapter. The carbon complex's logic of replication produces systemic irrationalities, illustrated by the failure to conserve what is ultimately a limited resource.

Oil, coal, natural gas, uranium, and thorium are fundamentally limited resources, as is the fresh water consumed in their utilization. These commodities supply chains are inherently waste-producing and environmentally contaminating. It therefore seems rational that societies would adopt prudential, conservation approaches. Yet, for 18 months through mid-2015, the world experienced an oil and natural gas glut caused in large part by increased Organization of Petroleum Exporting Countries production and the enhanced recovery successes stemming from the widespread application of hydraulic fracking in the USA ('The Oil Glut' 2015). The fracking boom has been described as a 'bubble' because it was funded by investors seeking safe haven in commodities and their infrastructures after the collapse of the housing bubble beginning in 2008 (Howard 2014). Overproduction collapses prices, sometimes below producers' cost points. The per-barrel price of oil plummeted from over $100 in 2014 to a bit under $40 by August 25. This price point is problematic for USA and Canadian producers whose costs of production per barrel in US dollars range from $39 to $65 for the USA, and from $49 to $61 for Canada.

Overproduction also leads to bankruptcies, resulting in greater industry consolidation, and encourages overconsumption by consumers, who are tacitly encouraged to view oil and natural gas as limitless resources. Even profitable price points for producers rarely incorporate the total costs and risks of oil and natural gas production, despite the profound economic, health, and ecological impacts they create. For example, a study published in the *Lancet*, a respected British health journal, found that carbon-derived air pollution, especially from vehicle exhaust, was a leading cause of death in Asia (Lim et al. 2012). The health costs of petroleum emissions rarely enter into pricing formula.

Carbon-supply chains carry several other specific risks. Crude oil includes a range of toxins, and the chemicals used to process and refine oil are similarly toxic. Production and especially combustion release many waste products into the air, including greenhouse gasses. Extraction processes also produce spills—some catastrophic—as well as other emissions, such as methane, a powerful greenhouse gas. The transportation of carbon-based fuels is fraught with risk as pipelines leak, as rail cargoes explode, and as freighters collide or ground. In sum, extracting, processing, transporting, and consuming carbon-based fuels produce significant volumes of atmospheric pollution and other waste products that adversely and measurably affect human health and the eco-system.

The current carbon regime is unsustainable given intrinsic resource limits and abundant externalities, yet its entrenched nature resists revision. Resistance to change was materially inscribed upon the twentieth-century landscape as carbon-based energy was institutionalized in industrial production, transportation, and war, among other pursuits. Carbon dependence, lock-in, and path dependency shape national and international policies as securing supply chains is defined as central to national security. US authorities as varied as Former Federal Reserve Chairman Alan Greenspan and Former Defense Secretary Chuck Hagel have publicly acknowledged that the Iraq war was fought over oil (Juhasz 2013). The relationship between oil and war demonstrates how the imbedded carbon infrastructures threaten human security and social justice, as documented by Michael Klare in *Blood and Oil* and Dikip Hiro in *Blood of the Earth* (Klare 2004; Hiro 2007). The carbon complex perpetuates the energy status quo through its material entrenchment in modern infrastructures, its control of financial capital, and (albeit limited) access to political and military power.

Nuclear energy promised to free humanity from the carbon curse. However, it created risks that arguably surpass those posed by carbon-based fuels, including from accidental releases and the use of nuclear weapons. Uranium mining and processing are carbon intensive and produce significant waste that must be managed, consuming energy and resources, and presenting long-term security risks. Nuclear energy plants are extraordinarily expensive to build, insure against liability, and decommission because of the degree of risk posed by radioactive processes and waste. Prohibitive decommissioning costs encourage regulators to allow utilities to operate beyond their engineered design specifications through 'uprating' and beyond their planned lifespan, effectively amplifying risks (Plumer 2012). Radioactive waste presents significant and unresolved hazards. Former Nuclear Regulatory Chairman Gregory Jaczko argued in 2015 that nuclear power is actually more expensive than energy from geothermal sources, or from natural gas with carbon sequestration technology (as quoted in Lin 2015). Further, he argued that current cost assessments for nuclear developed by the US Energy Information Administration fail to include costs for nuclear waste disposal and site decommissioning, which are the most expensive steps of the nuclear cycle. Nuclear accidents—both their threat and their existence—amplify costs still further.

Nuclear power is prone to industrial accidents that eclipse most other types that can be produced by human action, as illustrated by the nuclear contamination posed by decades of operation at Maiak and Hanford and by the Chernobyl and Fukushima nuclear accidents (Brown 2013; Oregon Department of Energy n.d.; Ramzaev et al. 2006). Lelieveld et al. (2012) predict a severe nuclear accident every 10–20 years. Another risk analysis of 174 accidents since 1946 predicted in dollar losses a 50% chance for a Fukushima-scale accident or larger in the next 50 years, a Chernobyl-scale event in the next 27 years, and a Three Mile Island scale event in the next 10 years. The study concluded that the damage from the Fukushima disaster was equal to 60% of the total damage of all 174 accidents in their database since 1946 (Wheatley et al. 2015).

Uranium and the waste generated through its supply chains have toxic effects. Research on American Navajos exposed during uranium mining found that uranium binds with DNA, which is degraded through uranium's chemical action (Arnold 2014). Moreover, uranium's alpha, beta, and gamma decay processes damage cells *directly* through their energy impacts—alpha particles that sever DNA entirely—and *indirectly* through creation of free radicals. Many of Uranium's fission products—such as Iodine-131, Cesium-137, and Strontium-90—present unique chemical and radiation risks because they bioaccumulate in living organisms and biomagnify across the food chain. For example, researchers predicted that Cesium-137 from the Fukushima nuclear disaster would bioaccumulate across time in North American coastal food webs, with trophic magnification in orcas reaching concerning levels within five years (Alava and Gobas 2014).

Quantifying the possible effects of environmental catastrophes is fraught with uncertainties, both real and deliberately cultivated. Beck suggested that the invisible character of radioactivity and other pollutants renders them open to social definition and construction by key social authorities, especially those situated within the media, legal, scientific, and governmental institutions (Beck 2008). We should perhaps question technologies that produce their own risks while losing control of them, especially when risks are catastrophically encoded into societal institutions with highly standardized decision-making criteria and centralized decision-making processes organized primarily around profit.

2 Catastrophic Energy Risk and Dispossession at the Top of the Energy Ladder

The 2010 BP Macondo oil spill and the March 2011 Fukushima Daiichi nuclear disaster represent two of the largest, single-event energy disasters in history. Each resulted from lack of planning, poor safety oversights, design flaws, bad luck, and regulatory laxity, according to government reports produced in the USA and Japan. Each disaster represented unprecedented assaults against the world's oceans and the livelihoods of the people who depend upon them. We briefly explain each of these events, focusing on their impacts and externalities (Nadesan 2016).[2]

The BP oil spill illustrates how the carbon complex institutionalizes injustice in risk-and-profit seeking operations, producing externalities for even

[2] For fuller discussion, see Nadesan Dispossession Liberalism's Crisis.

the most privileged citizens in developed economies. On April 20, 2010, BP's Deepwater Horizon oil rig exploded, producing the largest oil spill in American history. The BP accident killed 11 workers and caused widespread ecological damage. The blowout occurred 5000 feet below the water surface and then an additional 13,000 feet under the sea floor to the hydrocarbon reservoir, complicating efforts to contain the mega-disaster that followed (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011). At least 4.9 million barrels of oil were released into the Gulf of Mexico before the well was capped 87 days after the initial explosion (Trott 2015). This figure does not include releases of methane and other gasses, which are estimated to have constituted at least a third of the petroleum hydrocarbons released by the well (Hughes and Hotz 2010). Considerable oil reached the surface, but all the natural gas and approximately two million barrels of liquid oil are thought to have been trapped in a layer at water depths of ~1000–1300 m, before sinking to the bottom (University of California—Santa Barbara 2014). Surface oil covered 62,159 km^2 (Sammarco et al. 2013).

The Gulf of Mexico suffered significant direct contamination from the petroleum and also from the unprecedented use of chemical dispersants that were applied to the oil. Research published in 2013 reported toxic compounds from the spill in sediment, seawater, biota of many types, including seafood (ibid.). A 2014 study concluded that widespread use of the dispersant Corexit prevented typical bio-degeneration of the oil, leading to its persistence on the sea floor (Passow 2014), with measurable adverse impacts on bottom life.

Although poor cement quality and a failed blowout preventer contributed to the disaster, cost-cutting and negligence were ultimately designated as responsible for the blowout. They were inscribed into organizational operations according to the investigations and lawsuits, such as the US Presidential Commission that investigated the disaster. Specifically, the commission report stated that the Macondo explosion could have been prevented and resulted from systemic failures in risk management, the scale of which cast doubt on the entire industry's approach to safety (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011).

Indeed, British Petroleum (BP) had such a poor record of safety that judicial and media observers alike acknowledged openly that BP's corporate culture promoted deal-making over safety (Chazan 2011). In the Gulf of Mexico, BP relied on a well design described as 'risky' by Congressional investigations in over one third of its deep-water wells (Gold and McGinty 2010). Government regulators failed to rectify BP's risky operating culture because regulatory agencies were understaffed and many were corrupted by a 'revolving door' of employees who switched between government regulator and corporate employee, despite widespread knowledge that BP relied on cheaper wells with fewer safety mechanisms (Power 2010).

The BP crisis illustrated the inherent risks in accessing offshore oil while BP's crisis management approach demonstrated the prioritization of profits over transparency and accountability. BP misrepresented the oil flow, according to the US Securities and Exchange Commission and ultimately was fined $525 million charges for misleading investors about the oil flow rate during the crisis (Reed and Krauss 2015). BP allegedly destroyed evidence of spill effects. Locals living in Grand Isle charged that the company sought out and 'shredded' dead dolphins and whales before bringing them to shore in plastic to dispose of in dumpsters without tallying the death toll in order to reduce evidence of the spill's environmental impact (Goodell 2010). Freedom of Information Access requests pursued by *The Guardian* newspaper indicate deep conflict within the US government regarding the severity of the spill and the persistence of the oil, with the White House publicly supporting BP's claims that the oil was gone; and the Environmental Protection Agency and National Oceanic and Atmospheric Administration demanding a retraction of such claims (Goldenberg 2011; Dickinson 2010). Independent marine scientists studying the spill effects who were interviewed by the media alleged government censorship and lack of transparency in government-funded scientific findings (Coleman 2012).

Record US government contracts to BP in the year following the disaster indicate failure to sanction BP for its risk-seeking culture, as reported by Bloomberg News:

> BP's contracts with the military surged 33 per cent to $1.35 billion in the fiscal year that ended Sept. 30 from $1.02 billion in fiscal 2010, according to data compiled by Bloomberg Government. BP received 49 per cent more in defense contracts than the No. 2 fuel supplier, San Antonio-based Valero Energy Corp. (Ivory 2012)

BP's widely recognized risk-seeking culture was essentially reinforced by continued government contracting.

BP ultimately was charged $18.7 billion in civil settlements related to the disaster and $4 billion to settle criminal charges against the corporation (Juhasz 2015). This was in addition to the estimated $40 billion they paid for cleanup. However, as if to soften the financial blow to the oil industry in the years following the BP oil spill, the government opened up more areas for exploration and development, although it also instituted new regulations on drilling. In 2010, the Interior Department instituted new rules on drilling well casings, and in 2012, it instituted new rules on the cementing of wells. In 2015, it required safer blowout preventers, but only for new wells (Davenport 2015). Government policy has prioritized perpetuation of the status quo. The US Obama Administration announced in 2015 that it would open federal waters off the southeast Atlantic coast to drilling. Additionally in the summer of 2015, Royal Dutch Shell received US authorization to drill exploration wells in Alaska's Chukchi Sea on the condition that it could demonstrate capacity to clean up potential spills, despite evidence from the Exxon Valdez's Alaskan spill that oil and Arctic waters present significant cleanup and restoration challenges (Joyce 2015).

Despite proven and suspected externalities, deep-water drilling continues with government support because of the integral links drawn between carbon energy and state security. This formulation of security does not incorporate the significant eco-system and human health effects and costs for societies across the energy ladder. Economic and social costs are simply externalized in order to perpetuate a system characterized by catastrophic risks, even for those who purportedly benefit from its infrastructures because of the ease of their energy access. The same blindness to externalities can be found in the nuclear complex, with potentially even more catastrophic risks encoded into its operations (Nadesan et al. 2014).

The full vulnerabilities of nuclear plants to earthquakes and flooding were vividly revealed after the March 11, 2011, 9.0 earthquake and the resulting tsunami off the northeast coast of Japan. At the time, Japan had 54 operational commercial nuclear reactors. The Fukushima nuclear site operated by Tokyo Electric Company (TEPCO) was reportedly hit hardest. The site consists of Fukushima Daiichi and Fukushima Daini—which despite the fact that they are approximately 10 km apart, is treated as a single site—is about 290 km north of Tokyo. Fukushima Daini has four nuclear reactors and Fukushima Daiichi has six reactors. Each reactor has a spent fuel pool, in addition to a larger common spent fuel pool at Daiichi. These pools contain approximately 1600 tons of highly radioactive, spent uranium fuel rods (TEPCO 2010).[3] The earthquake and tsunami resulted in a station blackout that caused radioactive fuel to overheat in reactors and spent fuel pools, producing explosions, meltdowns, and at least one full 'melt-through', whereupon the nuclear fuel melted through containment (McCurry 2011).

[3] It is worth noting that although this report was produced on October 26, 2010, the file properties indicate the document was modified on March 13, 2011: *Integrity Inspection of Dry Storage Casks and Spent Fuels at Fukushima Daiichi Nuclear Power Station* (November 16, 2010), http://www.nirs.org/reactorwatch/accidents/6-1_powerpoint.pdf.

Many areas of Japan were contaminated by the explosions that wracked Daiichi reactors one through four. According to the French Institute of Radiological Protection (Institut de Radioprotection et de Surete Nucleaire, IRSN) Cesium-137 deposits alone produced areas of up to 30,000,000 becquerels in the most contaminated areas nearest the plant (IRSN 2012). Cesium-137 was not found on Earth's surface prior to the atomic age. The International Atomic Energy Agency (IAEA) defines land contamination at 40 kilobecquerels per meter squared, which is 40,000 becquerels (Christoudias and Lelieveld 2013).

Fukushima has been evaluated as the worst nuclear accident ever to occur for the world's oceans, with one study estimating that the total amount of Cs-137 believed to have ended up in the Pacific during March 2011 was equivalent to 20% of the remaining North Pacific Inventory of atmospheric testing derived Cs-137 from the 1950s and 1960s (Inomata et al. 2015). The greatest problem with the Fukushima ocean contamination is it has no end. The technology needed to extract melted reactor fuel does not exist. At least part of the melted core (from Unit 1) resides either in the basement or underneath the plant entirely and is in direct contact with fresh water coursing through the site from an underground river ('Radioactive water' 2013), which eventually empties into the Pacific Ocean (Nagata 2013). The contaminated water problem is compounded by TEPCO's deliberate injections of 300–400 tons of water a day to cool melted fuel from reactors and spent fuel pools in units 1–4 (Yoshida 2013). TEPCO cannot capture all the contaminated water and cannot fully remove radionuclides from the water it does capture. Only recently has it been able to remove strontium-90 and now water with strontium-90 removed counts as purified despite still containing tritium. TEPCO is running out of storage containers. Daiichi had over 1000 water storage tanks in 2014 (New steps worked out to deal with contaminated water 2014). *The Asahi Shimbun* reported that 'This is the first time this much radioactive water has been collected in any single place in the world—the scale of this project in unprecedented' ('More ALPS equipment approved for use at Fukushima plant' 2014). The tanks are leaking and may pose risks of explosions (Demetriou 2015).

A special Japanese National Diet report on the Fukushima disaster decried TEPCO's disaster preparation and crisis management (NAIIC 2012). Furthermore, Fukushima presents catastrophic ongoing *risks*. On August 23, 2014, Mitsuhei Murata, former Japanese ambassador to Switzerland and Executive Director of the Japan Society for Global System and Ethics, published an open letter on Fukushima at www.Solartopia.org warning that:

> Fukushima constitutes a global security issue. Fukushima is out of control and the situation at the site is dangerously worsening. The Japanese government and … TEPCO have lost credibility both at home and abroad. Nearly 4 and half years after the Accident, Japan is at a loss how best to cope with the current situation. (Murata 2014)

Despite public concerns about ongoing risks at the site, the Japanese Liberal Democratic Party leadership is pushing evacuated residents to return to areas measuring up to 19 millisieverts a year in external exposure, when the pre-crisis exposure limit was 1 millisievert of annual exposure (Kasai 2013). A millisievert is a biological measure of radiation exposure. In 2013, Japan changed the way it measured radiation levels by moving from aircraft readings to a badge system, resulting in lower—presumably less alarming—exposure readings (Lower radiation readings proposed to speed return of Fukushima evacuees 2013). In 2015, Japan raised the maximum annual radiation exposure level for local government and workers 'ahead of restart of nuclear reactors' (Gov't to raise maximum annual radiation exposure 2015). Japan's Fukushima residents and workers inhabit a significantly more radiation-contaminated world with unknown health and ecological risks. Loss of livelihoods in fishing and agriculture that were inherited across generations has led some distraught residents to resort to suicide because of the destruction of their lives ('TEPCO ordered to pay damages' 2015). The risks from the Fukushima disaster have been externalized to the public and the environment with potentially catastrophic long-term costs (Nadesan 2013).

The carbon and nuclear complexes operate by relentless logic of growth and profitability that escapes regulation because of bureaucratic entrenchment, regulatory capture, and short-term conceptualizations of security organized around an unsustainable status quo. Livelihoods and lives are uprooted by crises deriving from their risky practices, even for those purportedly benefiting from their position on the top rungs of the energy ladder. Citizens of advanced industrial economies have at least some level of legal redress, albeit it is limited to the calculable externalities produced by catastrophic failures. In contrast, the inhabitants of (developing) societies with more limited access to the top rungs of the energy ladder often have little-to-no-redress for the risks produced routinely across carbon and nuclear supply chains, while they simultaneously lack access to the energy produced by these chains. Marginalized individuals within societies located at the top of the energy ladder can also experience externalities, as shall be discussed next.

3 Routine Operations and (In)Justice Across the Energy Ladder

Unlike the catastrophic risks described above, other risks are more chronic or systemic. The chronic risks from today's energy infrastructures, such as those posed by smog and routine nuclear plant effluents, are often de-prioritized in decision-making about energy futures because abstract formulations of their impacts across time and space seem less pressing than status quo demands. Moreover, since energy security is a near universal goal for nations and individuals, the ease of existing infrastructures, especially for those at the top of the energy ladder, erodes short-term incentives for pursuing alternatives. In this context, political power accrues to those who control dominant societal energy forms, supply chains, and utilizations. It is therefore not surprising that ownership in the oil and nuclear complexes tends to be highly consolidated, with decision-making centralized in a small group of corporations and state-owned oil companies.

For most of the twentieth century, the 'Seven Sisters' (now reduced by mergers and acquisitions to just four companies) dominated the global oil supply chain:

- Anglo-Persian Oil Company (now BP)
- Gulf Oil (acquired by SoCal in 1985)
- Standard Oil of California (SoCal, rebranded as Chevron)
- Texaco (now Chevron)
- Royal Dutch Shell (now Shell)
- Standard Oil of New Jersey (Esso)
- Standard Oil Company of New York (Socony; later Exxon Mobil)

State-owned companies control more reserves than the remaining four of the seven sisters. These include

- Saudi Aramco,
- NIOC (National Iranian Oil Company founded 1951 by Iranian government),
- INOC (Iraq National Oil Company founded 1966 by Iraqi government),
- PDVSA (Venezuela State Oil Company founded in 1976 by Venezuela's government),
- PetroChina,
- Gazprom (Russia),
- Petrobas (Brazil), and
- Petronas (Malaysia) (Hoyos 2007).

The antiliberal 'cartel'-like characteristics of the oil complex were documented in a 1952 investigation by the US Federal Trade Commission (US Senate 1952). Yet, over 60 years later, a 2014 US senate report documented similar anticompetitive and risk-laden practices in the oil industry. Moreover, the carbon industries together resist solar and other alternative energies, as documented previously in this chapter. Rather than promoting new energy forms, the carbon industry promotes its perpetuation in new guises, such as natural gas generated through 'fracking', a technology that produces substantial chemically toxic and radioactive waste, whose injections into the earth cause earthquakes and contaminate fresh water aquifers.

The well-connected nuclear industry also resists new technologies that might erode its market share (Cooper 2015). Through its global consolidation and by virtue of the revolving doors between industry and government, the nuclear industry maintains its hold despite aging and deteriorating infrastructures and endless contamination by tritium and Krypton-85 from nuclear fuel processing and utilization. Centralized ownership centralizes decision-making, deferring decommissioning of dangerously flawed reactors, such as General Electric's Mark I reactors. According to the World Nuclear Association, the world uranium production market was consolidated during takeovers, mergers, and closures in the 1990s. By 2014, ten companies were marketing 88% of the world's uranium mine production (World Nuclear Association 2015). The 2014 US Senate investigation of 'Wall Street Banks' Involvement with Physical Commodities' found that the uranium supply chain ownership to be highly consolidated, with Goldman Sachs owning a significant share of the uranium processing (through the Nuclear Fuels Corporation of South Africa) and trading of uranium supplies and securities (US Senate 2014). Gabrielle Hecht's (2012) *Being Nuclear: Africans and the Global Uranium Trade* offers a genealogy of African uranium supply chains, exposing beneficiaries, such as mine owners, and losers, such as workers and communities who are required to assume the risk materially externalized by uranium mining and refining. Those risks include damage to health and environment, as well as the long-term economic risks of investing societal resources into uranium production rather than some alternative, less cost-incurring and externalizing technology.

The power of the carbon and nuclear complexes is institutionalized in transnational corporations, international governance entities (such as the IAEA), trade agreements and organizations (such as the World Trade Organization), and in transnational alliances among elite groups defined by their consolidated ownership. Institutional influence on public policy is everywhere evident, as illustrated by the Japanese government's decision to continue relying on nuclear energy despite strong public opposition and increased earthquake and volcanic activity (Lies 2015). It is also illustrated by the decision in drought-plagued California to cut water supplies to agriculture by 25%, but not limit supplies to California's oil and gas industry (Caroll 2015). Decisions about energy typically prioritize status quo institutional operations and values such as 'cost-efficiency' over demonstrated hazards and long-term energy sustainability. Measures of cost-efficiency too often rely on externalization of full costs of energy supply chains and institutional practices. Consequently, true market transparency in pricing is lacking, thereby helping legitimize the status quo by under-representing risk. Failures of markets and good governance can be found everywhere in human relations; they are often magnified where energy commodities and technologies are concerned.

The historic ascendancy of oil and uranium as energy sources produced a 'resource curse' for less-industrialized economies possessing coveted resources as their internal politics and infrastructures were shaped by outsiders (Watts, Chap. 23; Klare, Chap. 17). The resource curse includes health and environmental effects, but refers also to the inequality and corruption that bedevil countries rich in resources. Economists Sachs and Warner (1995) documented that economies with a high ratio of natural resource exports experienced less economic growth than resource poor nations, even when holding constant factors such as initial per capital income and government efficiency, among other variables. Resource-rich regions often suffer the political, environmental, and health consequences of their export-oriented resource supply chains because extractive logics prioritize access, efficiency, and profitability over other considerations. The prioritization of profits and the politics of dispossession that follow are illustrated by the nonexistent occupational protections for mid-twentieth century South African uranium workers described by Hecht (2012).

Change is slow despite the range of catastrophic risks encoded in our infrastructures by carbon and nuclear fuels. Specific failures to recognize and mitigate carbon and nuclear externalities can be regarded as 'energy injustices'. Injustices result when the actions of one group burden other groups in ways that are not fair or equitable, that discount the views and impacts on that group, and that are produced and suffered without consultation, consent, or compensation. Indigenous people, because they often lack adequate representation and political power, are particularly vulnerable to energy complex externalizations. For example, indigenous people in parts of eastern Ecuador for many years have had to accept the environmental and health impacts of oil developments of large multinational companies. In 2011, an Ecuadorean

Fig. 24.2 Oil pollution in the Lago Agrio oil field in Ecuador, 2007 (Photo by Julien Gomba. Creative Commons. Public domain)

judge ordered Chevron to pay $18.2 billion (£11.4 billion) for 'extensively polluting' the Lago Agrio region (Fig. 24.2). Ecuador's highest court in 2013 year upheld the verdict against Chevron, but reduced the amount of compensation to $9.5 billion. The alleged environmental damage was done by Texaco between 1964 and 1990. Texaco was later acquired by Chevron. In 2014, a judge in the USA ruled that lawyers representing Amazonian villagers used bribes to secure compensation worth billions of dollars from oil company Chevron in Ecuador. He annulled the case ('US judge annuls Ecuador oil ruling against Chevron' 2014).

Although issues of energy justice are often associated with the developing world, they are even found in fully developed countries, such as the USA. For example, it is a matter of injustice that environmental pollution from the Four Corners coal plant wafted for decades over the Navajo Nation. It is an especially egregious example of injustice, considering the length of time it went on and that the plant owners and consumers of the electricity never themselves suffered any direct ill effects. The Navajos are doubly jeopardized because they also suffer the health and environmental impacts of nuclearity from uncapped mines and uranium tailings scattered across their Arizona reservation (Western Environmental Law 2015). Radioactive contaminants from uranium mining also afflict other areas, such as northern Canada where contaminants leach into the local aquifer, streams, and lakes (Ashmead 2010).

Sustained and knowing energy injustices result in dispossession of others' rights, including the rights of entire nations. First Nations people are often among the most dispossessed, having lost lands, timber, and water over the centuries and are particularly vulnerable to the externalities produced by extractive industries. For example, Cree Indians of Ontario and Quebec lost much of their native lands when Provincial authorities and utility companies constructed large dams on the rivers entering James Bay ('40 years in, Manitoba apologizes to First Nations for hydropower dam flooding' 2015). Something similar happened in the wake of mining activities surrounding the Alberta Tar Sands (Pasqualetti 2009). Additionally, the Ejidatarios of Oaxaca, Mexico continue enduring the disrupting effects of the installation of wind turbines within their milpas with little to no consultation or compensation (Fig. 24.3) (84). The list of energy dispossession is long, and growing.

Alternative energy technologies that are not responsive to community concerns will likely result in the foundation of new complexes that operate with little regard for potentially catastrophic risks.

Fig. 24.3 Anti-wind protestors are met by state police in Union Hidalgo, Oaxaca, October 30, 2012 (Photo from the Asamblea de Pueblos del Istmo, used with permission. http://globalvoicesonline.org/2012/12/27/mexico-federal-court-halts-controversial-wind-park/)

The *Environmental Justice Atlas*, which attempts to map ecological conflicts and resistance efforts, has compiled an extensive list of hundreds of examples that illustrates the frequency and pervasive nature of issues of energy injustices (Environmental Justice 2014). These issues, which the Atlas refers to as 'socio-environmental conflicts', are defined as mobilizations by local communities and social movements. They may also include support of national or international networks against particular economic activities, infrastructure construction, or waste disposal/pollution whereby environmental impacts are a key element of their grievances. Resistance to these, and many other energy projects, has been rising, as issues of energy justice have gained recognition by people living outside immediately impacted areas.

In these and thousands of other cases, both historical and current, dispossession derives from sustained externalization of risks coupled with disregard for energy injustices, evidenced by failures of acknowledgement, mitigation, and compensation. Privileged energy interests deploy influence to normalize their pollution in policy and law, even within developed nations, as illustrated by industry efforts to combat regulations limiting toxic emissions, including lead, mercury, and ionizing radiation, as illustrated here:

> The Northampton Generating Plant in Pennsylvania is burning waste coal, tires, and—recently—pelletized Philly trash. Since they've violated their air emissions limit for toxic lead pollution in recent years, they want the state to increase their allowable lead limit by 22 times. It's like getting caught speeding, then asking the state to increase the speed limit from 65 mph to 1,430 mph. We were just quoted in this article leading up to a public hearing where we'll be speaking out soon—then working at the grassroots level to pass a local air ordinance since we don't expect the state to protect us. (Energy Justice 2015)

Too often, the solution to contamination is to raise exposure levels. Too often, outside and/or sectional interests impose degraded environmental quality and risks to personal health, resulting in a loss of livelihoods and cultural identity.

Long term, the solution to these routine externalities lies in energy innovation driven by technologies that offer long-term ecological and political sustainability. The ethical rationale for sustainable energy derives from societal commitment to human rights and opportunities. The economic rationale for energy innovation can be found in more realistic pricing of carbon and nuclear externalities. Perhaps alternative energy development will seem less expensive when prices more accurately reflect catastrophic ecological and health costs. Even so, transitioning to more rational energy infrastructures takes time, even under the best of conditions. In the meantime, more could be done to increase the transparency and accountability of the existing energy complexes, particularly by alleviating the 'resource curse'.

Most of the cases highlighted in the *Atlas* involve energy extraction, so one short remedy to the energy justice issue could be to mandate greater transparency, monitoring, and control over the activities of oil, gas, and coal companies. This is the purpose of EITIs, or 'extractive industry transparency initiatives' (see also Van Alstine and Andrews, Chap. 4). EITIs are voluntary, multi-stakeholder codes of conduct emerging from a collection of previous ad hoc efforts by companies, governments, and civil society (Sovacool and Dworkin 2014). Though they vary in their implementation from country to country, EITIs generally possess three core requirements:

1. energy companies must disclose everything they pay to the government;
2. institutions of the government must disclose everything they receive from energy companies;
3. independent auditors ensure the two sets of figures agree and produce a published report.

The intent of EITIs is to track the influence and interaction among energy companies and governments, protect citizens, but also protect governments and investors from 'rotten apples' in the industry (Eigen 2007). As of 2012, 14 countries were in compliance with EITI standards (though Yemen was recently suspended) and 21 countries were considering their candidacy.

Energy justice is closely linked to environmental justice, for several reasons. First, the quest for energy, especially by the poor, is often negotiated without effective or meaningful consideration to environmental degradation. Second, environmental impacts from energy production and use are often kept 'external' to the costs paid by the consumer. This means that the populous at large is burdened with the environmental costs or externalities. Third, energy resources are maintained at artificially lower prices because full environmental costs are not paid by consumers. Fourth, in the most egregious example, energy-rich countries often are populated by those who live in energy poverty, but who still suffer the environmental costs.

4 Energy Inequalities at the Bottom of the Energy Ladder

A final type of systemic risk derives from the sustained vulnerabilities for those at the bottom of the existing energy ladder. Readers of this chapter likely live in a developed country and experience a reasonably comfortable, convenient life. A large part of those benefits stems from having relatively unlimited energy on demand, with no restrictions on use. It is not free, of course, as paying for energy is part of the agreement accepted when embracing a taste for the services it provides. The medium of exchange for (indirectly subsidized) energy is money in the developed economies. In the poorest economies, energy is paid for in the labor and time spent finding it, gathering it, and bringing it home. The externalities of this type of energy economy are easily measurable. The concept of 'energy poverty' represents an important social justice issue stemming from status quo energy relations. Energy and fuel poverty are related but distinct concepts. Fuel poverty is the inability to *afford* adequate energy. By contrast, energy poverty refers to inability to *access* adequate energy. In other words, it is not just a matter of being poor; it is a matter of availability. Even though both can produce some of the same consequences—such unhealthy living conditions—they are significantly different problems.

Imagine a mother raising children in the Sahel of Africa that fertile transition zone between the arid Sahara desert and the humid rain forest. She needs fuel to cook meals each day and for warmth against air chills. There is little left to burn as trees that were once reasonably abundant, are all gone now, felled for firewood. She could move her family to wherever fuel was available, assuming she knew where to go and assuming she could move there without encountering resistance from residents or threats from marauding thugs. Alternatively, she could hire someone to find fuel or wander as far as necessary, perhaps sending children, knowing that such activity will displace time for their play, studies, and opportunities for personal advancement. The precedence of basic needs locks her in an endless cycle that has devastating impacts on the environment, human health, and social welfare (Greig n.d.). The pattern perpetuates (Fig. 24.4).

Energy poverty places women and children at risk of injury and violence during fuel gathering. This is a very serious problem. In Darfur, for example, women and girls trek for hours a day in the hope of finding a few branches or roots to burn. In her essay 'Sexual violence and firewood collection in Darfur' Erin Patrick reports: 'To avoid the midday sun, many leave in the darkness. To lessen competition, they travel alone or in very small groups. To find increasingly scarce combustible material, they may have to walk several kilometers away from the camps. In doing so, they become prime targets for the Janjaweed militia, local government or police forces and other men who act in a climate of almost total impunity' (Patrick 2007, pp. 40–41).

Darfur, in what is now South Sudan, has suffered war for years. Aid is sometimes available during such conflicts through the World Food Programme of the UN, which is mandated to provide food during a complex humanitarian

Fig. 24.4 Women returning from their vegetable gardens with cassava and firewood in India (Photo by Francis Hanaway, 2007. public domain. https://commons.wikimedia.org/wiki/File:Women_returning_from_their_gardens_Basankusu.jpg)

emergency. That is the good news, but it unfortunately ends there because no UN agency has been mandated to provide fuel for cooking food, despite provision of foods such as beans and whole grains that require cooking before consumption (Chynoweth and Patrick 2007). Consequently, refugee and internally displaced women and children often must leave the relative safety of their camp or settlement to search out cooking fuel, a quest that can take up to ten hours daily and renders them vulnerable to assaults and sexual attacks.

The consequences of energy poverty are widespread and numbing to those who live outside its grasp. According to the International Energy Agency, more than 2.6 billion people (40% of world population) have no access to clean fuels for heating and cooking. A billion of these people are in India and Africa, and more than half of China's population relies on solid fuels (coal and biomass) for cooking and heating. These emotionless statistics mask dreadful human costs.

Health impacts are among the most serious of these costs, particularly those resulting from indoor air pollution. A new book details these costs with gripping clarity (Yadama and Katzman 2013). It paints an alarming picture of more than 800 million people living in rural India. Women and children are dedicated, without respite, to gathering household fuel, and each year the grip of these conditions tightens as population grows and lands degrade further. The low-quality fuels they burn—often dung—produce unhealthy smoke from

Fig. 24.5 Indoor cookstoves kill more people each year than malaria (*Source*: US EPA. Public domain. Photo Credit: Romana Manpreet. Courtesy of The Global Alliance for Clean Cookstoves, a non-profit organization operating under the support of the United Nations Foundation. http://climatecare.org/wordpress/wp-content/uploads/2013/10/Clean-Cookstoves.jpg)

traditional stoves inside poorly ventilated living quarters. 'Such inefficient cooking fuels and technologies produce high levels of household air pollution with a range of health-damaging pollutants, including small soot particles that penetrate deep into the lungs. In poorly ventilated dwellings, indoor smoke can be 100 times higher than acceptable levels for small particles. Exposure is particularly high among women and young children, who spend the most time near the domestic hearth' (WHO n.d.)—see also Fig. 24.5. The WHO estimates that about three billion people—most of them poor and living in low- and middle-income countries—still cook and heat their homes using solid fuels in open fires and leaky stoves (see also figure below).

Diminished health leads inevitably to higher death rates. Residing largely in sub-Saharan Africa, India, and China, 'an estimated 4.3 million people a year die prematurely from illness attributable to the household air pollution caused by the inefficient use of solid fuels (2012 data)' (WHO n.d.)—see also Fig. 24.6. Stunningly, people are more likely to die of indoor air pollution than from many other, higher-profile causes, such as malaria (IEA 2006; Lim et al. 2012)—see also Fig. 24.7.

People living at the bottom of the energy ladder are among the most dispossessed in the sense that they are too often rendered invisible in national

Fig. 24.6 Deaths attributable to household air pollution by region (2012) (*Source*: World Health Organization. As accessed in William Pentland, Air Pollution Replaces Poor Diet as World's Largest Preventable Health Risk. Forbes. 3/25/14. http://www.forbes.com/sites/williampentland/2014/03/25/air-pollution-replaces-poor-diet-as-worlds-largest-preventable-health-risk/#605ca4e81dc8)

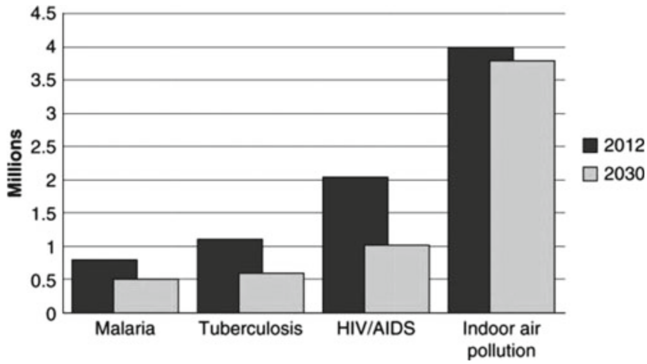

Fig. 24.7 Annual deaths worldwide by cause, 2012 and 2030 (*Source*: Adapted from International Energy Agency, World Energy Outlook 2006 (Paris: OECD, 2006); International Energy Agency, UN Development Program, UN Industrial Development Organization, Energy Poverty: How to Make Modern Energy Access Universal? (Paris: OECD, 2010), p. 7; and S. S. Lim et al., 'A Comparative Risk Assessment of Burden of Disease and Injury Attributable to 67 Risk Factors and Risk Factor Clusters in 21 Regions, 1990–2010: A Systematic Analysis for the Global Burden of Disease Study 2010', Lancet, 380 (2012))

and international energy policy-making. Yet, several initiatives have been established in response to energy poverty, including those that provide fuel-efficient stoves, firewood patrols, and the development of alternative fuels. As of May 13, 2014, the UN refugee agency committed itself to allowing safe access to fuel and energy for millions of uprooted people. The program started by providing stoves and solar powered lanterns. Recently, UN Secretary General Ban Ki-moon formally launched the International Year of Sustainable Energy for All Initiative. The goals of this initiative are to ensure universal access to modern energy services for the world's poor, double the rate of improvement in energy efficiency, and double the share of renewable energy in the global energy mix. Under this program, energy—especially in the form of electricity—is a basic human right (Energy is a Human Right n.d.).

As people gain economic security, they also gain in social stature. The form and quality of the energy used within the contemporary milieu reflects your position in the social hierarchy. This progression is encapsulated in the 'energy ladder' introduced earlier in this chapter. Such a ladder signals household surroundings whether in rural areas, near cities, or within cities. This energy ladder reflects the contemporary mix of energy sources. The poorest rely on the same solid fuels upon which their ancestors depended while the most privileged have access to relatively unlimited oil, natural gas, and nuclear generated energy whose prices do not reflect the full externalities to health and the environment. Individuals' level of empowerment within the global system is reflected in their rung on the energy ladder, as well as their ability to consume that rung.

Rather than seeking to simply move people up the existing ladder, with all of its externalities, energy justice advocates should seek innovations that empower individuals outside of it. For example, ENERGIA, the International Network of Gender and Sustainable Energy, seeks to leverage women's role as household energy managers to scale up energy access globally:

> ENERGIA believes that women can play a crucial role in scaling up energy access globally. At the same time, addressing their energy needs is a prerequisite for poverty eradication. In line with our commitment to the UN Sustainable Energy for All initiative (SE4All), ENERGIA's Women's Economic Empowerment Programme (WE). (ENERGIA n.d.)

Women's roles as household energy managers and their formal and informal networks make them well-positioned energy entrepreneurs. As users, they know what features every energy product must possess, particularly when engaged in microenterprise activities: 'when women who are home-based micro and small scale business owners or workers get energy access, they stand to benefit tremendously through increased productivity and lowered costs, resulting in increased incomes benefitting families, societies and local markets' (ENERGIA 2015). ENERGIA's Women's Economic Empowerment program, running from 2014 to 2017, hopes to enable 3000 women-led

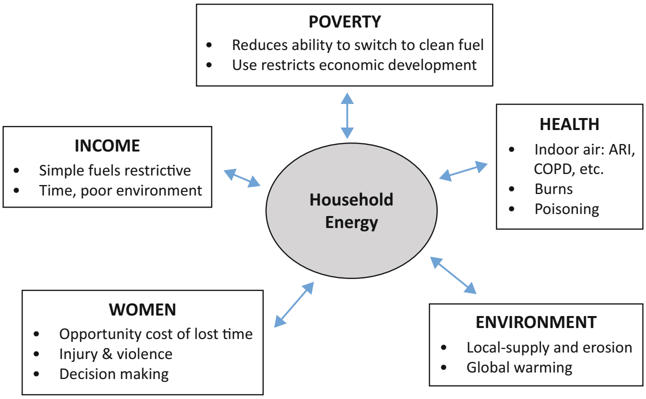

Fig. 24.8 Broader impacts of household dependence on solid fuels (*WHO*—http://www.who.int/indoorair/impacts/en/)

micro and small enterprises to deliver energy products and services to more than two million consumers.

Encouraging women to become energy entrepreneurs offers multiple development benefits, such as an expansion of economic activities for women, a diversification of productive options, and the creation of new sources of wealth and income to support family investments in education and health. In a recent article about unlocking the potential of women, Soma Dutta writes, 'Women are playing a significant role in reaching energy services to the poorest and difficult-to-reach customers, who would never gain access to modern energy otherwise, thereby making a contribution to the agenda of reaching energy access to all' (Dutta 2015). This is just one of many examples of the ties among energy poverty and prosperity, health, and self-esteem (Fig. 24.8).

From the foregoing discussion, one question rises above most others: How can we establish, promote, and sustain the principles of energy justice, while also aiding people's access to energy? Are these indeed opposing forces that will never come to an accommodated stasis, or are there energy options that will allow a rising standard of living among the billions on the lower rungs of the existing energy ladder? Can sustainable energy be reached for the multitude, or are the underprivileged destined to worsening ecological and health conditions on their way up?

It seems to us that—as convenient as it may be—simple-minded expansion of the existing carbon- and nuclear-based infrastructure is not the answer. Indeed, we believe that adopting this approach is a recipe for disaster on a global scale, and one that would retard reducing inequities of lifestyle. While we sympathize with those in developing economies who argue 'Now, it is our turn' to prosper, we must do everything we can to help them avoid the trap of moving up the ladder with complete disregard for the total costs of doing so. That cannot be the answer. We must provide options. Currently, the best option is to encourage—underwriting as necessary—the rapid and widespread expansion of alternative-energy economies. Not only is it nowadays the cheapest way to generate the electricity that is on the highest rung of the energy ladder, but it can be implemented without producing long-term wastes, without facilitating the production of weapons of mass destruction, without further impacts to air and water quality, and without threatening the health and safety of future generations.

5 Conclusion

The contemporary energy ladder derives from the institutionalization of historically rooted systems of energy conversion, distribution, and use. Unfortunately, the oil, coal, and nuclear complexes comprising this ladder encode significant inequalities and too often dispossess others' rights through sustained lack of regard for both routine and catastrophic energy injustices. Sociologist Ulrich Beck argued that significant risks are institutionalized into modern society's technological infrastructures, and that these risks tend to be denied or falsely made 'manageable', when in fact they pose catastrophic consequences that cannot be mitigated with available technologies. This chapter has documented that the (primarily) carbon and nuclear-based energy ladder presents significant externalities at each and every rung, ranging from the complete deficit of access to these energy sources for those at the bottom of the ladder, to the complex externalities produced both by catastrophic accidents and by routine environmental degradation for those across the ladder.

The 2010 Gulf of Mexico BP oil spill and the 2011 Fukushima nuclear crisis illustrate human-engineered catastrophes that were sometimes beyond imagination, but always beyond a willingness to fully mitigate and prevent. These catastrophes symbolically eclipse the equally significant, but more subtle, environmental degradation of the atmosphere, oceans, biotic diversity, and fresh water occurring as a result of the routine operations of nuclear and carbon supply chains. Yet, the most entrenched energy complexes—nuclear energy and carbon intensive fossil fuels—retain business models resistant to change, as illustrated by TEPCO's efforts to restart potentially damaged reactors on faults and near active volcanoes in Japan, and by BP's 2015 decision to reduce their investment in alternative energy. The power of the nuclear and carbon complexes derives from their consolidated control over energy infrastructures, historically institutionalized influence in government, direct impacts on Western markets, and their capacities to conflate the complexes' survival with 'national security' across nations.

Deeply layered and widely dispersed, the established tendencies of carbon and nuclear complexes trend toward technological over-reach, diminishing the opportunity for more democratic and equitable options that are available with alternative energy options. Worryingly, there is also some emerging evidence, though anecdotal, that dispossession can occur with the deployment of renewable forms of energy such as wind, solar, and biofuel (Pasqualetti, 2011). The concept of [liberal] 'dispossession' is adopted from critical social theory to name the conditions of sustained energy injustices found in Western civilizations as powerful energy complexes deny the scope and severity of resource limits and environmental degradation, discouraging public awareness of needed change.

Dispossession derives from the prioritization of profit over sustainability and from the disinclination by institutional powers to develop less externalizing and more egalitarian energy forms. With dispossession, preserving the biological vitalities of Earth's myriad life forms, including human life, matters less than preserving risk-laden carbon and nuclear infrastructures that promise utopia, but are destroying eco-systems, forging a degraded atmosphere that soon may be unsuitable for complex life forms. The age of the Anthropocene is upon us, and yet the carbon and nuclear infrastructures that forged it imprison us like a Weberian iron cage that permits sight, but restricts flight toward more sustainable futures.

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25

Energy and Global Production Networks

Dustin Mulvaney

1 Introduction: Understanding Global Energy Production Networks

Interest in understanding the social and environmental dimensions of globalization has led many researchers to study the attributes of global production networks (GPNs). GPNs are activities and organizational structures that transform knowledge, labor, nature, and capital across disparate geographies into commodities and services. Following and tracing GPNs can reveal socio-ecological materialities—the objects, bodies, and 'matter'—that connect systems of production and the lived experiences of people who live with these systems (Law and Hetherington 2000).

The GPN framework, advanced by researchers in economic geography, political ecology, and sociology, is used to answer various research questions from understanding colonialism, patterns of economic development, and global governance to the socio-ecological transformation of natural resources into commodities and implications for labor. While many commodities and products have long been produced through global systems of production, technology and other social forces of globalization are reshaping finance, capital flows, the ways global products are made, and their geographical composition. With the advent of containerization, information systems,

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telecommunications, and cheap energy, there is more 'acting at a distance' than ever before and multinational actors are more powerful than ever, and perhaps more unaccountable as their power might be seen to exceed the jurisdiction of nation states. So an objective of much of this research is to illustrate the political economic forces that shape GPNs, allowing for a deeper understanding of how commodities are constructed and their consequences for people and the environment.

Energy in particular has become an important topic for GPN research. Energy commodity chains—networks of firms, natural resources, and consumers of energy—constitute one of the largest economic investments made by human civilization, with energy infrastructure estimated at tens of trillions of dollars in value (Smil 2010). Historically, energy was a locally obtained resource. But the distances traveled by international energy flows increasingly lengthened through the extension of energy infrastructures and reach of energy commodities that are becoming more specialized and more readily transported across space. Energy was also almost entirely supplied by renewable resources until the transition toward what Lewis Mumford calls 'carboniferous capitalism' in the nineteenth century (Mumford 2008). The consequences of energy production have also been very local, but with the rise of global environmental problems such as climate change, and regional phenomena linked to energy production such as deforestation and acid rain, energy issues are as much global issues as they are local ones. These multiscalar phenomena make energy GPNs a ripe topic for bringing geographical research perspectives to these political economic issues.

2 Objectives and Theories of GPN Research

Theories of global production systems have raised several key issues that inform debates about economic institutions and governance (Coe et al. 2008; Bair 2009). Several concepts important to understanding GPNs include global commodity chains, global value chains, and supply chains. This chapter identifies several schools of thought that engage in questions related to GPNs, global value chains, and global commodity systems that comprise a taxonomy noted in Table 25.1. It is worth noting that networks and systems are often used synonymously, and that some have also turned to the rooted concepts of assemblage and actor networks (Murdoch 1995; Yeung et al. 2015).

There are numerous motivations for research on GPNs including the interest in understanding systems of governance. GPN research investigates why particular places become important nodes in systems of production or

Table 25.1 Global production networks, value chains, filieres, circuits, and commodity chains

Global production networks	In research that uses the concept of GPNs, there is a tendency to focus on the behavior of multinational actors and institutions
Global value chains	The concept of global value chains aims to capture the activities that give rise to global production systems (Gereffi et al. 2005). Firms construct value over space through sourcing and contracting arrangements, and this approach aims to understand how these activities are organized and governed. Value is added across the supply chain as materials move from raw materials to finished products (Gereffi et al. 2001)
Filieres	A French concept that seeks to explore the chain of activities related to the production of raw materials into final export products (Mather 1999). Research on filieres usually follow the commodity beyond its useful life, as opposed to other analyses, which may stop at the factory gate/site of production
Global commodity chains	There are several clusters of research (sometimes overlapping) that describe their unit of analysis as a global commodity chain. These include some sociological work that comes from world systems theory (Hopkins and Wallerstein 1986) and work in political ecology (Robbins 2011)
Commodity circuits	Studies of commodity cultures prefer the concept of circuits to chains because the metaphor does not imply a start and end point (Cook and Crang 1996)

how a range of issues—from cultural identities to working conditions of labor—change with the globalization of commodity production (Rossi 2013). Understanding the role of transnational neoliberal economic policies—trade liberalization, deregulation, and privatization—in shaping sites along GPNs is also an area of active research (McKenna and Murray 2002). For example, Klein is interested in the entry of neoliberal forms such as Major League Baseball in reshaping the elite labor markets of the Dominican Republic and uses the commodity chain approach to understand how neoliberal economic policies touch down in the informal rural economy and labor markets in this developing country (Klein 2012). The work elucidates the dynamics at work with the emergence of *buscónes*, where academies representing 12–16-year-old ball-players attend baseball academies and try out to become property of Major League Baseball franchises.

Other researchers seek to understand the factors that drive production networks to function in particular ways. These studies often identify who has the power to act or facilitate change in the production system. For example, it is sometimes important to know whether a commodity chain is buyer-driven or producer-driven in order to understand where the locus decision-making lies (Gereffi and Korzeniewicz 1994). Others look to understand degrees of influences on governance and how power circulates among stakeholders (Jackson et al. 2006). Often, questions about power asymmetries and issues of governance are at the center of these analyses, which tend to have in common a goal of unveiling production systems underlying commodities or understanding, including the rise of commodity culture (Crang et al. 2003), including accounts of colonial or corporate power over and control over space (Ramamurthy 2000; Freidberg 2003). But other studies focus on civil society and explore how the marginalized can exhibit power in certain situations, suggesting that individual or collective 'power over' and 'power to' are not necessarily predetermined (Sturgeon 2008). Nor is it self-evident how power operates across commodity chains. Raj-Reichert (2013) examines how health and safety governance systems are implemented in the global electronics industry, viewing the GPN approach through the lens of governmentality. This research on printed circuit board manufacturing demonstrates how the self-regulatory nature of private standards and industry codes of conduct produce self-disciplinary effects on safety and health managers.

Numerous researchers have examined GPNs, but the study of energy is limited relative to the value of the economic activities related to energy and its importance to human communities. Overall, there is a relative shortage of GPN case studies on natural resource extraction sectors such as mining and energy development, though there are several notable exceptions. Sovacool describes the forces at work along the production network that delivers one million gallons of oil per day along the Baku–Tbilisi–Ceyhan pipeline that connects the Caspian Sea to points along the Black Sea and Mediterranean Sea (Sovacool 2012). He shows how conflict and cooperation among the firms, national governments, non-governmental organizations, and civil society result in the creation of value and circulation of power. These operated across social processes mediated by claims of energy security, property rights, and impacts such as community displacement and increased environmental risk, as well as accusations about corruption and breakdowns in governance. The resulting pipeline seen as an infrastructure project, given its scope and magnitude, entrenches this pattern of natural resource consumption and reliance on fossil fuel development.

Other energy-related GPN research sheds light on the emerging issues around palm oil production (both a food and biodiesel feedstock) in Indonesia (McCarthy et al. 2012). This research finds that upstream actors, such as state regimes and agribusiness in this GPN, have the power to influence how palm oil production leads to land concentration, community marginalization, or improved livelihoods. They describe how these outcomes were shaped by a decade of the state's withdrawal from agriculture and liberalization of investment, regulation, and development. Ironically, this occurred as Indonesia shifted away from a top-down authoritarian rule to more democratic (yet laissez-faire) regimes. Ribot's (1998) research on Senegalese charcoal commodity chains—a primary source of domestic energy consumption—describes an economic system that distributes benefits to only certain segments on the chain. Using data on expenditure and profit margins, Ribot explains how wholesalers take much of the profit and rents are distributed among community leaders, whereas the laborers, woodcutters, and retailers make little more that subsistence wages. The upshot of this analysis is to show how these wage relations are mediated by access and control of natural resources.

Bridge (2008) uses the GPN framework to understand oil and the resource curse theory. The theory explains that when countries are overly reliant on a narrow range of natural resources and have poor governance, economic growth and development experiences decline relative to countries elsewhere (Auty 1995). Natural resources are identified as the basis for economic upgrading in many depictions of how economic development happens. For this reason, resource curse theorists are most interested in why places with abundant natural resources are unable to escape from poverty cycles or raise standards of living and quality of life.

Questions of access and control of natural resources are at the core of work in political ecology—a research community that studies the politics of natural resources with a deep understanding of the socio-ecological actors that shape interconnected systems of production and consumption with an emphasis on power and justice (Watts 2000). Political ecologists who draw on commodity chain approaches often ascribe agency to nature–human relationships, allowing non-human objects and ideas to shape as much as be shaped by socio-ecological processes (Bennett 2009; Lockie and Kitto 2000). Much of this research links developed nations' consumption patterns to land degradation in developing countries (Robbins 2011). Many GPNs have resulted in environmental pollution or poor treatment of workers that is in part due to the distances over which investment and consumption decisions are made, which mask their consequences. Consequently, sustainability is an important theme related to GPNs to correct some negative consequences of accountability gaps created at a distance (Caniato et al. 2012). Some of these forays into the sustainability of GPNs stem from a growing interest in corporate social responsibility (Bryant and Goodman 2004).

Another area of research related to GPNs is in rural and economic sociology and business management where there is interest in understanding the formation of innovation hubs and industrial clusters (Bair and Gereffi 2001), organizational learning (Hughes 2006), and/or the upgrading of production to higher-value or specialized products (Gibbon 2001). The literature seeking to understand clean- and green-tech industrial clusters is relatively thin given the centrality of innovation discourses in investments in renewable energy.

Yet another theme of GPN research is at the intersection of political ecology and science and technology studies where there is interest in the rise of quantification and expertise in matters of scientific debate (Forsyth 2004). The expansion of GPNs has also been accompanied by the need to harmonize and standardize technology and measurement (Tsing 2009). The interest in counting and quantifying environmental performance resulted in the development and standardization of life-cycle assessment (LCA), a tool used to evaluate environmental metrics based on material and energy flows through global production systems as raw materials are extracted from the Earth and eventually disposed of. LCA is the vanguard framework in assessing the sustainability of GPNs with important caveats about what the representations of biophysical phenomena as numbers can obscure. The author's own work on solar energy commodity chains reveals how LCA metrics, which represent environmental emissions such as greenhouse gases (GHGs) and other environmental impacts of solar energy, can obscure environmental justice considerations as numeracy has a tendency to dominate the framing (Mulvaney 2014).

International standards have become increasingly important as systems of governance for international commodity flows and are constantly changing (Patel Campillo 2011). Global demand for biodiesel in Europe extended commodity chains of palm oil production to Indonesia with negative consequences for the climate and biodiversity due to land clearing for palm oil monoculture (Fitzherbert et al. 2008). This has given rise to the Roundtable on Sustainable Palm Oil to help fill the void of comprehensive government oversight of biofuel production (Schouten and Glasbergen 2011).

Methodologically, Marcus' (1998) 'multi-sited ethnography' lays out a framework to follow systems of production. Cook (2004) 'follows the papaya' to understand the new places of interconnection in the globalization of food. They build on calls by Cook and Crang (1996) to 'thicken' our knowledge about the connections between production and consumption. Freidberg (2001) elaborates on many of the challenges of conducting commodity chain research, including questions about access to many of the sites through which commodity chains flow.

While the GPN approach has yielded numerous insights into the making of modern global commodities, it remains limited in several ways. Some researchers have raised concerns that GPN theories offer only partial causal evidence and are restricted to explanatory frameworks (Sturgeon 2008). Many of the concepts employed by these frameworks—industrial upgrading, value, governance—have not been consistently operationalized as social theory. Hence, it can be difficult to draw conclusions across case studies done by different researchers.

GPN research is also challenged by the question of where to draw boundaries around the unit of analysis. For example, when Bridge describes the 'hydrocarbon commodity chain,' he depicts the stages of production from exploration, production, processing, distribution, combustion, and carbon capture. Yet real-world GPNs are often far more complex (Bridge 2008). GPNs require ancillary commodity systems from those producing research equipment and scientific instrumentation to those selling pumps, compressor stations, trucking companies, and so on.

To provide more clarity and also demonstrate the utility of a GPN approach, each of the following case studies aims to illustrate the complexity of GPNs and illustrate how the many different forms of this concept can add to our knowledge of global supply chains. The aspects that are drawn out in the following vignettes are just some examples of the different ways to understand and analyze GPNs.

3 Global Solar Photovoltaic Production Networks

In 2006, the scientific journal *Nature* proclaimed that a Silicon Valley sunrise was about to put the region at the forefront of another clean-tech semiconductor revolution this time in thin-film photovoltaics (PVs) (Morton 2006). Instead of clean tech meaning semiconductor fabs with people outfitted in bunny suits to keep materials free of human contamination, the adjective 'clean' instead conveyed low-carbon technologies (even through there are analogous processes in PV semiconductor manufacturing and electronics semiconductors). Coarsely, PV devices, which take photons from sunlight and convert them into electricity, are classified as either crystalline or thin-film semiconductors (Mulvaney 2015). This section shows how the rapid development of PV GPNs can illuminate dynamics of competition, emerging structures of governance, and power flows along the commodity chain.

Thin-film PVs attract attention because they offer several advantages such as lower materials costs, lower energy inputs, and rapid manufacturing; a sheet of glass could enter one side of the factory in the morning and reemerge as a thin-film PV module in the afternoon. Thin-film PVs were the subject of numerous conferences and papers marking the technology as the future of solar energy, including a widely popular *Scientific American* article called the Solar Grand Plan, which argued that cadmium telluride thin-film PV could be at the core of an ambitious plan to power the USA with solar energy (Zweibel et al. 2008). Government research labs, venture and private equity capital, the blogosphere, and even mainstream semiconductor manufacturers all shared great enthusiasm for thin-film PVs (Shah et al. 1999). Billions of dollars in venture capital, private equity, and US government investments were made in innovative new thin films through the 2009 American Recovery and Reinvestment Act because they constituted an innovative form of production with significant energy and materials savings (Mulvaney 2014).

Thin-film PVs were the darlings of venture capital, Silicon Valley, particularly those on the famous Sand Hill Road such as Kleiner Perkins, Mohr Davidow Ventures, VantagePoint, Khosla Ventures, and Quercus Trust. The crystalline silicon PV sector experienced a 'silicon shortage' in 2007–2008, owing to the rapid growth and lack of polysilicon made specifically for PVs (historically, the industry relied on discards from the industry). The temporary price spike further fueled enthusiasm for thin films. Argonaut Ventures was a venture capital firm owned by billionaire George Kaiser who was US President Obama's 2008 presidential campaign fund-raising bundler. Kaiser heavily invested in a thin-film technology owned by Solyndra called CIGS—copper indium gallium selenide. The semiconductor showed great promise as it had more ideal physical properties and relied on fewer cost-volatile inputs compared to other thin films.

As investments poured into thin-film PV manufacturers, China was investing in the incumbent technology. Chinese manufacturers, some headquartered in the Cayman Islands, invested billions into manufacturing facilities across the crystalline silicon GPN from polysilicon refineries to manufacturing fabs to scale up the technology initially developed at the iconic Bell Labs (birthplace of the transistor) in the USA during the 1950s. Their approach was to take a mature technology and make it a global commodity. This would not be an easy undertaking as the crystalline silicon PV commodity chain contains multiple segments that can be located in different places: polysilicon refining, silicon ingot production, wafering, cell preparation, and modeling. The sheer scale of production that China would achieve in very short time—growing from a $2 billion industry to over $100 billion from 2007 to 2014—would ultimately result in significant overproduction and inventories and drive down expectations of the prices received for PVs and the value proposition offered by thin films (Platzer 2015).

This rapid expansion of Chinese manufacturing would by 2011 provoke widespread trade conflicts over PVs between the USA and China, Europe and China, Japan and Canada, and India and the USA to name a few. The solar trade war spread to input sectors as well as China launched investigations into polysilicon (the key silicon feedstock for crystalline technologies) dumping in China (Henry 2013). US Senator Ron Wyden (Democrat from Oregon) claimed that, 'China was cheating' and Energy Secretary Stephen Chu lamented how Chinese subsidies for PV undermined US innovations in thin films. Senator Wyden lobbied for the support of antidumping and countervailing duties investigations into the Chinese solar industry by the International Trade Commission and the Department of Commerce (Bradsher 2011). The petition argued that the Chinese received discounted or free land, underpriced water and electricity, direct subsidies for exports, and low-interest loans from the Chinese Development Bank. This eventually led to a ruling by the Department of Commerce to levy tariffs ranging from 10 % to 230 % on PV modules made in China and eventually Taiwan, depending on the level of cooperation of companies with the investigation.

The fallout from the conflict in solar energy commodity chains has not played out in full. One consequence of the tariffs and global oversupply was that China adopted very ambitious goals for installing PV domestically. These policies provided the markets with relief from the glut of PVs, and in 2014 China installed more PV modules than the USA has ever installed cumulatively. There is hope that a settlement might be reached as early as 2016, but for now, the Chinese PV industry remains subject to a regime of tariffs, which is add 10–230 % to the costs of PV module (which represents about 25 % of the installed cost in 2015) (U.S. International Trade Administration 2014).

Silicon Valley and other hubs of innovations, where thin films were once popular, no longer see the future firmly in thin films. Only a handful of thin-film companies made it through the 'valley of death'—the time between the need for capital to build factories and the moment the company becomes profitable—that characterizes so many start-up funded by venture capital firms.

The thin-film companies that survived tend to have large capital bases and seem to take advantage of important public policies. Solar Frontier (formerly Showa Shell) survived in part because of state supports, but also the coincidence of having a very large factory completed around the time of the Fukushima Daiichi nuclear disaster. The shutdown of over 50 nuclear power plants in Japan required imports of liquid natural gas and led to an ambitious solar incentive, which helped boost the marketability of Solar Frontier. Of all companies in the solar space, First Solar is seen as the most successful. It is far more capitalized than others in the space and has factories in Malaysia capable of producing hundreds of millions of PV modules annually. Initially supported by the US Department of Energy's thin-film partnership, the company received investments from a venture capital firm owned by the Walton family, owners of Walmart. First Solar was able to weather the thin-film storm through the construction of several gigawatt-scale PV farms some of which were built on public lands managed by the Bureau of Land Management and that were built using Department of Energy loan guarantees (essentially guaranteeing module sales and ensuring they were not frozen out of capital markets).

The scaling up of the production of two major PV technologies—thin films and crystalline silicon—raises a handful of questions related to environmental and social impacts (Mulvaney 2013). The environmental impacts of crystalline silicon PVs include waste generation during polysilicon feedstock refining, the use of lead-based solders, and the use of large volumes of chlorine- and fluorine-based chemicals during wafer and cell preparation (Fthenakis et al. 2008). Thin-film PVs typically rely on one of the several toxic heavy metals, most notably cadmium-based semiconductors, so there are a number of safeguards that need to be taken into account to ensure that these clean and green technologies improve environmental quality overall (Mulvaney 2014). Most LCAs illustrate the clear advantages of PVs to other sources when comparing GHG emissions on a per energy basis, but there are still impacts (Nugent and Sovacool 2014). A number of thin-film projects were also built on public lands in the California deserts, which raised concerns about the suitability of solar farms on sensitive ecosystems (Carlisle et al. 2014).

PV GPNs involve firms that have differing degrees of vertical integration with some owning all stages of semiconductor production and others specializing in one or more phases. The supply chains for PV companies are different than other electronics companies since at least for a handful of non-semiconductor inputs, top-tier manufacturers often buy inputs from companies that are much larger, making it difficult for PV manufacturers to exhibit control up the supply chain, typical of producer-driven commodity chains where the buyer cannot exert leverage over their supply chain (Gereffi 1999). It is unlikely that the less-well-capitalized PV manufacturers can use any leverage to dictate terms and conditions of production to their suppliers such as Dow or DuPont, which are powerful multinational chemical firms and not dependent on any single buyer.

4 Global Shale Gas Production Networks

The revolution in shale gas production in North America has been aided by a handful of ancillary commodity chains, which supply critical inputs. This section shows how the GPN approach can help illustrate the formation of seemingly unrelated, but firmly interconnected, new global economies and production systems: new and expanding sand mines across former glacier plains that once scoured the deposits of sandstone found in Wisconsin and Minnesota. The industry calls this 'northern white' or 'Ottawa' sand. The kind of sand most suitable for fracking processes is quartz that can withstand very high pressures, but also meet certain size consistencies and high sphericity, among other important properties. According to the United States Geological Survey, the production of sand underwent significant growth in 2004 and increased by more than threefold from 2009 to 2011 (United States Geological Survey 2011). In 2014, the oil and gas industry used 95 billion pounds of frac sand.

Sand mining is an activity that exists in areas distinct from sites of hydraulic fracturing. The sand is necessary as it acts as a proppant, holding open the fractures in shale. The sand is suspended in water and fracking fluid that is injected into the shale layer and the sand physically finds its way into the rock fractures. Holding these new fissures open allows for the natural gas to escape. The required attributes of frac sand are found only in a handful of deposits, suggesting that that places endowed with these resources are tied to systems of natural gas production. This has spurred community organizing against fracking sand mines where environmental concerns related to mining activities and land-use change have prompted concern (Pearson 2013).

Gaur gum plantations in India that provide a critical input for hydraulic fracturing also went through a boom and bust cycle followed the boom and slow decline in drilling the Marcellus Shale under West Virginia and Pennsylvania. An important additive to the fluid that is injected with two to five million gallons of water per well is an emulsifying agent, which suspends the sand in the fluid. The material is the same as the thickening agent used in ice cream. The emulsifying agent is made from an extraction of a bean that is grown in a number of regions including India and Pakistan. In India, the development of the fracking industry led to a significant increase in demand for this critical input. Production is led by the arid Indian state of Rajasthan, where over 80 % of guar gum exports are grown (APEDA Agri Exchange 2011).

But soon, natural gas prices declined and companies holding leases for natural gas fields began to mothball operations until the prices would recover. This lowered demand for the bean and led to severe price decline for the product in India. The full consequences of the boom and bust cycle are yet to be determined, but a full commodity chain and livelihood analysis could focus on alternative crops farmers could grow and other opportunities for farmers to weather the severe price declines and boom–bust cycles (Gibbon 2001).

The fracking boom also led to investments in new multi-billion dollar chemical plants that receive the valuable natural gas liquids (particularly ethane), reshaping the US chemicals' industry and incentivizing manufacturers to 're-shore' plants offshored years ago to be close to the input (Walberor 2012). In early 2012, National Public Radio reported that Pennsylvania won a competitive multi-billion investment from chemical manufacturer Royal Dutch Shell to build an ethane 'cracker' near Pittsburgh (National Public Radio 2015a). Ethane crackers take higher-order hydrocarbons such as ethane and convert them into ethylene, a critical feedstock for plastics, resins, and millions of other products. The investment in this facility seemed on the surface to challenge the presupposition about the consequences of globalization in the chemical industry, which can be characterized as one experiencing a great deal of offshoring. The 're-shoring' of the chemical industry is fueled by the shale boom. Many wet natural gas wells in the Marcellus Shale contain rich deposits of ethane, which allow many natural gas well operators to continue to produce natural gas at low prices so long as they can recoup the profits from ethane while they are high (National Public Radio 2015b).

Better understanding of the materiality of 'wet natural gas,' which contains higher-level hydrocarbons than 'dry natural gas' which contains only methane, allows for a decentering of claims that natural gas production is driven by energy independence and security discourses and instead shows that how multiple overlapping markets conspire to make production possible.

5 Salmon Aquaculture Production Networks

The speed and agility of emerging GPNs allow them to operate across compressed temporalities where a farmed fish can be caught in Port Angeles, Washington, in the evening and be on a Manhattan lunch table the very next afternoon. These are the new realities of food production, which are leading to an increase in the energy intensity of this particular agro-food system commodity complex (Pollan 2006; McMichael et al. 2007). Energy use in the global food system has experienced a significant rise, and the low cost of energy can hide some of these realities, particularly for food that receives a premium in the developed world (Tilman et al. 2002).

The enormous growth in salmon aquaculture is driven in part by the consumer desires for fresh fish. Salmon filets in particular are in high demand as many consumers are increasingly turning toward piscivorous fish (fish that eat other fish), and GPNs in aquaculture generally have undergone unprecedented growth. According to the Food and Agriculture Organization, production from aquaculture has risen from 5 million tons in the 1980s to 63 million tons in 2014 (Food and Agriculture Organization 2014). Salmon in flavor and function tend to more resemble American hamburgers than seafood and American and European consumers prefer non-'fishy' salmon. So human subjectivities too must be evaluated in examining the rise of global commodities. But understanding this commodity chain involves examining how the systems of production evolved as well, in addition to the forces shaping similar products such as changes happening to salmon fishermen. Wild caught salmon tend to be more expensive due to the labor and other associated costs, but are considered the more 'environmentally-friendly' by some who argue salmon net pen aquaculture is associated with 'fishing down the food chain' (it takes more fish to feed salmon, than the amount of salmon produced) and has a high carbon intensity (Pauly et al. 1998). The exploration of this commodity chain can help us understand why agro-food systems are becoming more energy- and GHG-intensive.

Widespread market penetration of farmed salmon began its ascent in the 1990s, primarily growing out varieties of Atlantic salmon. The first round of growth occurred in Northern Europe, the Pacific Northwest of North America, New England (USA), and the Maritime Provinces (Canada) of the Atlantic Seaboard. By the turn to the 2000s, the commodity system reproduced similar environmental degradation along the coast of Southern Chile. This further increased the distance from meal to plate as over 50 % of the Chilean farmed salmon produced were shipped to North American, Japanese, Brazilian, and European customers (UnderCurrent News 2014). The rapid growth in Chilean salmon industry was accompanied by a disastrous spread of infectious salmon anemia from 2007 to 2009 to 20 % of susceptible fish, a disease with a history of severe impacts on farmed salmon yields (Mardones et al. 2009). This illustrates the active qualities of the matter and nature that follow the routes through which global commodities travel (Crosby 1978).

There are numerous elements of this GPN that would be of research interest around questions of energy. Phyne and Mansilla (2003) use the salmon commodity chains to show how the concentration of power in the retail sector leads to a buyer-driven commodity chain and illustrate the implications for laborers who work on salmon farms The rise of aquaculture itself is a topic of great interest because it is undergoing such rapid expansion and transformation. There is no categorical answer to the question of whether aquaculture is 'better' for the environment as numerous fish make sustainability claims or achieve sustainability certifications such as the Marine Stewardship Council (Marine Stewardship Council 2015). We simply cannot say whether the growth of aquaculture improves environmental quality because there are cases where aquaculture appears to impair the environment, but also examples where aquaculture has displaced more harmful ways of acquiring seafood (Croxall and Nicol 2004). Usually, products of aquaculture are compared to products of fisheries and arguments in disfavor of each are numerous. This controversy is compounded by the fact that many aquaculture species require fish meal from deeper in the food chain (Pauly et al. 2005). Some kinds of aquaculture require fish meal or fish oils in their production. Aquaculture activities related to clams and mussels, tilapia farmed in Asia, and catfish and salmon in the USA all consume more net marine biomass than they produce (Sovacool and Siman 2011). For these reasons, and for more local environmental considerations salmon aquaculture is usually met with social resistance. Stakeholders tend to see the environment put at risk with the development of salmon aquaculture (Salgado et al. 2015).

But more often, such an either/or situation is not the real-world trade-off and the increased consumption of seafood generally is seen as movement away from other, often more sustainable sources of calories. The question of energy use is an interesting one because salmon aquaculture was proposed as a solution to the problem of salmon overfishing and today the movement of these salmon farms onto land is seen as a solution to the problem of net-pen aquaculture. Yet, land-based aquaculture requires the substitution of natural capital provided by nature (cool water of the ocean, pollution assimilation, oxygen supply) with conventional sources of energy for electricity, heat, and light. Changing the organization of this commodity chain presents trade-offs between decreased ecological impacts and increased energy intensity.

Other questions of interest revolve around the intersection of innovation and the regulation of emerging technologies introduced into salmon aquaculture GPNs. One particular variety of Atlantic salmon—genetically engineered to grow much faster than other farmed salmon—has raised concern among ecologists and natural resource managers tasked with managing issues with net pen aquaculture or salmon run restoration (Mulvaney and Zivian 2013). Some studies have gone so far as to say that the introduction of this fish into net pen aquaculture could lead to the eventual loss of wild salmon runs, which would be of concern to anyone interested in protecting threatened and endangered species, or livelihoods of fishermen (Muir and Howard 1999). Interestingly, the proponents of this genetically engineered salmon argue that the fast grow out will make growing farmed salmon in contained land-based systems economically viable, potentially alleviating some of the worst impacts from net pen aquaculture but at the same time deepening the energy investments for an already energy-intensive dining option (Kelso 2003).

6 Ensuring Just Transitions in Green Energy

GPNs provide a useful framework for illustrating how markets act at a distance to transform socio-ecologies. The challenge for human civilization is how to undertake impending renewable energy transitions in a way that minimizes the impacts to people and other species and consider ways that such impacts can be anticipated and incorporated into planning alongside plans to move away from fossil and fissile fuels. As GPN research continues, it will begin to better describe and explain these systems of production.

Future GPN research will have to tackle several key areas of research that are critical to understanding energy GPNs and assessing sustainable energy strategies. The first has to do with social planning for energy transitions which Clark and Miller describe as 'the process of seeking to understand and prepare for the societal implications and outcomes of energy transitions and to develop strategies for incorporating these considerations into energy system design, as well as energy policy and planning' (Miller and Richter 2014). The transition toward renewables in particular poses vexing challenges for land-use planners as the shift implies utilizing a more diffuse energy resource, which will require a larger land-use footprint and inevitably generate conflicts (Smil 1984). Relatedly, the second important area of research is to fully map and assess the implications of the ancillary supply chains for energy technologies. There is a tendency in the GPN literature to only treat the core commodity as the supply chain (e.g., natural gas), when it fact the production of energy involves a diversity of firms and commodity chains that support energy production. Particularly, with the rapid development of renewable energy GPNs, this kind of research can illuminate the potential environmental risks and social impacts that will accompany this transition. Finally, there remains a dearth of research on energy GPNs in general. Future areas of research could highlight the territorial nature of GPNs or their cultural politics—the numerous attributes of commodities that make them in high demand and how we might change energy GPNs for the better through consumer mobilizations.

The cases presented here highlight the aspects of production systems—institutions, governance, cultures, and natures—that are revealed by the GPN approach to understanding the political economy of energy and the environment. Mapping and describing GPNs provides a sense of what makes them operate as they do and identify prospects for social change. The approach can help reveal how problems with nature–society relations and environmental inequality manifest and might be overcome. The GPN approach can unveil the social relations of production and give us a greater appreciation of all the things that go into making the stuff that makes modern society possible and the means to make energy systems more sustainable and just.

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26

Enclosure and Exclusion Within Emerging Forms of Energy Resource Extraction: Shale Fuels and Biofuels

Arielle Hesse, Jennifer Baka, and Kirby Calvert

1 Introduction

Enclosure and exclusion (E&E) are discursive and material processes by which power is exercised to shape access to territory. Societies have used forms of E&E throughout history as strategies to organize the flow and accumulation of energy. Employing a combination of spears and group coordination, hunter-gatherers enclosed herds of animals into confined spaces for more efficient extraction of meat. In medieval Europe and sixteenth-century Britain, fences and land deeds marked exclusive rights to resources, transforming common arable land and woodlots into private property. Recently nation-states and multinational corporations have militarized and securitized petroleum reservoirs and pipelines to prevent terroristic activities from disrupting global supply chains, enclosure at a distance and exclusion for profit elsewhere. In all forms, E&E are economic—social and technical innovations to manage

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resources and improve security of supply—and political—non-partial decisions about which resources have 'value' and for whom resources are managed and secured. These expressions of territoriality organize socioecological relationships, become materialized into our physical surroundings, and are shaped by the nature of the resource base (type, quantity, spatial distribution). Examining forms of E&E offers insight into the (changing) political ecologies of energy resource extraction.

This chapter considers mechanisms of E&E and their resulting spatialities within two emerging forms of energy resource extraction: shale fuel recovery in the northeast USA and biofuel production in India. Shifting from 'subterranean' or 'subsurface' to 'surface' energies, the chapter examines how and to what extent these energies lead to new forms of E&E. In so doing, it offers frameworks for conceptualizing emergent social, technological, and ecological relationships within alternative systems of energy extraction.

2 Conceptualizing Enclosure and Exclusion

E&E represent the discursive and material processes by which coinciding physical, social, and economic spheres of life become bounded, and thereby coproduce spatial formations and forms of power (Vasudevan et al. 2008). Traditionally applied to transfers of common to private property (e.g. Levidow and Paul 2010), the concepts have analytic power within the dynamic geographies and power geometries of subterranean extrac-

Table 26.1 Mechanisms of enclosure and exclusion

Mechanism	Method and function	Examples of spatial formations
Rationalities of the state	Law, rights, regulation, political ideologies	Property rights, eminent domain, exclusive economic zones
Rationalities of science and technology	Categorizing, ordering, measuring, ranking	Land classification, resource-reserve classification
Geographic imaginaries	Normalization, cultural codification, subjectification	Spatial, gendered, and racialized identities, nationalisms, regionalisms
(State) Violence	Dislocation and dispossession, othering, coercion, subjectification	Regional securitization and militarization
(Material) Infrastructure	Physical 'disruption' of landscapes, visual representation of land, and resource claims	Fencing, boundary checkpoints, gates, vegetation

tive processes (Bebbington and Bury 2013). Our chapter distinguishes five interrelated mechanisms by which E&E unfold within energy extractive contexts at both the surface and subsurface. While overlapping and not exhaustive, these mechanisms illustrate the socioecological dimensions of recent energy transitions (Table 26.1). In contrast to literature that identifies E&E as discrete concepts (e.g. Sovacool et al. 2015), we identify mechanisms whereby one necessarily entails the other, arguing that E&E are intimately connected *spatial* processes.

Analyses of E&E often prominently feature the state and market to examine power regimes through political–economic ideologies, capitalist relations, and processes of primitive accumulation and dispossession (Vasudevan et al. 2008; Blomley 2008; Hackett 2015). Enclosure, described by Hardin as a corrective to the 'tragedy of the commons' (1968), divides territory into parcels, and forecloses access except by approval of the property's owner (McCarthy 2009; Blomley 2008), often following laws of private property enforced by the state. When law defines and enforces boundaries that mark the territorial expression of private property, the law becomes a mechanism by which the state endorses and (re)produces socio-spatial relationships. Further, markets can reduce incentives for states to protect livelihoods while enabling 'elites' and accommodating global forces of dispossession (e.g. commodification of land) (Sidaway 2007; Li 2009; Heynen and Robbins 2005); indeed, capitalism and globalization (re)produce enclosures of nature and discourse, albeit indeterminately (Heynen and Robbins 2005; Hackett 2015). Moreover, the notion of private property often entangles the state with the market; critical political economy and political ecology often trace the role of property rights in (re)producing capitalist relations (McCarthy 2009; Blomley 2008).

Scientific and technical logics also legitimatize the management and control of land and its resources, rendering territory a 'political technology' (Elden 2010, p. 811). The scientific production of knowledge makes land and its resources knowable, assigns value, and rationalizes control. Resource-reserve classification systems, for example, are a form of quantitative reasoning that rank mineral and fossil fuel deposits to monitor their 'value' and determine if and when legal or economic instruments should be used to create an extractive space. Geographic information systems enable 'indicative mapping' to make land 'legible' as 'acceptable areas' and 'exclusion areas' for resource development. Similarly, classifying land as 'idle' suggests that, while not enrolled in the capitalist system of production, it is 'available' for investment (Levidow and Paul 2010). Political economic logics identify productive areas through 'technical zones' (Barry 2006), areas defined, shaped, and legitimized through established standardized and normalized practices. The state and market's roles in buttressing classifications that enclose the material environment are never value neutral (van der Horst and Vermeylen 2010), and often find value through technical, political, and economic technologies.

Geographic imaginaries normalize ideas of land and its inhabitants. Imparting values to produce and maintain E&E, imaginaries have justified energy projects by drawing upon nationalisms (Perreault 2013). Desbiens (2014) explains how Aboriginal territories of Quebec's 'north', imagined as a coherent space devoid of human activity, was enclosed as a productive landscape that could produce hydroelectricity for the south. Such an imaginary fostered a moral and rational landscape in which large-scale hydroelectricity belonged, and counter-narratives and indigenous societies did not. Enrolling geographic imaginaries in enclosure simultaneously produces exclusion as such constructions define and restrict access to certain groups and uses.

Conflict and violences decisively produce and maintain E&E. However, violence need not only be state-led and/or armed conflict (Blomley 2003; Vasudevan et al. 2008). Different rationalities of political and social spheres—law, cultural imaginaries, and scientific categorization—produce violence as they enable dispossession, forced relocation, and subjectification (Blomley 2003; Vasudevan et al. 2008). Violence operates in many forms and across scales linking experiences of E&E to state-based, geoeconomic, and geopolitical projects (Vasudevan et al. 2008).

Material infrastructure provides a mechanism by which enclosures are bounded and exclusion is defined and maintained. Fences, walls, vegetation, and security guards provide visual cues of E&E, maintain temporal rhythms of access, and act as discursive symbols of who and what belong. Biophysical objects also act as symbolic representations of private property (Blomley 2007). Yet, their physical vulnerability—hedges and trees can be torn down or uprooted—has made biophysical objects also sites of resistance. Further, not all resources stay within these boundaries. For 'fugitive resources' such as wind or water, physical infrastructure can exclude downstream or downwind users (van der Horst and Vermeylen 2010). In concert with a given resource, infrastructure discursively and materially shapes the spatial patterning of enclosures and exclusions.

The remainder of this chapter juxtaposes two case studies to show how many of these mechanisms of E&E work in concert within emerging forms of energy resource extraction.

3 Case Study 1: Extracting Shale Fuels

This case study traces how rationalities of the state, entangled with other mechanisms of E&E, enable the production of shale gas within Pennsylvania's Marcellus Shale region by relying upon interdependencies between established legal discourses and the materiality of shale gas (Fig. 26.1).

Owning (under) ground: Ad coelum and Rule of Capture

Federalism, whereby political powers are shared between a centralized government and the states, strongly shapes legal and regulatory oversight of the US oil and gas industry (Warner and Shapiro 2013). Oil and gas development is subject to laws established and maintained by individual states, including many pertinent to private property. Of powers vested in the states, the ability to define land and mineral ownership has been critical to shale fuel development; however, ownership rights can be ambiguous and thus have been challenged in state courts.

Ownership rights in most states are rooted in the common law doctrine ad coelum, 'whoever owns the soil also owns up to the sky and down to the depths' (Hepburn 2013, pp. 8–9), thereby allowing surface estate owners to own the rights to the resources that lie beneath their land, including oil and

Fig. 26.1 Marcellus Shale development (Credit: A. Hesse)

gas. Most states allow surface rights to be separated from subsurface rights, and subsurface rights to be apportioned by stratigraphy and specific resources, creating spatial relations defined through vertical geographies of enclosure.

In the mid-nineteenth century, the materiality of conventional oil and gas confounded the application of ad coelum (Ragsdale 1993; Hepburn 2013) and led to legal precedent that shapes shale fuel development today (Lamarre 2011; Hepburn 2013). One such precedent is 'rule of capture', a legal tenant that accounts for the migratory nature of mineral resources such as oil, gas, and water. Analogized to ownership models for migrating wild animals, migrating resources are owned when possessed under rule of capture. This precipitated a race to the bottom, quite literally, as landowners sought to quickly dig deeper to be the first to access resources that pooled below multiple properties (Hepburn 2013). Conservation rules, such as pooling and unitization, acted as a corrective to this perceived problem (Lamarre 2011; Hepburn 2013), but have applied differently across states and resource basins. Likewise, states have unevenly implemented rule of capture, leading to different models of resource ownership (Lamarre 2011). The law's definition of resources and their ownership reconfigures sociospatial relationships. Yet unconventional fuels have confounded these relations ordered primarily by the legal interpretation of the materiality of conventional fuels. This has challenged the courts to determine what shale gas is, who has rights to develop it, and where.

Boundary Making: Defining 'Mineral' and Subsurface and Surface Rights

Unconventional shale fuels do not always conform to existing legal discourses generally, or the language of private property rights in particular, as their geographies and materialities work to confound, exploit, and reshape existing precedent overseeing their development. As early as 1993, legal scholars recognized how the materiality of shale fuels and hydraulic fracturing would test contemporary legal discourse (Ragsdale 1993). To date, some courts have analogized the materiality of shale fuels to establish ownership rights through case law.

In the early 2000s, new extractive landscapes emerged in the northeast USA. Advancements in drilling techniques, high natural gas prices, cheap credit, a liberalized pipeline network, and record breaking estimates of recoverable fuel made the Marcellus Shale, and other shale plays across the USA, commercially feasible (Medlock 2014). Hence, Pennsylvania has rapidly experienced significant extractive activity. Conflicts spurned by this influx of development have leveraged legal arguments that challenge the courts to rule on how the law regards shale gas in relation to other forms of oil and gas resources. While some states, such as Texas, have developed more extensive case law on these issues, Pennsylvania's case law is still emerging (Hepburn 2013; Lamarre 2011; Andrews and McCarthy 2014).

The industry has introduced spatially dispersed, large-scale surface operations in mostly rural landscapes accustomed to conventional shallow-well drilling. Unlike conventional oil and gas accessed from a reservoir, unconventional development employs horizontal drilling and hydraulic fracturing to access gas trapped within high-porosity, low-permeability shale rock. Whereas vertical wells each require a dedicated well pad, horizontal drilling employs one pad hosting multiple wells radiating underground 'laterals' that stretch as far as 1.5 km, enabling subsurface resources to be extracted from distant surface locations.

Much unconventional extraction in Pennsylvania occurs on private land and landowners have sought greater control over development through ownership rights. As technology enables multiple wells to be drilled from one well pad, operators do not need to acquire rights to develop land from each individual surface owner to access the subsoil. Like most states, Pennsylvania allows the separation of surface and subsurface rights. Many leased acres of mineral rights, the measure by which both surface and subsurface geographies of ownership have been bounded, without granting companies access to the subsurface due to the divergent surface and subsurface resource landscapes.

Yet, as development expanded, some landowners discovered that they do not own their subsurface rights due to their separation by a previous owner. If mineral rights were already severed, current landowners have no rights to the subsurface shale gas *and* have little agency over development at the surface. Pennsylvania law privileges rights of the subsurface above those at the surface by allowing development at the surface to access minerals on at the subsurface (Pifer 2010). Not only does this diminish the surface owner's control of their property, '*Chartiers* places the burden on the surface owner, not the subsurface owner, to file a legal action to challenging the reasonableness of the surface use' (Pifer 2010). The law defines sociospatial relationships of enclosure by privileging the subsurface over the surface, and requiring the surface owner to police the activities of the subsurface owner.

Splitting the surface and subsurface is not always a 'clean' division. Old deeds have sold rights based upon access to certain resources and at particular depths, and with use of specific techniques (Pifer 2010). Further, blanket selling of 'mineral rights' in Pennsylvania does not necessarily include oil and gas. Often in question is whether the gas contained within the Marcellus Shale has been sold in an old deed. Under the 1882 doctrine known as the *Dunham Rule*, Pennsylvania uniquely does not consider oil and gas in all forms (Dunham v. Kirkpatrick 1882; Hepburn 2013). Although Pennsylvania uses rule of capture, the legal interpretation of methane has further varied based on its source. Coal bed methane, for example, is treated differently than conventional gas. Pennsylvania follows the 'ownership-in-place' doctrine in which static sources of oil and gas, like coal bed methane, can be owned prior to production and possession as defined by Pennsylvania's Supreme Court decision in *United States Steel Corporation v. Hoge* (1983) (Lamarre 2011).

Recent rulings suggest how the courts will define ownership through the materiality of shale gas. In 2012, the Pennsylvania Supreme Court heard arguments concerning whether a deed conveying rights to 'minerals and petroleum oils' includes shale gas after a previous ruling remanded the case to trial court to establish basic definitions of how to treat shale gas under the law. Of issue was whether the Dunham Rule applied (is *shale* gas a mineral?) and further, whether shale gas under *Hoge*, is owned as a part of the shale mineral.

> *Appellees liken the Marcellus Shale to Coca-Cola and the shale gas as the 'fizz' that emanates from the liquid soda, arguing that no court could ever reason that the 'fizz' is separate and apart from the Coca-Cola liquid … and thus must be included within the deed reservation in accord with Hoge II. (Butler v. Charles Powers Estate, 17)*

The Appellees analogized shale gas to the fizz of Coca-Cola to argue that the gas cannot be considered separate from the shale mineral such that owner of the shale owns the gas within. However, in a unanimous decision in favor of the Appellants, the Court found that the rights to shale gas had not been transferred as, 'the rule in Pennsylvania is that natural gas and oil simply are not minerals because they are not of a metallic nature, as the common person would understand minerals (Butler v. Powers Estate, 22)'. By upholding the Dunham Rule, the court retained existing patterns of ownership on which many leases had been based.

Rationalities of the state that discursively inscribe the materiality of shale gas work in concert with technologies that enable divergent surface and subsurface landscapes to produce geographies of E&E. In what follows, we examine alternative political and material rationalities that facilitate enclosures and exclusions pertinent to biofuel development in India.

4 Case Study 2: Jatropha Biofuels

Widely promoted in the early 2000s as an environmentally benign, welfare enhancing form of renewable energy, biofuels have been at the heart of recent 'land grab' debates, the large-scale acquisition of lands by companies, governments, and individuals currently taking place in developing countries. Discursive and material practices of E&E are central to these transfers (Fig. 26.2).

Shifting Biofuel Feedstocks: 'Solving' the Food Versus Fuel Debate

Reacting to the potential food versus fuel trade-offs engendered by using edible grains and oils for biofuel production, biofuel policies over the last decade have shifted toward using non-edible feedstocks grown on marginal lands (Fargione et al. 2008; Searchinger et al. 2008). Non-edible oilseeds such as *Jatropha curcas* (hereafter Jatropha) were cast as miracle crops capable of growing on degraded lands under rain-fed conditions. Further, remote-sensing estimates identified significant portions of marginal lands available for biofuel production. Approximately 385–472 million hectares (Mha) of abandoned agricultural lands—roughly 2–3 % of the world's land area—were available

Fig. 26.2 Jatropha field (Credit: J. Baka)

globally for biofuel production (Campbell et al. 2008). Restricting biofuel production to non-edible feedstocks grown on marginal lands was framed as 'beneficial biofuels' capable of resolving the food, energy, and environment trilemma of biofuel promotion (Tilman et al. 2009).

Yet terms such as 'marginal' lands are political constructions because their representation in policy documents often does not resemble conditions on the ground (Bailis and Baka 2011; Franco et al. 2010; Levidow 2013). Such labels typically denote lands perceived by outsiders as being unused or having low productive value. However, lands labeled as 'marginal' by governments are frequently common property regimes providing steady sources of fuelwood and fodder feedstocks to landless communities throughout the developing world. As White et al. (2012) document, efforts by development agencies such as the World Bank to label lands as 'empty' or 'unproductive' has facilitated new rounds of land enclosures throughout the world. Evaluating how such land labels are constructed, and how degraded land 'improvement' projects unfold, are two key challenges within recent biofuel and land grab debates (Borras et al. 2010; De Schutter 2011; Franco et al. 2010).

Finding Value in 'Wastelands': Biofuel Policies in India

India is a leading world advocate of growing biofuels on marginal lands. In 2008, after nearly a decade of debate, the Government of India (GOI) passed the *National Policy on Bio-Fuel* mandating that non-edible biofuel feedstocks be grown on 'wastelands', the GOI's official term for marginal lands (GOI 2008). Although the policy did not specify particular feedstocks, Jatropha was the most commercially advanced feedstock in India at the time, a result of the GOI's 2003 *National Mission on Biofuels* that aimed to grow Jatropha on 17.4 Mha of wastelands (GOI 2003). However, neither the National Policy nor the National Mission defined wastelands or detailed how wastelands would be identified for biofuel promotion.

The concept of wasteland dates to John Locke's usage to refer to any lands that were not privately owned (Locke 2011 (1680)). Arguing that the productivity of privately held lands would exceed those of lands 'lying waste in common' (Sec. 37), Locke advocated implementing systems of private property. As a result, privatizing the commons became an important focus of colonial land settlement schemes. Although the land category wasteland existed in India before the colonial era (1757–1947), the category took on new meaning when the colonial government used it as a means of dispossessing indigenous land users labeled as 'backward' and thought incapable of improving the productive capacity of land (Gidwani 2008). The colonial government did not have a methodical process for classifying wastelands but instead believed their extent expansive and their existence a grave threat to colonial revenue generation (Gidwani 1992). The category did not disappear with colonialism and the GOI has implemented successive rounds of wasteland development policies since independence in 1947 (Saigal 2011). Improving wastelands through biofuels is the latest iteration of this policy (Baka forthcoming).

Since independence, the GOI has refined its definition(s) of wastelands and developed increasingly advanced wasteland identification procedures. Illustrated by the definition of wastelands advanced by the GOI's National Wasteland Development Board in the mid-1980s, current conceptions of wastelands extend beyond Locke's economic rationale of land use to include the ecological conditions of land use change:

> Wastelands refer to degraded lands which can be brought under vegetative cover with reasonable effort and which are currently lying under-utilized, and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes. (National Wastelands Development Board, undated)

However, definitions of wastelands continue to obscure the livelihood significance of such lands, despite considerable research establishing these connections both within India (i.e. Jodha 1986, 1989) and across the developing world (i.e. Ostrom 1990).

'Top down' and 'bottom up' assessments of wasteland classification procedures use different assumptions and methods and thus yields different, incommensurate results (Baka 2013). One of the most widely recognized wasteland assessments is the *Wasteland Atlas of India*, a remote-sensing analysis conducted periodically since the mid-1980s. The *Atlas* identifies wastelands throughout the country, categorizes wastelands by type (i.e. waterlogged, saline, scrublands) and assesses their severity (i.e. light, moderate, severe). Scrublands, lands capable of supporting some vegetation but incapable of supporting agriculture, have been the largest single category of wastelands across all iterations of the *Atlas* to date (Baka forthcoming). According to the most recent version of the *Atlas* released in 2010, 47.2 Mha of wastelands exist across India, 18.5 Mha of which are classified as scrublands. Policy makers indicated that scrublands would be the category of wastelands most likely targeted for Jatropha plantations (Baka 2014). Thus, on paper, India has enough wastelands for its National Mission on Jatropha. These practices detail how wastelands are discursively imagined, but to be put to more 'productive' use, they must also be physically inscribed on the land through practices of enclosure (Goldstein 2013).

Valuable to Whom?: Jatropha and Prosopis

Since the 1970s, trees have been central to India's wasteland development and enclosure practices. To mitigate the 'other' energy crisis of the 1970s, the projected shortage in fuelwood supplies across the developing world (Eckholm 1975), the GOI launched its Social Forestry Program and began establishing tree plantations on wastelands (GOI 1976). As many of the trees promoted under Social Forestry, namely Teak and Eucalyptus, were better suited for industrial purposes rather than as household fuelwood, Social Forestry has been widely criticized as a project of rural dispossession because of the resulting loss of access to common lands (Agrawal 1986; Jodha 1989).

However, one tree promoted under Social Forestry, *Prosopis juliflora* (hereafter Prosopis), has helped to stave off fuelwood shortages across parts of rural India (Gidwani 2008; Baka and Bailis 2014). Yet, in the South Indian state of Tamil Nadu, Prosopis lands are now classified as wastelands by the GOI and are being uprooted to make space for Jatropha plantations (Baka 2014). Prosopis is now considered to be an invasive species because once it establishes itself it is difficult to uproot making it a menace to rural land owners. However, in a subregion of Tamil Nadu targeted for Jatropha plantations, harvesting Prosopis, which involves cutting but not uprooting the tree, provides about nine months of steady employment to landless workers. In contrast, Jatropha plantations in Tamil Nadu were found to provide about two weeks of steady employment per year after the plantations had been established (Baka 2014).

Presently, households and a range of rural industries, including paper mills, brick kilns, and match factories, use Prosopis as fuelwood, and as a feedstock for charcoal manufacturing and electricity generation. Jatropha biodiesel is a liquid transportation fuel that is primarily demanded in urban regions. Some Jatropha by-products, most notably seedcake residue, can be dried and used to replace some energy services currently provided by Prosopis. However, exact uses of and demand for Jatropha and its by-products are not yet determined as the Jatropha economy in Tamil Nadu and elsewhere across India has yet to mature.

The Prosopis economy in rural Tamil Nadu currently provides roughly 3–10 times more useful energy than would the government's proposed Jatropha economy (Baka and Bailis 2014). Replacing Prosopis with Jatropha may result in regional energy shortages, particularly in rural areas, as Jatropha and its by-products are not direct substitutes for Prosopis. Significantly, neither the central or state government biofuel policy documents mentions the Prosopis economy, a factor that will likely exacerbate rural energy shortages if the Jatropha economy matures. In rural Tamil Nadu, Prosopis workers displaced by Jatropha plantations (and the subsequent expansion of Special

Economic Zones in the region) are attempting to migrate to rural areas across South India or the Middle East in search of factory or extractive industry work (Baka 2013). If, whether, and to what extent the migrating agriculturalists become 'surplus populations' is to be determined (Li 2011).

This case study links alternative energy promotion with contemporary practices of E&E. A politically constructed category, 'wasteland' enables enclosures promoted as job creating and welfare enhancing. Yet Jatropha plantations in South India have reduced jobs and rural energy security through the substitution of Prosopis with Jatropha. Moreover, this case study is not an outlier as hundreds of thousands of 'empty' lands have been transferred to corporations and foreign governments for 'pro-poor' energy plantations in rural African, Asian, and Latin American regions (Borras et al. 2011; Sulle and Nelson 2009; Cotula et al. 2008).

5 Discussion and Conclusion

The case studies, illustrated by Figs. 26.3 and 26.4, examine processes of E&E within early stages of resource extraction to show how discursive strategies inscribe new meaning and popular geographic imaginations onto landscapes and resources. Energy extraction is always, first, a discursive process of E&E, whereby various mechanisms intersect to delineate and (re)produce a moral, cultural, legal, and physical space of resource extraction and define rights to its access.

The implications of examining energy resource extraction through these mechanisms (see Table 26.2) are fivefold. First, the case studies affirm Andrews and McCarthy's (2014) call for sustained engagement between political ecology and legal geography to show how legal discourse and the materiality of

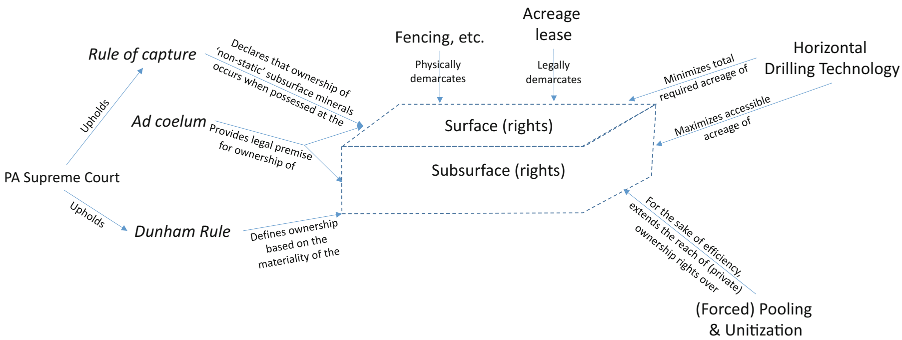

Fig. 26.3 Conceptual map of Marcellus Shale case study

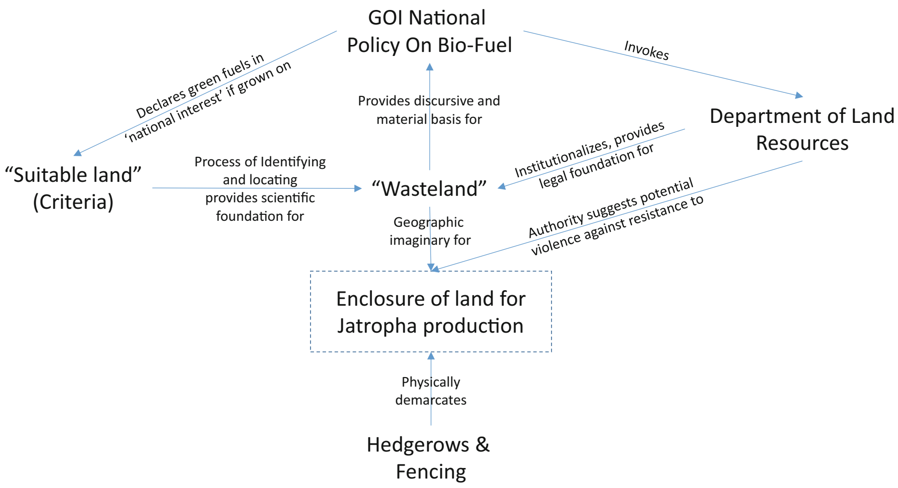

Fig. 26.4 Conceptual map of biofuels case study

Table 26.2 Enclosure and exclusion in new forms of energy extraction

Mechanism	Implications for new forms of energy extraction
Rationalities of the state	Render land legible by legitimizing certain characteristics of resources, often through analogy; Coevolve with material properties of resources to shape configurations of power and reproduce (in)justices
Rationalities of science and technology	Render land legible through scientifically identified characteristics of resources, often valued for technical and economic reasons (New) accepted forms and circuits of knowledge emerge in interplay between discursive and material properties of resources
Geographic imaginaries	Configurations of power shaped in relation to (new) resource through (new) narratives/expressions of nationalism/regionalism Entail processes of discursive layering
(State) Violence	Discursive and material tools perceived as necessary to shape social relations and reproduce (in)justices (Re)produces, defines, and bounds contested terrain where resources are deemed 'accessible' and 'acceptable'
Infrastructure	Direct and material expression of configurations of power which entail processes of material layering

resources coproduce spatial relationships and configurations of power, with broader ramifications for the study of justice within energy transitions. The nature of shale fuel resources requires that the law facilitate landscapes of E&E at both the surface and subsurface, such that the agency of certain stakeholders based on their relationships to the surface and subsurface is both enabled and constrained. Yet, shale fuels confound legal discourses that have evolved in the USA to manage access to conventional sources of oil and gas. Surface expressions of resource extraction are reduced due to advances in horizontal drilling, which employ fewer well pads spaced at greater distances. However, producers are compelled to capture large areas underground. Sometimes legal regimes adapt by creating more appropriately scaled underground enclosures, for example, in states with forced pooling and unitization. The privileging of some rights over others, and the question of who has rights and authority to produce and who does not, entangle resource histories, prevailing political economic systems, and regional and national energy futures within complex questions of distributive and procedural justice.

Further, renewable energies generally, and biofuels in particular, require that the surface accommodate energy generation at an unprecedented scale, adding new pressures to, and requiring new legal interpretations of, surface rights. India's biofuel development policies enroll land of a particular quality and character into industrial fuel production. Legal discourse is adaptive, establishing Prosopis plantations as 'wastelands' seen to be suitable for Jatropha-based liquid fuel production rather than, as originally intended, a local source of heating fuel. The materiality of feedstocks and discursive tools the state employs draw attention to the representation and valuing of different stakeholders across scales.

Second, the case studies demonstrate the significance of distinguishing legal regimes separately from rationalities of science and engineering when examining E&E. Indeed, these are two very different, although complementary, logics by which to make land and resources legible and eligible for resource extraction. Rationalities of science and technology produce assessments of territorial resources that operate as political technologies to legitimize patterns of land use and access. The areas these measurements identify may or may not be explicitly supported by legal regimes such as property rights and zoning; property rights and zoning may be forced to react to new patterns of development facilitated by these calculations. Knowledge claims about the insecurity of conventional supply or ways of measuring and representing 'peak oil' is arguably the strongest rationale for enclosing and enforcing exclusivity over new resources (Bridge 2011). Indeed, Nalepa and Bauer (2012) consider 'marginal land' or 'wasteland' as a 'post-scarcity resource imaginary' which helps to craft a new commodity supply zone. The reclassification of shale fuels from 'resources' to 'reserves'—as a result of new geological and engineering analyses made within new political–economic and technological environments—operates in the same way.

Further, the biofuels case study evidences the role of rationalities of science and technology in E&E as the quantity of energy is secondary to the quality or type of energy. Areas considered 'wastelands' are often used for subsistence economies that result in net energy returns that are higher than emerging commercial Jatropha systems. The form in which energy is carried and the service toward which it is used—woodfuel for heat—does not fit new and increasingly dominant logics surrounding liquid fuel for transport. Claims about resource scarcity combined with interpretations of a standard resource assessment tool, in this case energy return on investment, have helped re-enclose 'wastelands' in India for the purpose of producing renewable liquid fuels, and exclude other potential users and uses of these lands. These enclosures also shape geographic imaginaries, entangling visions about past and present value of land, and its potential energy future (Fatimah 2015) that are exclusionary.

Third, the materiality of the resource matters (Bakker and Bridge 2006) to these rationalities; legal discourse along with the materiality of resources and extractive technologies coproduce the spatiality of E&E. Ensuring that the 'natural domain' of the resource matches the 'rights domain' so that new rights domains are consistent with new resource materialities remains a challenge within energy transitions (see Giodarno 2003).

Fourth, E&E entail processes of layering as new enclosures always layer on old ones. Land and resources are never fixed categories but are in a constant state of 'becoming' (Li 2014). In India, so-called wastelands initially used for Prosopis plantations to provide fuelwood to households have been reinscribed as wasteland because they are not suited to liquid fuel production—at least not until said lands are 'improved' by way of Jatropha plantations. In the case of shale fuels, emerging legal regimes navigate established legal discourses to facilitate new enclosures. Legal regimes are adaptive, but also constrained by precedent. Law defines 'shale gas' given its material location at the surface and subsurface, analogism to other resources, and the technologies used to access it, and thus layer emerging definitions atop established understandings of 'mineral' and 'natural gas'.

Finally, the underlying mechanisms of E&E are issues of representation and distributional justice; the social, cultural, and political categories people associate with, or are assigned to, factor into who wins and who loses (see Kirshner and Power 2015; McCauley et al. 2013). Boundaries are permeable but selective. Certain peoples, behaviors, and ideas belong. Exclusion drives resistance as E&E render multiple violences.

Forms of energy extraction and emerging energy transitions are cultural and political projects shaped by processes of E&E. As Huber (2015, 9) writes,

> [d]evelopments in critical social theory suggest energy should no longer be seen as a mere 'object' of empirical analysis. We need to grapple with the role of energy in fueling the very stuff of social theory—modernity, democracy, capitalism, and ideas of freedom.

Shifting between energy inputs involves the reconfiguration of socio-technical structures, society–environment relations, everyday routines, and their organizing social institutions and norms. This chapter has presented several mechanisms of E&E as tools to contend with the spatial (re)configurations of power emerging within new forms of energy extraction.

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The Political Economy of Energy Justice: A Nuclear Energy Perspective

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1 Introduction

Energy justice seeks to apply justice principles to energy policy, energy production, energy consumption, energy activism, energy security, and climate change. Energy justice has arisen within the social sciences in multifaceted forms, existing as a concept, research agenda, issue, topic, or frame, amongst other conceptions. It is, in this regard, both a versatile idea and a burgeoning one that is ripe for exploration. It aims 'to provide all individuals across all areas with safe, affordable and sustainable energy' (McCauley et al. 2013, p. 1), and carries three core tenets, distributional justice, procedural justice, and justice as recognition. Within this chapter, we begin by exploring these core tenets of energy justice, as they are understood in academic theory. Using three case

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studies throughout the nuclear energy system, we then illustrate manifestations of energy justice in practice from a political economy perspective.

We use our case studies to test three hypotheses. Firstly, that potential trade-offs will exist between the core tenets of energy justice. Here we give the example of the siting of Deep Geological Repository (DGR) for Canadian nuclear waste and the complexity of balancing distributional and procedural justice calls. Secondly, that a political economy approach to energy justice can resolve the political economy dilemma of having winners and losers from an energy policy perspective. We illustrate our reasoning through a case study of the development of the UK Energy Act 2013. Thirdly and finally, we show potential for the deployment of one tenet to mask another. Here, our example of the recognition of indigenous groups surrounding uranium mines highlights the necessity of not only attention to who is involved in decision-making but the legitimacy of social inclusion.

In utilising a political economy perspective throughout, we therefore identify both winners and losers with regard to energy justice throughout the nuclear energy system. The modern political economy research agenda, and within, the concept of the international political economy, first appeared as a subfield of international relations in the 1970s (Hancock and Vivoda 2014). Emerging primarily with a focus on the interrelationship between public and private power in the allocation of scarce resources, it sought to answer the fundamental questions of 'who gets what, when and how?'. Thus, it questions, in essence, who the winners and losers are in fundamentally intertwined political and economic choices (Ravenhill 2005, p. 18).

Our discussion leads us to provide two insights into the debates surrounding energy justice. Firstly, we demonstrate that energy justice offers an opportunity to explore where injustices occur—highlighting the maldistribution of burdens and benefits and allowing for the development of new processes of avoidance and remediation as well as the recognition of new actors. It is therefore an agenda that inspires both evaluative accounts and normative solutions to dealing with both the winners and losers in energy policy. Secondly, through exploration of these case studies, we illustrate the international scope of energy justice concerns across all sections of the nuclear energy system. Thus, we highlight that energy justice provides a new framework for bridging existing and future research on energy production *and* consumption. Here, the hitherto competing discourses are united in the common goal of achieving *just* energy-based processes and outcomes.

On this basis, we promote the application of energy justice's three core tenets, distribution, procedure, and recognition—a three-pronged framework—for assessing the winners and losers across the energy system. Throughout, our political economy focus leads us to highlight the potential for conflicts and trade-offs amongst the core tenets of energy justice. Further, it not only provides cautionary tales around the implementation of energy justice tenets but also demonstrates how energy justice may be used as a positive tool for resolving political economy issues. Indeed, we do not claim that the emerging concept of energy justice provides a panacea for our energy concerns; instead, we draw attention to the need to explore and consider its own political economy as the concept makes policy ground.

2 Energy Justice: The Tenets

Generally, justice theory rests upon three tenets: distributional justice, procedural justice, and justice as recognition. Table 27.1 summarises their core evaluative and normative reach before each is discussed in the proceeding sections, first theoretically, and secondly through a series of case studies.

Distributional Justice

Distributional justice, the first of three tenets of energy justice, recognises the inherently spatial nature of the concept. It includes attention to both the physically unequal allocation of environmental benefits and ills, and the uneven distribution of their associated responsibilities (Walker 2009) and recognises that issues in specific localities become entwined with the desirability of technologies more generally (Owens and Driffill 2008). Further, it represents a call for the even distribution of benefits and ills on all members of society regardless of income, race, and the like.

This first tenet of energy justice fits classically with the concept of political economy, which, in questioning, 'who gets what, when and how?' (Ravenhill 2005, p. 18), is primarily concerned with questions of distribution. Nancy

Table 27.1 Summary of the core tenets of energy justice

Tenets	Evaluative	Normative	Case study
Distributional	Where are the injustices?	How should we solve them?	Deep Geological Repository siting in Canada
Recognition	Who is ignored?	How should we recognise?	UK Energy Act 2013
Procedural	Is there fair process?	Which new processes?	Indigenous Groups involvement with Australian Uranium Mining

Fraser highlights this focus in her work 'Social Justice in the Age of Identity Politics: Redistribution, Recognition and Participation', where she states, 'the redistribution paradigm focuses on injustices it defines as social-economic and presumes to be rooted in the political economy. Examples include exploitation, economic marginalisation and deprivation' (Fraser 1999, p. 73). In this regard, both distributive justice as a tenet of energy justice and the political economy agenda call to question where the benefits and burdens of our energy infrastructures lie.

Such distributional concerns typically emerge as public opposition to energy developments and therefore highlight instances of *in*justice. Research has demonstrated the unequal placement of nuclear facilities in areas of low income, for example, and in the case of waste storage, the contamination of Native American Lands (Sze and London 2008; Fan 2006; Kuletz 2001; LaDuke 2004; Sachs 1996). We highlight, however, the importance of noting the distributing of benefits too and their role in creating injustice, thus recognising both winners *and* losers. Conflict surrounding community wind farm developments has stimulated interest in 'community benefits', for example—the provision of material and financial benefits by developers to local communities (Cowell et al. 2011).

Procedural Justice

Energy justice requires the use of equitable procedures that engage all stakeholders in a non-discriminatory way (Walker 2009; Bullard 2005). It states that all groups should be able to participate in decision-making, and that their contributions should be taken seriously throughout. It also requires participation, impartiality, and full information disclosure by government and industry (Davis 2006), and the use of appropriate and sympathetic engagement mechanisms (Todd and Zografos 2005).

Our aim here is to assess the extent to which such a procedural justice is observable in energy policy and to what degree there is energy justice from a political economy perspective. In essence, this involves assessing who the potential winners and losers may be in terms of procedural justice. We note, however, that the aim should not be to look at one case of procedural justice in isolation, it is necessary to look at the entire energy cycle, as is evidenced by our discussion in the sections below.

Firstly and in brief, we take the example of energy subsidies, where there is an the issue of full information disclosure, questioning, in particular, whether the public are in full knowledge of what subsidies different energy sources in the energy sector receive. Analysis was undertaken in the UK (by the UK Environmental Audit Committee) to determine the exact levels of subsidies that are being received by different energy sources in the UK, and how this could then inform public decision-making on what represents the best choice of energy for the future.[1] However, there was not a conclusive outcome. The International Energy Agency (IEA) has also produced a well-documented analysis that identifies that the fossil fuel industry receives $550 billion annually (IEA et al. 2010). Despite this, however, there continues to remain a lack of core procedural justice elements of participation, impartiality, and full information disclosure by government and industry on the issue of energy subsidies, and the energy sector remains significantly skewed in favour of fossil fuels as a result.

Such information disclosure should be readily accessible so that all stakeholders can access informed decision-making as to what energy sources we should have. This is especially relevant given the notable effect of subsidy costs of societal welfare, as is discussed in Farrell and Lyons' (2015) exploration of renewables subsidies in Ireland. Nevertheless, there is a lack of research into the access to knowledge of energy subsidies by all stakeholders in the energy sector (Heffron 2013).

Justice as Recognition

The third tenet of energy justice is recognition justice or the injustice of misrecognition—originating also from Nancy Fraser's (1999) 'Social Justice in the Age of Identity Politics: Redistribution, Recognition and Participation'. Misrecognition is not the same as a lack of participation, instead manifesting as 'the process of disrespect, insult and degradation that devalue some people and some places identities in comparison to others' (Walker 2009, p. 615). Justice as recognition is also more than tolerance, and states that individuals must be fairly represented, that they must be free from physical threats, and that they must be offered complete and equal political rights.

From an unconventional energy systems perspective, under-represented health impacts exist for communities who are often based in a developing world context. Health problems due to poor indoor climate from burning of traditional fuels impact women and children disproportionately, due to gender roles and division of household chores (Gurung and Oh 2013; Bouzarovski

[1] See both: Volume 1 and 2 from the Environmental Audit Committee just published on 2 December 2013, available from: www.publications.parliament.uk/pa/cm201314/cmselect/cmenvaud/61/61.pdf and www.publications.parliament.uk/pa/cm201314/cmselect/cmenvaud/61/61vw.pdf accessed 30 July 2015.

and Petrova 2015). Furthermore, the task of collecting firewood tends to be the responsibility of women and children, who spend hours every day collecting wood (Heltberg 2004). Further, in terms of conventional energy systems, the renewable power industry and environmental non-governmental organisations often deride local campaigns against wind farms as 'not-in-my-backyard' (NIMBY) protests by self-interested and misinformed individuals who care much less about the public good than about undisturbed scenery and property values (Barry et al. 2008). This not only denies respect and justice as recognition for local anti-wind groups but could also deepen public resistance to new forms of low-carbon energy installations.

Justice as recognition may therefore manifest itself not only as a failure to recognise but also as misrecognising—a distortion of people's views that may appear demeaning or contemptible (Schlosberg 2003). Thus, it includes calls to recognise the divergent perspectives rooted in social, cultural, ethnic, racial, and gender differences. From this perspective, recognition justice scholarship challenges the predominantly universalist discourse of distribution and procedure, suggesting a terminology of *distributive* versus *post-distributive* (or recognition) aspects of justice (Bulkeley et al. 2013). Bulkeley and colleagues employ the *post-distributive* concept 'to engage with how … justice is actually practiced and embedded in the city … by moving from universal principles of climate justice to its articulation in particular places', and to highlight the *recognition* aspect of justice (Bulkeley et al. 2013, p. 25).

3 Energy Justice in Practice: The Case of Nuclear Energy

Here, we use three case studies to both illustrate the emergence of the tenets of energy justice in practice and to highlight the tensions that exist between them. We do so through, firstly, an assessment of the siting process for a DGR in Canada, secondly, consultation and due process around the development of the UK Energy Act 2013, and finally, the recognition of indigenous groups around Australian uranium mines. Our analysis seeks to demonstrate two points: (1) that the tenets of energy justice are subject to their own political economy at any one scale and (2) that a political economy perspective highlights many of the trade-offs that exist in the energy system and that need to be resolved to increase the practice of energy justice.

Nuclear Waste Siting: A Canadian Case Study

The fundamental underpinning of distributional justice is the idea of equality—the idea that everyone should be subject to the same amount of environmental burdens and benefits (Huang et al. 2013). However, there is acknowledgement too that some resources are either naturally, or unavoidably, uneven in their distribution (Eames and Hunt 2013). This is true of nuclear waste. For technical, managerial, and safety reasons, it is infeasible and unsafe to distribute nuclear waste equally amongst all those who benefit from nuclear energy (Krütli et al. 2012). Potential sites for DGRs are restricted by geological conditions, for example, meaning that some areas are practically more suitable than others.[28] Thus, the unavoidable 'stock-piling' of nuclear waste necessitates that some people who live in communities neighbouring nuclear waste storage facilities face a disproportionate burden from the radioactive material.

Where maldistribution is a necessity, then, claims for distributional justice must be made in tandem with an argument for fair treatment—procedural justice and justice as recognition (Eames and Hunt 2013). Here, we use the case study of the siting of a Canadian DGR for nuclear waste as an example of the complexity of balancing distributional and procedural calls.

Despite the acknowledgement amongst the scientific community that deep geological disposal is a safe means of disposing of radioactive waste, almost all countries that have tried to find a location for a repository site have failed (Ramana 2013). To date, only Finland and Sweden have made progress towards site development, with operations expected to begin sometime between 2020 and 2025, though developments are criticised for their lack of independent review and on the grounds of geological suitability (Alley and Alley 2014; Sovacool et al. 2014). With plans across several countries to expand their nuclear fleet, plus several countries running out of storage space, and given that solutions to the nuclear waste legacy are a strong influence on attitudes to nuclear, a solution must be found (Ramana 2013; Alley and Alley 2014). Canada in particular, has a long history of trying to find such a path (Ramana 2013).

Initial attempts to find a site for a Canadian DGR began in the mid-1970s and initially took what Kojo and Richardson (2014) describe as a 'hierarchical approach', the most extreme model of which is known as DAD—decide, announce, and defend. Within the hierarchical approach, whilst it may contain elements of consultation and public engagement, the final decision on proceedings ultimately rests with state or federal authorities, which have the right to impose a facility on a community (Kojo and Richardson P 2014). By 1972, the then established committee of waste owners had already decided that a DGR was a necessity. Indeed, the Canadian nuclear waste management programme initially envisaged a timeline in which site selection and the early construction of a repository would have been completed in the late 1980s, with a fully operational site then expected around 2000 (Durant 2009). The initial actions of Atomic Energy Canada Limited, the overseeing body, demonstrated that they planned to move quickly on developments for a waste disposal site on the assumption that it was the responsible thing to do. Durant (2009, p. 152) highlights here 'the notion that because disposal was an, "urgent need", and because sufficient technical means and know-how was available, public consultation was unnecessary'.

However, in the midst of intense public opposition, this programme was halted in 1981, and the decision was made that no disposal site would be identified before a full public inquiry on the disposal concept was held—the Seaborn panel (Ramana 2013; Durant 2009). Reasons for objections can be numerous, arising over a desire not to contaminate pristine ground, tactical refusal in a bid to stop the development of future nuclear stations, NIMBYism—a refusal to host a facility in the local area despite recognition that the development of one is necessary, and because the siting process does not consider transparency or the sufficient involvement of affected peoples (Ramana 2013; Bickerstaff 2012).

In a bid to overcome such opposition, the organisations responsible for the repository's development changed tack. The Nuclear Waste Management Organisation (NWMO) was developed as an independent body tasked with investigating a DGR, the storage of materials above ground at reactor sites in a centralised location, and, primarily, with achieving social acceptance (Durant 2009). The NWMO created the process of Adaptive Phase Management, which moved away from a position in which technical and political elites held all decision-making rights, to one in which public stakeholders had a far greater role, with decision-making capacity granted to communities across time and space (Durant 2009). The NWMO described the subsequent consultation process as a 'dialogue', which included, 'nation-wide surveys, focus groups, issue-focused workshops and roundtables, e-dialogues and deliberative surveys, and public information and discussion sessions' to reach out to people, including specifically targeting indigenous populations (NWMO 2005, p. 61).

Following a lengthy engagement phase, the NWMO is now in the process of identifying an informed and willing community to host the repository (Ramana 2013). The end result being that despite lengthy consultations and an ongoing deliberative process, no site for a deep geological disposal facility has been found 40 years after the initial exploration of the DGR concept. This case study, whilst necessarily brief, demonstrates potential trade-offs between the tenets of energy justice, as calls for procedural justice significantly lengthen the progress for distributional justice. Ramana (2013) states that emerging conflicts between the principles underlying siting and the process of site selection itself may pose barriers for the successful establishment of a repository. Alley and Alley (2014) highlight, too, that even if a facility was opened tomorrow, it would take decades to transport all of the fuel to it, and that even then the transport of radioactive waste will undoubtedly itself be subject of opposition. In this regard, the demands for procedural justice in the development of a DGR have dampened its progress and, arguably, posed greater distributional risks since the nuclear waste destined for the DGR remains in above-ground, distributed, interim storage.

Nuclear Electricity Supply: A British Case Study

Energy justice requires that 'people are provided with the opportunity to participate effectively and meaningfully in decisions concerning the production and distribution of energy' (Kojo and Richardson 2014, p. 121). Within this case, we examine participation, consultation, and due process using the example of the formulation of the UK Energy Act 2013. We highlight that through a focus on procedural justice, energy justice can resolve the political economy dilemma of having winners and losers from an energy policy perspective.

The traditional meaning of the term political economy is that branch of the art of government concerned with the systematic inquiry into the nature and causes of the wealth of nations, although it is now often used loosely to describe political aspects of economic policy-making. It is this latter perspective that this section utilises to illuminate the political aspects of energy policy and legislation formulation in the UK and its consequences on energy justice in the energy sector.

At its core, the political economy concept has three central facets: institutions, information, and behaviour (Weingast and Wittman 2006). Here we focus on the second—information—which is the object of focus in political economy in the context of provision, revelation, and aggregation. The nature of political economy allows for the analysis of why, how, and what information is provided and its effects in terms of legislative and political decision-making; a necessity given that whilst information is important to any economic sector,

Table 27.2 Policy and legal developments in the UK electricity sector, 2002–2012

White Papers and Legislation 2002–2012
2002 *The Energy Review*
2002 *Managing the Nuclear Legacy—A strategy for action*
2003 *Energy White Paper: Our Energy Future—Creating a Low Carbon Economy*
2006 *The Energy Challenge: Energy Review Report 2006*
2007 *Energy White Paper on Energy 2007. Meeting the Energy Challenge*
2007 *Planning for a Sustainable Future White paper*
2008 *Meeting the Energy Challenge: A White Paper on Nuclear Power*
2008 Energy Act chapter 32
2008 Climate Change Act chapter 27
2008 Planning Act chapter 29
2009 *The UK Low Carbon Transition Plan: national strategy for climate and energy*
2009 *The Road to 2010: Addressing the nuclear question in the twenty first century*
2011 *Planning our electric future: a White paper for secure, affordable and low-carbon electricity*

it is even more so in energy activities where the risk is so high should a project fail or because of the long life cycle of energy infrastructure (and the resulting level of potential environmental effects).

The UK's current energy policy—the Energy Act 2013 (Energy Act 2013)—was developed through a process of consultation lasting over a decade. Whilst, in general, consultation has not been at the forefront of policy development, the UK did aim for a more inclusive process that involved the production of successive policy documents. In addition, there was a similar process to changing law in other areas, such as planning and climate change before the final introduction of the Energy Act 2013 was possible. Table 27.2 outlines the major policy and legal developments over the decade prior to the Energy Act 2013. All stakeholders had access to significant information to inform and enhance their potential to make inputs into the process.

The next few paragraphs detail the development of the UK Energy Act 2013 and highlight that it was aimed at addressing the concerns of all stakeholders, to provide complete information to them, and to then result in energy law that was more just and equitable, rather than to identify clear winners and losers. The following is a description of these steps:

- The initial transition began and was greatly influenced by the 2002 Energy Review (CO 2002) and then in turn by the 2003 White Paper *Our Energy Future: Creating a Low Carbon Economy* (DTI 2003). The 2002 and 2003 documents represented a shift in attitudes towards the UK's energy strategy, framed in terms of a response to commitments made by the UK government to reduce carbon emissions, and to assess energy security. There was a particular reference to the need to build new energy infrastructure, and this was to involve the construction of a large number of renewable energy projects around the country.

- In 2006, the UK government's Department of Trade and Industry produced another Energy Review (DTI 2006), assessing the UK's progress towards the medium and long-term goals of the 2003 Energy White Paper. The 2006 Review reinforced the need to build more large-scale renewable projects and also represented a *public* shift in government attitudes towards nuclear energy, advocating an expansion of nuclear power through Generation III nuclear power plants.
- In the 2007 White Paper *Meeting the Energy Challenge*, the UK government set out its energy strategy, basing it on 'tackling climate change' and 'ensuring secure, clean and affordable energy' (BERR 2008, p. 6), a strategy that formed the basis of the 2008 Energy Act (Energy Act 2008). The year 2008 was significant in that it also saw the creation of the Department of Energy and Climate Change (DECC) to lead energy policy development in the UK. A new department had been considered before, with Maugis and Nuttall (2008) noting that this type of reform had been an issue since 2003. DECC was given a Cabinet seat and was formed from the Climate Change Group in the Department for Environment, Food and Rural Affairs and the Energy Group from the Department of Business, Enterprise and Regulatory Reform (BERR). Also in 2008, three other government outputs modified the UK's approach to energy and energy infrastructure planning: the White Paper on Nuclear Power (Energy Act 2008); the Planning Act; and the Climate Change Act (Climate Change Act 2008).
- In 2011, a new White Paper entitled *Planning Our Electric Future* was presented by the Department of Energy and Climate Change, and the key elements of this White Paper were intended to become law by 2013 (DECC 2011). This White Paper was an attempt to develop a long-term energy policy in the UK, and alongside the 2011 White Paper, the Renewables Roadmap (UK Renewable Energy Roadmap 2011) detailed proposals for a major expansion of large-scale projects by 2020.

We illustrate here that each phase of the development of the UK Energy Act 2013 over the previous decade involved several periods of consultation. The aim of the UK government, by having core goals of consultation and due process, was to achieve a greater balance between economics (cost focus), environment (climate change goals), and politics (energy security) so as to deliver a better outcome for society. All stakeholders were given equal opportunity to make an input to the process with extensive information being made available. Also there were more than several opportunities to be involved in the process.

As a result, the UK Energy Act 2013 is seen across Europe as a model for new energy law that aims to achieve a more 'just' energy policy (in essence energy justice), and which also aims to balance the competing objectives of economics, the environment and politics and thereby avoid having a policy outcome trade-off where there are winners and losers.

Despite the apparent successes of the UK Energy Act 2013 process, however, Whitton et al. (2015) take a critical look at current legislative developments. They discuss the proposed amendments to the UK planning and infrastructural law presented within the 2014–2015 Infrastructure Bill, and note a potential U-turn in infrastructural politics. They highlight in particular the suggestion that more decision-making powers for large-scale developments, particularly in the low-carbon sector, will be returned to the Secretary of State—a threat to opportunities for local democracy. Energy justice in this regard is sensitive to political timescales and changes in political process, highlighting again that it is subject to its own political economy.

Nevertheless, there is a counter argument in that in the energy policy literature where policy outcomes and the winners and losers are discussed there is too often a focus on nuclear energy and its pitfalls in comparison to other low-carbon energy sources, such as renewable energy. In Whitton et al., they ignore the phased development of the UK Energy Act 2013 and instead focus on how nuclear energy may benefit from a potential U-turn with the introduction of the 2014–2015 Infrastructure Bill. This ignores how this U-turn (though whether it really was a U-turn is open to debate) would be available for all energy projects and other infrastructure.

A further example is highlighted in a more recent article by Johnstone and Stirling who again focus on nuclear energy and have a comparison with renewables (Johnstone and Stirling 2015). They focus on comparing civil nuclear energy development in the UK and Germany. They even assert that it is only countries who are slightly less democratic that are considering to build nuclear energy (Ibid., pp. 62–64). Indeed, the authors state that (Ibid., p. 69): 'Put simply, the question is raised as to whether the main reason for nuclear discontinuity occurring in Germany rather than in the UK, is that the latter affords less effective general opportunities for diverse kinds of democratic pressure and challenge'. The authors also highlight the success of renewable energy in Germany.

A familiar story emerges in energy literature that in discussing nuclear energy policy, there is always a return to a debate where the discussion is where society has a choice between nuclear energy versus renewable energy. We hope to highlight in examining the development of the UK Energy Act 2013 that it was an inclusive process and that that Act also benefits other energy sources. Further, we advocate that in future, political economy energy justice debates it is not whether one of nuclear energy or renewable energy will be the winner or loser, but that that the focus needs to be on the energy system in its entirety. The debate needs to include fossil fuels and if climate science and environmental pollution data are examined, it is fossil fuel energy sources that need to be the losers, and low-carbon energy sources, the winners.

Uranium Mining: An Australian Case Study

In this case study of uranium mining in Australia, we illustrate the emergence of justice as recognition in practice. Throughout, we identify the need to recognise previously misrecognised social groups—including, most pertinently in Australia, First Peoples. We demonstrate too that recognition alone is not sufficient, and show instead that it must be accompanied by due process. Thus, we highlight the potential for hidden injustices and losers with regard to energy justice.

Geographically, Canada, Kazakhstan, and Australia account for more than half of global production of uranium, an estimated 70 % of which is mined in the traditional lands of First Peoples (Sovacool and Dworkin 2014; Graetz 2015). It is a story well versed that governments permit large corporations to undertake mining on their land in exchange for the growth and prosperity of their country. However, whilst there are some benefits, such practices can be at the detriment of the local area. The potential for negative impacts include, amongst others, damage to human health and the local environment, poor economic compensation, concerns over sovereignty and indigenous rights, and the erosion of indigenous social cultures (Karlsson 2009).

Sovacool and Dworkin (2014) draw attention to the case of the now-closed Rum Jungle mine in Australia, where they illustrate widespread environmental damage, giving evidence of the discharge of acidic liquid wastes into surrounding creeks and the Finniss River, land contamination, and localised land erosion. Socially, too, relationships between mining organisations and landowners have typically been damaging, characterised by conflict, negative influence, and the denial of rights (Jenkins 2004). An assessment of uranium mining practice within the Kakadu National Park in the Northern Territory of Australia, for example, illustrates the use of coercive tactics to override opposition. Sovacool and Dworkin (2014, p. 168) report that historically 'operators of both the Jabiluka Mine and the Ranger Mine (both of which are within the national park's boundaries) have been documented intimidating, illegally imprisoning, bullying, and bribing the indigenous Mirrar people into signing over land rights'. Such cultural domination—a form of misrecognition—is common in resource conflicts around the world, especially in regard to the relationship between indigenous populations and extractive industries (Acuna 2015).

In the face of previous malpractice and as the result of increasing attention to the social and environmental impacts of uranium mining, including calls to recognise the rights of indigenous peoples, the global mining industry has progressively turned to the concept of corporate social responsibility (CSR) to improve their operations (Jenkins 2004). Australia's three operating mines, as well as the sites at which major uranium deposits have been discovered, are all situated on the traditional lands of the country's First Peoples (Acuna 2015). Thus, in this context, the mining industry's focus on CSR necessitates the recognition of newly empowered stakeholders, and engaging with affected communities in a way which is respectful of their host community's interests, knowledge, concerns, and objectives (Martinez-Alier 2001; Guerra 2002; Acuna 2015). However, top-down processes for mining decision-making commonly lack legitimacy for indigenous stakeholders (Chamaret et al. 2007). In this regard, our uranium mining case further highlights the political economy of energy justice, where justice as recognition cannot exist in silo—it requires the presence of procedural justice too. At this point, we further develop our case of Australian uranium mining.

In Australia, the 1993 Native Title Act has given native populations increasing power to negotiate agreements with developers, often ensuring some kind of monetary compensation for social, cultural, and environmental damage, as well as employment and business development opportunities (O'Faircheallaigh 2008). Yet the Act, a structure designed to increase fairness of governance structures, does not ensure exclusive indigenous control over lands and resources, especially if the lands contain resources of national interest (Banerjee 2000). Take for example Banerjee's (2000) explorations of the development of the Jabiluka mine in Australia. Despite protests from the indigenous Mirrar community and various national and international environmental groups, including United Nations Educational, Scientific and Cultural Organization (UNESCO), developments were given the all clear. In addition to failing to hear the extensive objections, developers were criticised for failing to provide equal opportunity for the Aboriginal population to view and comment on environmental reports (Newell and Mulvaney 2013). Thus, despite their recognition, they were unable to participate in due process. Jenkins (2004, p. 168) rather scathingly states in this regard that the

Australian mining industry takes a 'devil may care' attitude, 'operating in areas without social legitimacy, causing major devastation, and then leaving when an area has been exhausted of all economically valuable resources'.

Such examples raise questions of not only who is involved in decision-making but the legitimacy of social inclusion. In this respect, it is not sufficient for the state to recognise its citizens in equal, legal form—the state and the powers that be must also 'establish comparable life chances between citizens through provision of social entitlements' (Flüeler and Blowers 2007). Flüeler and Blowers (2007) add, in line with the principles of good governance, that participating local communities must benefit from their involvement in decision-making, and not only via short-term compensation. This is even more the case when we consider the use of financial compensation for losses. These payments are frequently used to cover the costs of services that the state already has a duty to provide, for example, healthcare and education. Financial payments, therefore, should not be substituted for social entitlement (Flüeler and Blowers 2007).

4 Operationalising Energy Justice

Our chapter so far has introduced two key ideas: energy justice as it exists in theory and energy injustice as it exists in practice. In providing real-world examples of the tenet's applicability, we have demonstrated the concept's ability to highlight areas of injustice—giving it evaluative reach. Cognisant of such opportunities to improve the social performance of our energy systems, there is recognition of the need to address the key political economy questions of 'who wins, who loses, how and why they relate to the existing distribution of energy, who lives with the side effects of its sites of extraction, production and generation, and who will bear the social costs of decarbonising energy sources and economies' (Newell and Mulvaney 2013, p. 133). Here, our political economy and energy justice foci provide real potential.

Through our three brief case studies, we have also sought to demonstrate that energy justice is subject to its own political economy—demonstrating in real terms the challenges of balancing the winners and losers in the nuclear sector and in balancing the tenets of energy justice. By utilising case studies from throughout the nuclear energy system, at the stages of uranium mining, energy production and waste, we have further highlighted that these winners and losers not only exist on a site-by-site basis but between systems components and across both space and time. We argue here then that energy justice, whilst full of potential, needs to be managed effectively or it is liable to endure its own political economy.

As a further illustrator to our discussion above, whilst it is sometimes acknowledged that nuclear energy is a low-carbon energy source (Canfield et al. 2015), Newell and Mulvaney (2013, p. 138) discuss the frequent presentation of nuclear power as ‘clean’ energy, without acknowledgement of its social context, including the environmental injustices associated with uranium/yellow cake mining and long-term nuclear waste storage problems. They warn, then, of the burdens of nuclear power being unevenly distributed internationally, ‘particularly if “clean energy” is pursued without attention to energy justice’. Furthermore, nuclear power’s depletion of finite uranium sources, production of long-lived nuclear waste and contribution to climate change raises justice questions between generational borders (Taebi 2012; Kojo and Richardson 2014). Indeed, with the issue of nuclear waste in mind, the benefits of nuclear power exist primarily for the present generation, leaving the burdens of long-lived radioactive waste to future cohorts (Taebi et al. 2012; Kojo and Richardson 2012). However, this has to be taken into the context of all energy sources which all leave waste in some form to future generations.

With such dilemmas in mind, many authors argue for a multi-scalar focus; an acknowledgement, according to Holifield et al. (2009, p. 4), that ‘place-specific policies and practices can have consequences that cross national boundaries, affect multiple scales, and extend across global networks’. In this vein, Newell and Mulvaney (2013, p. 138) comment too that the ‘social and spatial dimensions of energy and climate justice force us to consider the scope for stronger forms of energy governance beyond the state that are able to address these complex relationships’ (see Chap. 25). Such an approach, according to Newell and Mulvaney, ‘reiterates the importance of comprehending the global dimensions of the issue in the everyday, increasingly transnational, organisation of production and consumption through global supply chains, rather than through the dramatic, site-specific and more visible instances of environmental justice conflicts and mobilisations which feature in much of the literature’ (Newell and Mulvaney 2013, p. 133). Further, such an approach overcomes scalar ambiguity and failures to account for actor diversity within the current environmental and energy justice literature (Jenkins et al. 2013).

When a political economy perspective on energy justice is developed with a whole systems approach to energy justice, it highlights not just case-specific injustices but also the trade-offs required between different systems components, allowing a full social costing of an energy source. In light of this, Heffron and McCauley (2014) highlight the importance of the energy justice concept for two reasons: (1) the assessment of justice throughout the supply chain can enable an energy source to be valued at full cost and (2) valuing an energy source at full cost will affect whether it is chosen as an energy source, and therefore affect energy security. In this regard, Sovacool et al. (2014, p. 200) comment that 'the incorporation of considerations of justice into energy policy making will alter how we view entire energy systems'.

5 Conclusion: A Future Outlook on Energy Justice in the Energy Sector

Throughout our exploration, we have used three case studies to highlight the merit of a political economy approach to energy justice. Our examination of the siting process for a DGR for Canadian nuclear waste demonstrated potential trade-offs between the tenets of energy justice. Here we showed that procedural justice can significantly lengthen the progress for distributional justice, as, over a 40-year time span, demands for extensive consultation in Canada has meant that no site has been developed and nuclear waste destined for the DGR remains in above-ground, distributed, interim storage. Secondly, in our exploration of the development of the UK Energy Act 2013, we examined participation, consultation, and due process. We highlighted that through a focus on procedural justice, energy justice can resolve the political economy dilemma of having winners and losers from an energy policy perspective. Finally, our example of the recognition of indigenous groups surrounding uranium mines highlighted the importance of considering not only who is involved in decision-making but the legitimacy of social inclusion; in essence, the necessity of operationalising both justice as recognition and procedural justice in tandem. Thus, our exploration of political economy approaches to energy justice not only provided cautionary tales around the implementation of energy justice tenets but also demonstrates how energy justice may be used as a positive tool for resolving political economy issues.

With this in mind, we conclude that energy justice offers, firstly, an opportunity to develop new crosscutting social science agendas on exploring where injustices occur, developing new processes of avoidance and remediation, and recognising new sections of society. It is therefore a paradigm that inspires both evaluative accounts and normative solutions for dealing with both the winners and losers in energy policy.

Energy justice provides, secondly, a new framework for bridging existing and future research on energy production and consumption. The hitherto competing discourses are united in the common goal of achieving *just* energy-based processes and outcomes.

Lastly, it sets out a three-pronged framework for assessing the winners and losers. Distributional and recognition-based injustices in the siting of nuclear waste and mining infrastructures are evoked above within the context of opposition and developer movements, highlighting trade-offs between energy justice's core tenets. With regard to procedural justice, our case highlights that energy justice can resolve the political economy dilemma of having winners and losers from an energy policy perspective.

Our whole-system analysis suggests that the contribution of political economics in energy policy requires, more generally, to be revised. Economics, more specifically, needs to better accommodate (1) other disciplines in its calculations for modelling and analysis and (2) inherent physical attributes of whole energy systems. This call for a new direction is driven by several concerns. Pre-eminent amongst these is the unacknowledged reliance on the same economic thinking, the Chicago neoclassical economic perspective, which has created the current unjust distribution of winners and losers. This economic viewpoint and its drive for competition have led to the current *malaise* of many sectors in the economy. At the same time, investments in energy policies such as nuclear involve a buy-in to the physical constraints of its whole energy system. In this way, we must develop new concepts such as energy justice as a means to investigate the injustices of both economic thinking and physical realities.

Dominant neoclassical economic thinking continues therefore to prop up the 'physical frameworks of injustice' of whole energy systems. Because of word limitations here, we are unable to investigate fully the relationship between physically generated injustices in whole energy systems and economic social systems, though we note that this area is ripe for future research. We call, in any case, for a reflection on what contribution energy justice can make to our adaptation and mitigation strategies. Further, we propose, as an area of further research, that scholars develop energy justice metrics as a new tool for costing energy infrastructural projects with an explicit link to whole energy system implications. This builds on the energy justice matrix or checklist proposed by Sovacool and his peers (2014), where through the matrix or checklist it is possible to assess the justice 'performance' and true social impacts of our energy system—though this matrix/checklist is a qualitative and potentially subjective process. Metrics, however, are more precise in their approach and aim to directly connect with economists and early work has been started in this regard (Heffron et al. 2015). Thus, the aim of energy justice inspired metrics is to incorporate them into economist's models, and deliver a concept, which has a value that can be calculated and costed so that the consequence of its application can be more easily understood by the public, ensuring, we hope, more *just* energy outcomes.

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28

Energy Justice in Theory and Practice: Building a Pragmatic, Progressive Road Map

Mark Cooper

1 Introduction

Political Economy and the Energy Sector

In urging social scientists to engage in the "old-fashioned" practice of political economy, Piketty argues that economics is set apart from the others social sciences "by its political, normative and pragmatic purpose… The question it asked was: What public policies and institutions bring us closer to the ideal society?" (Piketty 2014, p. 574).

By this standard, there has been a long tradition of political economy in energy analysis. Triggered by the oil price shocks of the 1970s, the role of policy and politics in the energy sector has been undeniable, with a very refined analytic debate focused on market imperfections and failure in the energy paradox or efficiency gap literature (Cooper 2014a). This emphasis on the role of policy has been greatly magnified by climate change. Confronted

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with the urgent need to respond to a massive global externality, the analysis of policy to direct the market toward a specific outcome is central. In seeking to craft policy to respond to climate change, the role of institutions and inertia, of sunk costs and subsidies, could not be ignored. Seeking ways to break out of "carbon lock-in," analysts could not help but ask how the lock-in occurred in the first place (Pearson and Foxon 2012).[1] The role of policy choice made through the state became immediately clear. While the logic of the neoclassical recommendation to "just get the price right" still has an important role, the need for much more direct intervention in the market is also widely recognized.[2]

There is a second aspect to the magnification of the importance of political economy that is evident in the current energy sector policy debates. Once one recognizes that political action and policy play a crucial role in shaping the economy, the issue of the "values" that are being pursued inevitably arises. Equity and justice, values that were seen as separate and apart in the neoclassical school,[3] are an integral part of the political economy approach.

We can see this recognition of "values" in the literature on energy poverty,[4] which has been magnified by the challenge of climate change. Faced with a severe threat in the global commons, the global community confronts a dilemma of billions of people who lack access to electricity, a basic necessity

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[1] Their diffusion can be slowed by effects of path dependence and lock-in of earlier technology systems … high carbon technologies and supporting institutional rule systems have coevolved, leading to the current state of "carbon lock-in." For example, reductions in cost and the spread of infrastructure-supporting coal- and gas-fired electricity generation enabled the diffusion of electricity-using devices and the creation of institutions, such as cost-plus regulation, which encouraged further investment in high carbon generation and networks. This created systemic barriers to investment in low carbon energy technologies …. The proposition that industries or technologies whose ascendancy is threatened by new competition tend to respond, carries some weight. It also suggests that actors, such as large energy companies, with substantial investments in the current system and its technologies, and relatively strong political influence, are likely to act to frustrate the implementation of institutional changes that would support the implementation of low carbon technologies.

[2] Cooper (2014a) shows the link between the market imperfection analysis underlying the efficiency gap literature and the emerging approach to climate change.

[3] Alfred Kahn (1988, pp. 14–15) claimed the same goal as Piketty (2014), but hammered away at why economics was science, applied neoclassical concepts across the board and essentially claimed welfare economics to be the bible, declaring lawyers and policy analysts who did not embrace the marginalist economic theology to be doomed to live in purgatory, if not hell.

[4] "Energy poverty is lack of access to modern energy services. It refers to the situation of large numbers of people in developing countries whose well-being is negatively affected by very low consumption of energy, use of dirty or polluting fuels, and excessive time spent collecting fuel to meet basic needs. It is inversely related to access to modern energy services, although improving access is only one factor in efforts to reduce energy poverty. Energy poverty is distinct from fuel poverty, which focuses solely on the issue of affordability." https://en.wikipedia.org/wiki/Energy_poverty. "Modern energy services are crucial to human well-being and to a country's economic development; and yet globally 1.2 billion people are without access to electricity and more than 2.7 billion people are without clean cooking facilities." http://www.iea.org/topics/energypoverty/. .

for a modern standards of living and an increasingly important necessity for full participation in economic, social and political activity (Barnes et al. 2014; Bruce and Ding 2014). At the same time, on a per capita basis, advanced industrial nations exhibit consumption levels and release pollutants, particularly greenhouse gases, that are an order of magnitude higher than less developed nations.[5] Reconciling the legitimate aspiration of the many for a modern standard of living with the urgent need to reduce emissions is a moral challenge that magnifies the problem of responding to climate change.

The Papal Encyclical on climate change puts an exclamation point on this dilemma.[6] Although it was attacked by free-market-oriented climate deniers as antimarket, even Marxist,[7] and criticized by economists supporting climate policy as insufficiently appreciative of the role of markets and technology,[8] it was widely recognized as an extremely important development in the global debate over climate change and energy poverty.[9] More importantly, I believe that the Encyclical fits squarely at the intersection of the broad, contemporary field of political economy and the specific field of energy poverty/justice. The Encyclical recognizes the importance of technology and markets and reconciles the complementary roles of the scientific and religious worldviews by insisting that the science, technology and markets should be embraced only when they are guided by social values, one of the most important being the commitment to promoting social justice.

Purpose and Outline

The field of energy poverty and energy justice has received increasing attention over the past couple of decades and there is a strong consensus among analysts and policymakers that efforts to reduce energy poverty and establish energy justice are urgently needed, made all the more pressing by the need to

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[5] http://data.worldbank.org/indicator/EN.ATM.CO2E.PC, show US per capita CO_2 at over 40 times that of Bangladesh. https://en.wikipedia.org/wiki/List_of_countries_by_greenhouse_gas_emissions_per_capita, shows that North America is almost five times sub-Saharan Africa and Asia, while Europe is over twice as high.

[6] *Laudito Si,* June 18, 2011, Daniel Burke, "Pope Francis: "Revolution" needed to combat climate change," CNN, June 18, 2015. The Encyclical was leaked two days early, which some saw as significant, Jim Yardley and Elisabeth Povoledo, 'Leak of Pope's Encyclical on Climate change Hints at Tension in Vatican,' *New York Times,* June 16, 2015.

[7] Robert Wilde, "Climate Expert: Marxists, Global Warming Extremists control Vatican," Breitbat.com, June 13, 2015; Rushlimbaugh.com, "The Pope's Leaked Marxist Climate Rant," June 16, 2015; Denise Robins, "Conservative Media v. The Pope: The Worst Reactions to Pope Francis' Climate change Encyclical," Media Matters, June 18, 2015.

[8] Joseph Heath, "The Pope's Climate Error," *New York Times,* June 20, 2015.

[9] The *New York Times* ran front page and major stories five days in a row.

address climate change. This chapter builds directly on the development of the field by extending the conclusions of two recent, comprehensive reviews of the literature, Sovacool & Dworkin's *Global Energy Justice* (2014) and *Energy Poverty*, edited by Halff et al. (2014).

My objective is to reinforce their empirically grounded arguments on energy justice by suggesting improvements in three directions.

- Section 2 establishes a positive, progressive frame that recognizes that the current "crisis" is part of an evolutionary process that progressive capitalism has repeatedly, successfully navigated in the past.[10]
- Section 3 offers a comprehensive theory of justice that is consistent with the history of a progressive market economy.[11]
- Section 4 identifies specific policies to achieve justice in the energy sector, while preserving the dynamic economic and social forces of progressive capitalist markets.

In addition to establishing the fundamental conditions for justice in advanced capitalist economies, Sects. 2 and 3 establish the fact that energy consumption certainly qualifies as a primary good and fundamental capability that humans must have to participate fully in the economic, social and political activities of daily life in the twenty-first century. But energy is more than that; energy is the enabling resource for many, perhaps even most, other capabilities. Without energy justice, there cannot be social justice.

Section 4 supports the policies recommended to advance energy justice in two ways. First, having made the case for progressive market and capitalist economics, it emphasizes approaches that diminish the tension between progressive policies and economic efficiency. Second, it seeks to give the general

[10] I do not mean to suggest that Sovacool and Dworkin (2014) ignore progress. In fact, progress is clearly noted as important at the beginning and the end of the book. In this analysis, I extend the recognition of the importance of progress by arguing it fundamentally alters the terrain of justice. Humanity does not utilize electricity and fossil fuels in a vacuum; instead, our society depends on them and other modern energy services to enable importance of progress lighting, heating, communications and transport. Perhaps for these depends on them reasons … as the human population has grown, so has its use of primary energy, and so has its economic development.(p. 48) To be sure, history is full of examples where we have dramatically improved the efficiency of various energy technologies, sometimes in the time span of a few decades. In practice, we have not seen efficiency gains dwindling as "low hanging fruit" is consumed; instead, we have seen new paths to greater efficiency developing as technologies improve. The best example is the history of lighting, as human beings transitioned from open fires to candles up to incandescent lamps, through compact florescent bulbs and, now, LED (p. 312).

[11] While I rely on the work of Carlota Perez and Elizabeth Anderson, who have articulated a broad theory of economic progress and distributive justice (respectively) in numerous articles and books over decades, as discussed in Sect. 2, Daron Acemoglu and Jason Robinson, *Why Nation's Fail,* 2012, provides a theory that integrates the two aspects.

prescriptions that one finds in policy analyses specificity by grounding them on welfare economics, which has been informed by the theory of justice.

2 Capitalism and Progress

This section discusses the dramatic increase in material progress brought about by the capitalist and industrial revolutions and their implications for distributive justice, in general, and energy justice, in particular.

The Immense Leap in Material Well-Being

Global Energy Justice provides important data on several key energy-intensive activities that deeply affect daily life (heat, light, power and transportation). In Fig. 28.1, I augment that data with measures on population, income and total energy consumption, as well as technological change and developments

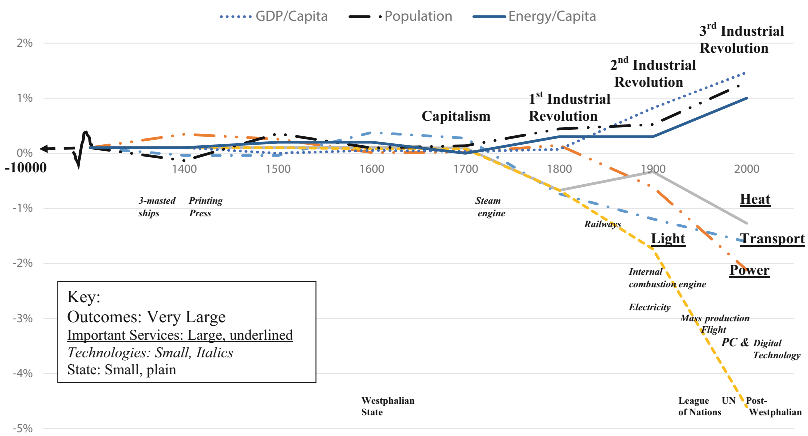

Fig. 28.1 Indicators of progress in human material conditions (*Sources*: Based on data from: Benjamin, K. and Michael H. Dworkin, *Global Energy Justice* (Cambridge University Press, 2014, pp. 48, 312), heat, light transportation, power; Douglas North, *Understanding the Process of Economic Change* (Princeton, Princeton University Press, 2005), p. 89 US Bureau of the Census, https://www.census.gov/populaton/international/data/worldpop/table_history.php, UN 1999 where available, average of lower and upper summary elsewhere. Wikipedia for 2000, https://en.wikipedia.org/wiki/World_population_estimates; J. Bradford De Long, Estimates of World GDP, One Million BC–Present, *Standard* Chartered, *Technology: Reshaping the Global Economy,* January 19, 2015, p. 11, technologies. https://en.wikipedia.org/wiki/Westphalian_sovereignty)

in the state. Figure 28.1 identifies rates of growth in key activities that define the material conditions in which people live. I use a 100-year view to calculate the rate of improvement, which is consistent with efforts to analyze distributive justice.

Lighting, heating, power and transportation are energy-intensive activities that receive a great deal of attention in the discussion of energy poverty and justice. Light, heat and power are central to defining the standard of living and, hence, the energy justice analysis. The direct link between energy consumption and income is also central to that discussion. Starting with the emergence of capitalism and accelerating in the industrial era, these four services exhibited a dramatic decline in cost, which made them affordable for an ever increasing number of people.

I include three measures of the overall outcome of the economic development process—population growth, output per capita and energy consumption per capita. North (2005, p. 89) points to population for an obvious reason:

> Statistical data … can get us part way in describing the magnitude of changes in the landscape. They provide dramatic evidence of the revolutionary changes in the human condition. Man's subjugation of the uncertainties related to the physical environment is most clearly manifested in the explosive increases in population since the beginning of the modern age in the eighteenth century …. [T]his dramatic change along with major development in knowledge, technological progress, and scientific breakthroughs that contributed to this explosive development.

The close correlation between GDP per capita and population is clear. GDP per capita and its growth have been the primary focal point of the analysis of economic growth and development for quite some time. The close correlation between GDP per capita and energy consumption per capita has also been a focal point of analysis.[12]

The graph also identifies several technologies that are widely seen as ushering in fundamental shifts in economic activity. An important and obvious point to be made is that these involve power and transportation technologies. Three of the recent examples involve energy—steam, internal combustion engine and electricity. Substituting mechanical power for human and animal power constitutes a major leap. The shift to electricity, considered a General

[12] The correlation coefficient between GDP/capita and energy/capital in the full period shown is 0.89. For the short period of the industrial revolutions (1800–2000), the correlation is 0.84. Other analyses of slightly different period (1820–2000) yield a correlation of 0.86 (see *An Optimistic Energy/GDP Forecast to 2050,* Peak Oil News and Message Boards, July 30, 2012).

Purpose Technology (Jovanovic and Rousseau 2005),[13] was one of the key factors in the second industrial revolution. Finally, at the bottom, the graph shows key developments in the structure of policy making. The nation-state was a key development that enabled the process of economic growth to gain traction (Acemoglu and Robinson 2012, Figure 5). The Westphalian state was a key development. Efforts to organize relations between states were the subject of a stream of treaties, but the graph shows the major efforts to organize multilateral relations in the twentieth century.

It is important to keep in mind that the graph is truncated. Prior to the year 1400, the rate of growth in the factors that affect material well-being was virtually nil. The data underscore the immense progress made in the material condition of society in the past three centuries. The dramatic change in the rates of progress is coincident with the emergence of capitalism and, in particular, the industrial revolution. The key message for the purpose of this analysis is strikingly clear. If we accept the proposition that human civilization dates back about 12 millennia, then the capitalist era is about 4% of human history. The industrial era covers the second half of that period. Measured by population, per capita income, heat, power, transportation, lighting, about 90 % of human progress has taken place in the most recent 2 % of human history, the very short period of capitalist industrialization.[14]

The Virtuous Cycle of Progress and the Potential for Justice

The progressive capitalist frame for a theory of justice launches from this dramatic change in the human condition. Obviously, it postdates much of the thinking of the ancient philosophers and early modern (preindustrial) political theorists who naturally make up a large part of the intellectual and cultural heritage of the Western concept of justice, as discussed at length the *Global*

[13] https://en.wikipedia.org/wiki/General_purpose_technology, lists all three of these among the general purpose technologies.

[14] Brad Delong, The History of the Global Economy since 1,000,000 BC, Business Insider, May 28, 2014, p.7, shows 97 % of GDP per capita and 87 % of population growth have occurred since 1800. The Wikipeida entry on general purpose technologies (GPTs) cited above, reinforces the point. It defines GPTs as technologies that can affect an entire economy (usually at a national or global level). GPTs have the potential to drastically alter societies through their impact on pre-existing economic and social structures. Examples include the steam engine, railroad, interchangeable parts, electricity, electronics, material handling, mechanization, control theory (automation), the automobile, the computer and the Internet. It lists 10 general purpose technologies spread across 11 millennia, from the neolithic agricultural revolution to the eighteenth century and 14 during the quarter millennium of capitalist industrialization, which suggest the rate of innovation is over 50 times as great.

Energy Justice. There has been a dramatic transformation of the terrain of justice in three ways.

- The capitalist industrial revolution has not only produced a dramatic improvement in the human condition, it has also created the possibility/hope/expectation that there will be a massive and continuing improvement in the material well-being of people. Mankind has been freed from endless poverty and expects continuous economic growth and improvement in material conditions.
- The improvement in material well-being comes with (and is in part dependent on) an increasing interdependence of economic activity (a refined division of labor and globalization).
- Increasing wealth and improvements in communications (which are made possible by changes in energy technology, i.e. electrification) have allowed more and more people to engage and participate more directly and forcefully in self-governance.

In the capitalist industrial era we no longer have to treat human history as a kind of zero-sum, depleting resource story. The current generation should not be chastised for overconsuming scarce resources as long as it produces the means to maintain and improve the prospects of future generations. For the past quarter of a millennium, the groundwork for a much higher standard of living has been laid by each successive generation. Perez (2002) argues that capitalist development needs to be progressive in the sense I use the term.

> Technology is the fuel of the capitalist engine (Perez 2002, p. 155).
>
> The potential for production and productivity growth is considerable. What is needed for its realization is a new space for the unhindered expansion of markets, favoring economics of scale and fostering a new wave of investment. This essentially means that adequate regulation … has to be established and an institutional framework favoring the real economy over the paper economy needs to be put in place … So the rhythm of potential growth is modulated by the qualitative dynamics of effective demand (Perez 2002, pp. 114–116).
>
> Since market saturation is one of the main limits encountered in deploying the growth potential of a technology revolution, ensuring consistent extension of markets is the way to facilitate the pursuit of those goals. Consequently, it is progressive distribution and worldwide advances in development that can best guarantee a continued expansion of demand (Perez 2002, p. 124).

The impact of progressive capitalism on the terrain of justice involves more than simple progress. It also reflects the structure and process by which capitalism creates progress. Two key processes are involved. A discussion of these broad issues is beyond the scope of this chapter and has been offered elsewhere (Cooper 2015). Here I emphasize two points that are central to the discussion of energy justice.

- First, the explanation asserts that capitalism has given birth to recursive feedback loops, virtuous circles and cycles, of creative destruction and construction that creates a spiral of progress.
- Second, the division of labor advances relentlessly, which ultimately increases human capital and promotes democratic equality.

The stark contrast between the twenty-first-century digital mode of production that is emerging and the twentieth-century mode of production described by Perez (2004, 2009) underscores this process in several ways. First, the mass market production of the twentieth century was very much driven by fossil fuel consumption. The digital mode of production is much more dependent on electricity. Second, technologies are emerging to power more and more activity with electricity. Third, the heterogeneity of products creates niche markets. Fourth, the new division of labor is much more global and complex, shifting a great deal of activity and autonomy to the edge of the networks.

The virtuous cycles of economic progress are interconnected in the sense that they tend to produce the key ingredients to solve the next great challenge that faces the economic system. Perez builds this into her model of capitalism by linking Schumpeter's concept of creative destruction to the equally powerful process of creative construction. The result is a spiral of development. While analysis of this process is also beyond the scope of this chapter, one aspect of the current phase of development is critical to the discussion of energy justice. Industrial revolutions produce the ingredients necessary to solve the challenges that they faced.

This is certainly true of the third industrial revolution in the energy sector, the electricity sector in particular. Dynamic technological development has produced the tools for the transformation of the energy sector that can solve the problem of climate change, while dealing with the challenge of energy justice. The central station model of base-load facilities combined with high cost peaking power and massive amounts of pollution, including greenhouse gas emissions, has been undercut by dramatically declining cost for distributed renewables and storage. The Information and Communications Technologies revolution has now made it possible to integrate and manage demand and supply rather than build central station, fossil-fuel-based powered facilities that passively follow load. Economic analyses of the cost of addressing energy justice that were offered as it became a topic of increasing attention a decade ago are obsolete as a result of dramatic innovation and competition (Cooper 2014b). An electricity sector centered on smaller scale, more flexible resources should facilitate and lower the cost of addressing both energy poverty and climate change. This technological revolution not only delivers affordable electricity, but it also does so in a manner that utilizes local resources and fosters local autonomy.

As has always been the case, however, there is a struggle between the incumbent and the new entrant technologies over the speed and ultimate configuration of the new system and which values will be expressed by the system. In short, the energy sector, in general, and the electricity sector, in particular, are at the "turning point" (Perez 2002) or "critical juncture" (Robinson and Acemoglu 2012) of the "quarter-life crisis of the digital mode of production" (Cooper 2013b). Political economy is about driving the economy in the right direction with policy. While the outcome is uncertain, the technological progress suggests that prospects are good for a successful deployment of the third industrial revolution.

3 A Broad Frame for Justice

Building on the intense discussion of energy justice presented in the two books noted in the introduction, the theory of distributive justice offered below is intended to provide a framework that makes the inclusion of progressive values and the policies that address energy poverty more compelling in the process of institutional recomposition that is taking place. Needless to say, this was the purpose of the Encyclical on climate change.

The analysis makes several basic points that lead to an important conclusion—distributive justice is not an afterthought to a dynamic economic system, it is an indispensable, core ingredient of success:

- Markets have a critical role as the driver of progress.
- The state plays an equally critical role with policies to guide the economy toward a stable growth trajectory and in a progressive direction by placing constraints on property and the accumulation of power.
- Egalitarian relationships are consistent with the need to advance the division of labor.
- Autonomy and choice for individuals plays a critical role in promoting efficiency and democracy.
- The convergence and synergy between an inclusive market and an inclusive state is necessary for progress to continue.

In their review of theories of justice, which is centered on Rawls, Sovacool and Dworkin point out several shortcomings that result from the narrowness of his concept that have been noted by other scholars. I believe that embedding the concept of progress at the core of a Rawlsian theory of justice results in a better (more realistic and useful) concept of justice and provides the necessary depth. Here, I rely on the work of Elizabeth Anderson, a student of Rawls, who identifies herself, Rawls (1999, 2001) and Sen (Anderson 2003) (among others) within a broader school of relational (or contractual) theorists. Over the course of two decades, she has articulated a comprehensive theory of "democratic egalitarianism." Table 28.1 presents the specifics of democratic egalitarianism as I interpret Anderson's work. It also provides citation to the encyclical on climate change, which tracks the distributive justice frame, as I interpret it.

The Market and the State

Anderson argues for the superiority of progressive capitalism because of its remarkable and unequaled success in improving the human condition as "an inherently dynamic economic system … distinguished … by the large scale of productive enterprises, requiring a fine-grained division of labor *within* the firm" (Anderson 2015a, pp. 8–9). She sees

> capitalism as expanding the scope of cooperation and trust by enabling people to reap gains from trade worldwide, bridging parochial divisions of nationality, religion, and ethnicity… an engine of cosmopolitanism.... The impersonality, anonymity, and openness of markets to all comers is favorably contrasted with social orders in which people are tightly constrained by parochial connections and loyalties of family, ethnicity, and neighborhood (Anderson 2000, p. 196).

She notes that socialism shares the aspiration but strongly favors capitalism for a variety of reasons that flow from the superiority of markets as economic institutions (Anderson 2007, p. 268) and as a stronger pillar on which democracy can be built. The resulting egalitarian system is what Rawls called a "property-owning democracy … contrasted … to a welfare state" (Anderson 2007, p. 268). Markets and democracy are linked because they rely on autonomous agents and have parallel reinforcing structures as information processing institutions that have superior performance.

Table 28.1 Democratic equality: the political economy of progressive democratic capitalism

Focus	Social purpose	Income level	Threat/problem	Policy tools/remedies	Derivative and complementary effect
Democracy[1,A]	Collective self-determination by means of open discourse among equals,[5] co-operative[6] social experimentation[9,B]	All the way	Oppression,[AA] Lack of respect[AB] Reciprocation [AC]	Pure procedural justice[2, BA] & substantive outcomes,[4, BB] institutions for discovery Discussion, decision, voting,[7, BC] dissent,[8, BD]	Humanitarian impulse,[3] Unfairness of bad luck
	Social relations of equality[10]		Segregation[12, AD]	Integration	Social basis of self-respect[13]
	Social basis of equal standing[11,C]		Disrespect, shunning		
	Epistemic justice[14] to create institutions to foster norms[16] of communicative justice[18, D] & expand scope of prosocial norms[20, E]		Prejudicial exclusion from meaning making activities[19, AE]	Education, [BE] integration[15]	Value-based individual action[17]
Property[1, F] owning markets[29]	Individual & collective responsibility, [25, G] agency[26, H] Recognize role of capital labor & firms,[34, I] understand capitalism's dynamism,[37] progress,[40, J] & risk management[41, K]	All the way & Global[30]	Inadequate surplus[22,AF] Misallocation of risk & reward[31, AG] Market failures[35] & behavioral factors[38, AH]	Division of labor[23, BF] careful[24] range constraint,[27,BG] progress[28,] Workplace governance[32, BH] Rich opportunity set[36, BI] Proper role of state & corporations[39, BJ]	Keynesian demand sufficiency Avoid stigma and pity[33]

Equality[42, L]	Entitlements set the thresholds[43, M] to achieve autonomy, equal standing, reciprocity[47] & personal independence[50, N]	Bottom	Poverty[44, AI] Subordination Insufficiency[48, AJ]	Distribution through the division of labor,[46, BK] redistribution through the development of human capital[49, BL] & the safety net,[51, BM]	Distributive fairness[45]
Independence	Ensure freedom to choose[52, O] Promote solidarity & community	Middle	Insecurity,[53, AK] Segregation	Social insurance (risk pooling) [54] as an entitlement[55]	Prevent envy
Constrain inequality[58, P]	Promote solidarity & community [Q], prevent leverage for advantage[59, R]	Top	Hierarchy,[56, AL] Segregation	Taxation,[57, BN] campaign spending limits, [BO] Integration	Promote mobility Prevent envy

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Table 28.1 (continued)

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2. 2007a, pp. 240, 241, 24.
3. 2008, pp. 260-261.
4. 2006, p. 11.
5. 1999, p. 332.
6. 1999, p. 321, 2008, pp. 264-265.
7. 1999, p. 332.
8. 2006, pp, 13, 15, 16, 17.
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12. 2010, pp. 7-16, 90.
13. 2010b, p. 90.
14. 2012a, 172.
15. 2012a, p. 171.
16. 2000, pp. 191, 192, 193.
17. 2012a, pp. 168-169.
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20. 2000, p. 196.
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41. 2015, p. 11, 2007a, p. 249.
42. 2007a, p. 242, 1999, p. 315, 2007a, pp. 264-265.
43. 2015b, p. 12, 1999, p. 289, 1999, p. 3, 2004b, 106.
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48. 1999, p. 318, 2007a, p. 266.
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50. 2004a, p.348, 350-351...352... 355, 2015a, 7.
51. 1999, p. 325, 2007a, p. 257, 2007a, pp. 256-256.
52. 1999, p. 314, 2007a, pp. 240, 242.
53. 2007a, p. 262.
54. 2007a, p. 255.
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56. 2013, p. 263.
57. 1999, p. 3.
58. 1999, p. 2.
59. 2007a, p. 264… 267.
60. 2008, p. 157.

Source: Encyclical Letter Laudato Si' of the Holy Father Francis on Care for Our Common Home, June 2015.

A) pp. 35, 106, 134, 148 134.
B) pp 114, 109, 132.
C) pp. 14, 15, 61, 70, 136.
D) pp. 12, 32, 33.
E) p. 168.
F) pp. 38, 69.
G) pp. 60, 87, 106, 131.
H) p. 154.
I) p. 92.
J) pp. 20, 74-75, 142-143
K) p. 98.
L) p. 70.
M) p. 36.
N) pp. 116-117, 143,147, 166.
O) pp. 74-75, 84, 91, 150.
P) pp. 121, 130.
Q) p. 160.
R) p. 142.
AA) pp. 34, 92, 117
AB) pp. 49, 87-88.
AC) p. 120
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BD) p. 134
BE) pp. 84, 153, 156.
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BL) p. 95.
BM) pp. 95, 136.
BN) pp. 126-127.
BO) pp. 131-132.

> Socially dispersed information can be transmitted in three forms: talk, votes, and market prices. Markets respond primarily to price information; democratic states primarily to talk and votes ….Prices transmit information about private preferences. But … the mere fact that a private preference is widely held does not make it a public interest. Talk is needed to articulate proposals to make certain concerns a matter of public interest; votes are needed to ratify such proposals (Anderson 2006, pp. 10, 14).

The key link between the market and democracy flows through the state. Democratic egalitarianism must be built through the creation of institutions. Anderson's view not only supports the view of a strong state, but takes it to a higher level by examining its role in constituting capitalism. The state is constitutive of the relations of production because it defines and enforces property rights and the relations both among capitalists and between capital and labor. "From an egalitarian point of view, property rights are artificial, *all the way down.* A primary role of the state in a market egalitarian system is to *define* a system of artificial property rights that realizes the freedom and equality" (Anderson 2007, p. 243). However, "[w]ith power comes responsibility. As economies became richer, the capacity of states to regulate distributions systemically grew, as did public demand for such policies" (Anderson 2015, p. 11).

The recognition of the role of the state in creating markets is the central dividing line one in only theories of progressive distributive justice, as it was in the economic theory of capitalist progress. "Thus, this isn't *laissez faire.* It's the popular use of state power to extend the privileges enjoyed by capitalists to everyone else … a fulfillment of the presuppositions of capitalist market exchange that Smith and Condorcet championed" (Anderson 2004a, p. 358). *Laisse faire* capitalism foregoes the central virtue of capitalism as a socioeconomic system by failing

> to grasp some ways in which capitalism advanced freedom and equality… in the concrete social relations and social meanings through which capital and commodities are exchanged. Contrary to laissez-faire capitalism, the conditions for sustaining these concrete capitalist formations require limits on freedom of contract and the scope of private property rights ….Capitalism enabled the mass of people to see themselves as entitled to respect and dignity in their commercial relations (Anderson 2004a, p. 347, 357–8).

The constraints placed on private action by democratic egalitarian societies include a number of market structural constraints that Anderson describes as central to the nature of advanced capitalist democracies. Anderson identifies an "integral part of advanced capitalist democracies" that amount to departures from laissez-faire "and should be seen as developments internal to the dynamics of democratic capitalism itself, rather than borrowing from fundamentally alien economic systems":

1. State provision of public goods, such as roads, public health programs and schools,
2. Centralized banking,
3. Regulation of the environment, securities markets, food and drugs, auto safety, and so on.
4. Social insurance and to a much smaller extent, "welfare,"
5. Laws enabling labor unions (weak in the U.S., but much stronger in Europe) (Anderson 2005, pp. 2–3).

The structural constraints include regulatory constraint on market power and monopoly rents or market failures that rig outcomes, but more importantly public policies to address market imperfections like infrastructural public goods, lack of appropriability that leads to inadequate research and development, and network effects.

> These considerations undermine … the idea of laissez-faire, of *unconstrained* pure procedural justice—the thought that just outcomes are whatever outcomes are produced by voluntary market transactions in a private property system based on "natural rights," letting the chips fall where they may. If justice requires state action, such as social insurance, to protect individuals against the "gale of creative destruction," then the state must be free to define *positive* (artificial, legal) property rights so as to enable such protection. A system of property rights must be justified systemically, in regard to its expected overall consequences (Anderson 2015, p. 11).

The Dynamic Structure of Democratic Egalitarianism

A just society is built on equality in interpersonal relations, which is defined by the autonomy and independence of individuals who have equal standing to make claims on one another. Equality is multifaceted, cutting across the major dimensions of social order—the economy, polity and civil society—and rests on an "expansive understanding of the social conditions of freedom" (Anderson 1999, p. 315). Anderson's framing of the division of labor links directly to the issue of inequality. Anderson's view is based on "principles for a just division of labor and a just division of the fruit of that labor," based on "joint production" that stands in contrast to regarding "the economy as if it were a system of self-sufficient Robinson Crusoes, producing everything by themselves until the point of trade" (Anderson 1999, p. 321).

The predicate for democratic equality in the economy is a "comprehensive system of joint production, workers and consumer regard themselves as collectively commissioning everyone else to perform their chosen role in the economy" (Anderson 1999, pp. 322–3). The primary tool for achieving interpersonal equality is a properly functioning division of labor, based on the recognition that all labor contributes to the output of a cooperative social endeavor. Placing the division of labor at the center of economic and social institutions also makes distribution of surplus through the division of labor the first pillar on which democratic equality stands. The distribution of surplus through the division of labor should reflect the interconnectedness of the roles. Recognizing the importance of each role underpins the key characteristics of democratic egalitarian relationships: equality and dignity. This has a direct and parallel predicate in the polity, expressed in the observation that "most people gain much more from other people's freedom of speech than from their own" (Anderson 1999, p. 332).

The distinction between capitalism and socialism has important implications here. For capitalism the "proper positive aim is not to ensure that everyone gets what they morally deserve, but to create a community in which people stand in relations of equality to others" (Anderson 1999, pp. 288–9), with equality defined as "sufficientarian" (Anderson 2007, p. 243). Anderson adopts the first two Rawlsian principles of justice (Chambers 2012)—universal basic liberties and inequalities attached to positions that are open to all under conditions of fair access—but she rejects the third, more controversial difference principle. She doubts the rationale that can "motivate redistributive policies that push equality beyond ensuring that all have a minimum income" (Anderson 1999, p. 2). Instead she defines the minimum in terms of social equality, which places a strong constraint on inequality at the bottom. "What is important is not that everyone has equal opportunities to acquire resources and fulfilling jobs, but that everyone has "enough"" (Anderson 2004b, p. 106).

As the division of labor transcends national borders, the principles of democratic equality apply to all workers, wherever they are located (Anderson 1999, p. 321). The reliance on the division of labor highlights the importance of investment in ensuring that workers have the tools to perform properly rewarded tasks within and the opportunity for upward mobility through the division of labor.

The range constraint that has been the focal point of democratic equality focuses primarily on income distribution, which exhibits productivity implications, because without a just income distribution, members of society either cannot be productive (primarily at the bottom or in the middle) or resources are wasted in unproductive activity (at the top). The need for an increasingly fine-grained division of labor does not mean it is free of constraints. Although efficiency "may require some form of hierarchy, they do not entail that those in authority exercise arbitrary power over their workers …. The question is about constitutional design for legitimate workplace government … limits on social inequality are necessary for freedom" (Anderson 2015, p. 10, 15).

Outcomes are "range constrained," not based on pity for those who fail or envy of those who succeed, but because constraints on the range of outcomes is indispensable to the proper functioning of a market-based economy and the achievement of the democratic equality that makes markets work (Anderson 2008b, p. 143). The ideal of equality in social relations helps us devise acceptable constraints at the bottom, in the middle and at the top. Progressive distribution of the surplus of the division of labor "calls for raising the income of low-wage workers in part on grounds of their entitlements as citizens, and in part on the ground that they play an underappreciated role in the economy" (Anderson 1999, p. 7). In the middle, the progressive division of labor succeeds with "a rich set of opportunities for people to engage in market activities according to their preferences … includes freedom to create, own, and operate private productive enterprises" (Anderson 2012, p. 1). Education and training are primary determinants of the location in the division of labor and mobility within it (Anderson 1999, pp. 325–326). She also places constraints on inequality at the top that go beyond equality of opportunity by adding the stipulation that "the super-rich don't use their wealth to undermine democracy—for example, by buying elections—or to oppress other people" (Anderson 1999, p. 2).

The extent of inequality exhibited in progressive capitalist society reflects a balance between individual and shared responsibility (Anderson 2007, p. 244). Personal responsibility reflected in the exercise of choice in the market—the willingness to bear risk to achieve reward—is a necessary, but not sufficient condition for democratic equality. When the consequences of choices undermine the ability to achieve equality there are conditions under which society must intervene to restore the opportunity of the individuals (Anderson 2007, pp. 257–258). One of the distinguishing features of debate about democratic equality is the demonstration that inequality must be constrained to its economically useful function as an outcome of the market which is "to provide the price signals needed to direct people's choices in developing and exercising their talents in ways that are valued by others" (Anderson 2008a, pp. 260–261).

Equality between individuals is a threshold question. It rests on the proposition that individual members of society need a number of capabilities at a specific level to participate as equals in society. The threshold level is progressive and far above merely avoiding poverty (Anderson 2008, pp. 253–254). That is, the standard of living necessary to support equality in interpersonal relations is defined by the general standard of living in the society and rises as the general standard of living does (Anderson 2007, p. 266).[15]

At the bottom, democratic equality "provides a safety net" (Anderson 1999, p. 325). The mechanisms include minimum wages, social disability and old age insurance and tax credits set at a level that meet the threshold requirement of social equality. These mechanisms correct a failure of markets "to cover numerous risks… at prices consistent with avoiding poverty" (Anderson 2007, p. 255). These thresholds occur in a progressive capitalist system as entitlements to promote the independence necessary as the basis for social equality. This social purpose is accomplished by the exercise of the fundamental institutional principle of placing a constraint on property (Anderson 2007, p. 268).

In the middle Anderson argues for security to ensure social equality and mobility to meet the individual desire to advance. Thus, a significant level of inequality is necessary not only to drive economic progress at the societal level through market incentives, but also to meet human desires for progress at the individual level. Here is where her rejection of the Rawlsian difference principle arises (Anderson 2007, p. 262). To establish the sense of security, the thresholds need to be defined as entitlements, thereby promoting autonomy and constraining property rights and market outcomes (Anderson 2007, p. 268).

While there is widespread condemnation of rentier wealth and its conspicuously wasteful consumption, Anderson bases her argument for constraints at the top on the opposite observation,

> The fundamental reason for egalitarians to seek constraints at the top is that income and wealth do not buy only frivolities. They buy political power and influence, access to positions of command, and superior social standing…. [T] o the extent that wealth does influence politics, ensuring the fair value of equal political liberties requires policies aimed at limiting the top and not just raising the floor. Otherwise, the rich will capture the political agenda and secure public policies that specially cater to their interests, thereby converting democracy to plutocracy (Anderson 2007, p. 264–267).

[15] The higher the general level of consumption, the more is needed by any particular individual to sustain a dignified appearance.

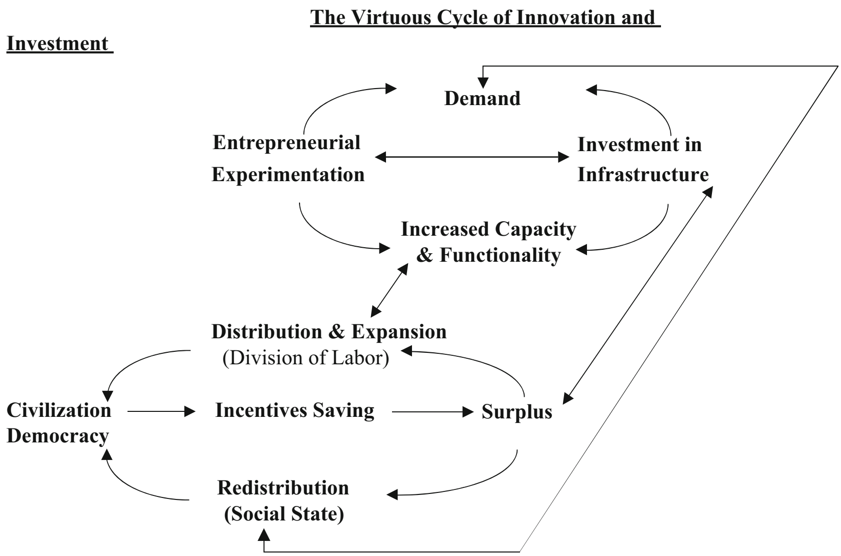

Fig. 28.2 Recursive loops of expanding output and democracy in the progressive, capitalist political economy

The key to my argument is that the terrain of justice evolves with economic development and the social institutions that are created to support it, as shown in Fig. 28.2. I emphasize three key recursive links between the economy and the system of distributive justice—the generation of surplus and the advance of the division of labor to support investment and growth and the social state to support demand. Expansion and distribution are two sides of the same coin. They are key links in a virtuous circle of rising civilization and surplus. The creation of surplus provides the resources to expand and improve material wealth, which allows civilization to advance.

Thus, the equitable distribution of surplus is not about charity or philanthropy or sympathy or even morality, it is about a fundamental structural condition for the sustainability of success, the need to have sufficient demand to drive the economic engine, and the recognition that the creation of surplus entails the supportive participation of a continually enriched labor force. I focus on distribution rather than redistribution because progress founded on a properly functioning division of labor that ensures a labor force capable of filling the division of labor. The broad distribution of resources necessary to support mass consumption and widespread savings is critically important to the long-term growth and stability of the system. Redistribution is an important and necessary feature of the mode of production that corrects flaws in the primary distribution of resources.

This concept of progressive capitalism is not a particularly extreme framing of the aspiration for the mode of production. In fact, it is at the core of the American progressive tradition. Sherer and Ross (1990, p. 4) identify several important measures of "good performance" that are generally considered progressive. Paraphrasing Sherer and Ross, we use a "multidimensional" definition of good performance that embodies an interconnect set of goals, each of which is progressive in a different way. The economy should:

- use resources efficiently and try to increase efficiency, in responding to consumer demands,
- take advantage of the opportunities opened up by science and technology to increase output, and provide consumers with superior new products,
- achieve long-run growth in per capita income by facilitating stable full employment of resources, particularly human resources
- and distribute income equitably.

4 A Pragmatic, Progressive Capitalist Framing of Energy Justice

In this section, I propose a pragmatic framework for a comprehensive theory of justice to respond to the challenge of energy poverty in a progressive capitalist economy. I outline a set of definitions and policy prescription for a progressive theory of justice to address energy poverty in the age of the digital mode of production. I do so by expanding and restating the "Energy Justice Framework" offered in *Global Energy Justice* along several dimensions on the basis of the earlier discussion in this chapter (see Table 3.1). Then I tie this framework, which reflects the energy poverty literature, back to the analysis of progressive capitalism and the principles of democratic equality offered in Sects. 1 and 2. Finally, I examine the welfare economics underlying and supporting progressive policies to advance energy justice.

Dimensions of Energy Justice

At a high level of generality, the discussion above suggests that a broad framework of justice must contain a number of key characteristics:

- **Broad** to include the full range of human capabilities, material, psychosocial, cultural and political.

- **Socially and culturally specific** because interpersonal relationships are the foundation of equality.
- **Sufficient** not just minimal levels, but levels sufficient to ensure democratic equality “all the way down” the income distribution.
- **Hierarchical** to reflect that the level of well-being starts with material well-being as the necessary but not sufficient condition of justice, and to recognize the increasing needs as one moves up the division of labor/income distribution.
- **Evolving** to capture the fact that the aspiration of well-being is continually expanding.
- **Global** to ensure that justice applies to all people.
- **Intergenerational** including the lifespan of those currently alive and at least the lifespan of the next generation, which equals roughly the 200-year view.
- **Progressive** to recognize that expanding surplus through the division of labor is paramount and redistribution is necessary to provide justice to the least well-off and powerless, supported by the most well-off who shoulder a greater burden, that is progressive taxation. Innovation should be rewarded, while indolence and abuse should be deterred and a crypto-plutocracy of the wealthy avoided.
- **Pragmatic** to reflect the fact that simplistic, extreme concepts tend to be based on erroneous assumptions that do not fit the complex reality of contemporary society; that a wide range of outcomes is possible and sustainable, and that directionality (improving performance) is important because justice is aspirational and evolving.

Table 28.2 shows the eight core principles (underlined) of the “Energy Justice Framework.” I have add to the framework in several ways. In the principles and practices section, I extend several of the definitions and concepts (in italics) and then I offer specificity for measurement and policy. I provide citations to the two main texts on which I have based the general framework. In the lower part of the table, I identify the economic principles, challenges and responses from a progressive capitalist point of view.

The first dimension along which I elaborate on the framework adds the depth of the broader framework of distributive justice. For example, consistent with the broad framework of democratic egalitarianism, I suggest the following approaches to the main definitions.

- Availability should be stated with respect to the median level of consumption of the broader society.

Table 28.2 A pragmatic, progressive approach to energy justice

Distributive justice principles and practice		
Principles	**Basic definitions**	**Extensions, measurement & policy**
Use		
Availability	People deserve no less energy than the median household consumes[2,a]	*Devote attention to surplus & least well-off* [1]
Affordability	All people, including the poor, should pay no more than 10% their income for energy services	Living wage level [c] Rates should be no higher than the median and people of should pay no more than 2× median as a % of income[e, 3] *Balance fiscal viability*[b] *and hierarchy of needs*[2,d] *Service not supply* [f] *Extensity and intensity of use*[,h]
Quality		Ensure adequacy, reliability and timeliness[g] Recognize and promote movement up the hierarchy of needs[4] Attend to strong complementary goods, skills[i]
Responsibility		
Individual responsibility		*Households must take some responsibility for cost*[j]
Social responsibility	All nations have a responsibility to protect the natural environment and minimize energy-related environmental threats	*Externalities*[5] *optimization, robustness*[6] Steadily increasing share of cost recovery as income and usage rises[9,k] Least-cost[7] conservation[l]
Intragenerational	All people have a right to enjoy a good life undisturbed by the damage our energy inflict on the world today	*Primary goods*[18] *Capacities*[m] All the way[n] Hierarchy of uses [o] reflect local needs systems (conformity, convenience, adequacy) [p] Open for all[1] Intergenerational
Sustainability	Energy resources should not be developed too quickly. Future generations have a responsibility to protect the natural environment and minimize energy related environmental threats	*Depletion* [9] *environmental harm*[10] Incentives to create recoverable/valuable resources [11] renewable resources[12,q] Preserving resources[13,r] to the maximum extent consistent with technology that maximizes use of local resources benefit[14,r]

(*continued*)

Table 28.2 (continued)

Transaction		
Due process	Countries should respect due process and human rights in their production and use of energy	*Technocracy & Exclusion*[12] Participatory governance[17] Subsidiarity, [18]
Information	All people should have access to high-quality information about energy and the environment and fair, transparent and accountable forms of energy decision-making	Information [16]

Capitalist challenges for implementing distributive justice		
Principles	**Challenges**	**Responses measurement & policy**
Manage externalities	Capture positive,[19] Reduce negative,[20]	Use a full range of policies, not just price[21]
Effectiveness of subsidies		
Dumb subsidies	*Confusion of means-ends* [s] *leakage,*[t] *exaggeration of cost and impacts*[22]	Smart subsidies [u,23] Recognize relatively small sums needed when targeted to promote access and adoption, Targeting with means testing [v] Reflect value of externalities (positive and negative) [24,w]
Monopoly bias	*Incumbent bia*[ax]	Competitive neutrality in funding of subsidies (Uniform tax rate for all potential suppliers, general revenue); Competition in supply to minimize cost (Reverse auctions)
		Competition in demand to maximize utility (consumer sovereignty through vouchers)
Administration	Chronic inefficiency, rigidity, corruption	Adaptive, flexible, effective, quality control, monitoring & evaluation
Market structure		
Excess cost:	*Failure to require least cost & over recovery*	Competition & regulation (IRP) to eliminate abuse of market power & unnecessary supply-side subsidies
Centralization	*Concentration of wealth & power*	Promotion of decentralized alternatives: employment of local resources,
	Diseconomies of scale	Improving fit between supply & demand, Autonomy
Inefficiency in consumption	*Waste, excess cost*	Promoting efficiency lowers bills, reduces subsidies, strengthens finance

Efficiency in cost recovery		
Cost causers do not bear cost	*Misplaced subsidies*	Marginal cost, Capture economies of scale, Social allocation of common costs to maximize users, not usage favoring small users (equal benefit, equal burden, standalone cost rules at the top)
	Shared responsibility	Consumer/subsidy, public/private, microfinance of amortized fixed cost

Sovacool, Benjamin, K. and Michael H. Dworkin, Global Energy Justice (Cambridge University Press, 2014)

1) p. 367
2) p. 350.
3) pp. 367-368.
4) p. 330.
5) p. 271.
6) p. 215.
7) p. p.376.
8) p. 11, 245.
9) p. 294.
10) pp. 108, 130, 149.
11) pp. 300, 314.
12) pp. 246, 314.
13) pp. 207-208.

14) pp. 248, 200.
15) pp. 5, 191, 130, 149.
16) pp. 213, 367.
17) p. 218.
18) pp. 214-216.
19) p. 245-252.
20) pp. 68-87, 124-129.
21) pp. 279-288, 358.
22) pp. 279-287.
23) pp. 279-287.
24) pp.256-262.
25) p. 125.

Antoine Halff, Benjamin K. Sovacool, and Jon Rozhon, Energy Poverty: Global Challenges and Local Solutions (Oxford University Press, 2014)

a) p. 153.
b) p. 259,
c) p. 259.
d) p. 301.
e) p. 263.
f) p. 96.
g) p. 56
h) pp. 47, 303.
i) pp. 57, 65.
j) p. 263.
k) p. 229.
l) pp. 264-295.
m) p. 3.

n) p. 172.
o) p. 407.
p) p. pp. 48, 50.
q) pp. 96, 315.
r) pp. 308, 311, 340.
s) p. p. 15.
t) pp. 250, 322.
u) p.363.
v) pp. 311.
w) p. p.311.
x) p. 316.

- Affordability should be some multiple of the median, perhaps defined by the concept of the living wage.
- Quality should recognize the hierarchy of needs "all the way up" the income distribution and the need for complementary goods and skills.
- Both individual and social responsibilities should be required. As usage increases, household responsibility for cost recovery should increase, with a crossover point at median income. Households below the median should get a benefit; households above it should bear some of the burden supporting those below, a burden that gradually increases as income and use continue to rise.
- Intragenerational equity should support the hierarchy of needs and must be nation specific. It should give (equal) weight to meeting basic needs but also encouraging mobility up the scale of consumption.

The second dimension of expansion, summarized in the lower part of Table 3.1, starts with the positive externalities associated with reducing energy poverty and improving energy justice. I emphasize the fact that there are a range of policies available to accomplish the goal. At the same time, the negative externalities of energy consumption must also be dealt with.

The other categories involve the challenge that ensuring progressive development imposes on efforts to use policy to advance justice. Many of these issues frequently occur in regulatory proceedings involving electricity. For example:

- Market power abuse resulting in excess profits and in rates that are higher than need be.
- Failure of least cost planning due to incumbent resistance when technology/resource options do not maximize their profits, again resulting in rates that are higher than need be.
- Mis-targeting of subsidies.
- Inefficiencies that stem from ineffective administration of subsidy programs.

Leakage (mis-targeting) and ineffective administration receive a great deal of attention (Koplow 2014; Palit et al. 2014; Bordoff 2014). General subsidies, whether on the supply or the demand sides, lower rates for all consumers, rather than target subsidies to the needy. Ineffective administration consumes resources rather than delivering them to the intended targets. Administrative inefficiency should not be allowed to obscure the fact that there are many other barriers to energy justice that must be overcome.

Beyond better targeting and administration, cost allocation rules can be applied that distribute cost burdens in a manner that is socially responsible and economically efficient. Joint and common costs, which are large in the centralized electricity structure can be recovered from those most able to pay. Nevertheless, even with rate reform and progressive cost allocation to favor the under- and unserved, it is important to recognize that while this will reduce energy poverty and injustice, it is unlikely to be enough to eliminate them. Explicit subsidies will be necessary and they should be well-targeted and explicit.

Links Between the Progressive Justice Framework and Energy Poverty

Perez emphasizes the comprehensive nature of technological revolutions, arguing that the techno-economic paradigm must find a compatible and supporting socio-institutional framework to succeed. This comprehensive vision of the socioeconomic structure of society is central to Anderson's democratic egalitarianism and the Encyclical on climate change. Overcoming energy poverty can be defined in these terms as well. Energy consumption is seen as dramatically altering a relatively unproductive, very local division of labor and transforming the social roles of the most powerless among the poor, women and children (Barnes et al. 2014; Bruce and Ding 2014). Many of the economic benefits claimed for the reduction of energy poverty, particularly rural electrification, entail increasing productivity to free labor for "higher," uses, for example education for children, more productive work for women (Barnes et al. 2014; Sovacool 2014). The opportunity to engage in new forms of production expands the local economy and the division of labor (Socacool 2014; Banerjee et al. 2014). The micro-local economy may create or be drawn into a broader local and regional economy (Sovacool 2014).

This concept of comprehensive socioeconomic impacts leads directly to an adaptation of the principle of "all the way down" the income distribution, although in the energy poverty context it is "all the way up." While it is important to get the most basic level of service to the entire population, the full benefit of eradicating energy poverty cannot be realized unless households can consume energy for a wide range of purposes that are widespread throughout the population (Sovacool 2014; Barnes et al. 2014; Bruce and Ding 2014; Farhar et al. 2014; Januzzi and Goldenberg 2014). This is the essence of Anderson's concept of democratic egalitarianism.

At the same time, while the framework of distributive justice requires support to much more than subsistence levels of consumption, it also requires that users assume some responsibility for the costs (Van Leeuwen and Ruff 2014). The share of the cost that can be borne by the household must be sensitive not to make it unaffordable (Palit et al. 2014). As consumption and income rises, the share borne by the household could increase (Benali and Barrett 2014).

Perez emphasizes the critical role of finance capital in the process of progress in two regards, one positive and one negative. Suffering from stagnating growth in returns in the mature economy, finance capital goes in search of higher returns by providing initial support for the technological innovation that will trigger the next cycle of economic development and expansion. As the new techno-economic paradigm expands, finance capital is prone to excessive financialization and abuses. These abusers must be restrained by regulation and the economy guided toward a stable trajectory of progressive growth.

We can see analogies to these two important roles for finance in efforts to reduce energy poverty and increase energy justice. Finance is widely recognized as central to starting the process of reducing energy poverty and that the funding of increased energy consumption must be placed on a stable, sustainable basis (Banerjee et al. 2014; Palit, Bhattacharayya, et al. 2014; Zuzhang 2014).

The Economics of Progressive Policy to Reduce Energy Poverty and Promote Energy Justice in Market Economies

Market Imperfections and the Need for Policy

Much of the discussion in Sect. 3 above brings us back to the discussion of market imperfections and market failure introduced at the beginning of the chapter. A World Bank study of energy poverty programs puts an exclamation point on this dimension of the analysis.

> The argument is a simple utilitarian one: the marginal benefit to the low-level consumer exceeds that to the high-end consumer; reducing the consumption of the latter by charging a higher price to raise the consumption of the former results in a net welfare gain.
>
> The strength of this argument is reinforced by the fact that low-income households may be willing to pay but cannot afford to… [T]he absence of credit markets means these households are not in a position to spread the payment in this way. The two solutions are to fill the gap in the credit market and

to subsidize the connection fee for poorer households. As argued earlier, the market can be segmented by the connection lag, allowing an increase in both the utility's financial performance and the economic return to the project (White et al. 2008; see also Banerjee et al. 2014).

This observation on a willingness to pay that goes unfulfilled is a classic market imperfection, inadequate capital available to some groups to meet a need that can profitably be supplied. In the broader framework discussed here, it entails a maldistribution of surplus. The discussion of energy poverty has identified numerous other market imperfections,

- Negative externalities: pollution and climate change.
- Positive externalities: improved education of children, liberation of women for more productive work, more productive rural enterprises.
- Market structure: abuse, fragmented markets, lack of complements, regulatory obstacles.
- Transaction cost: information, risk.
- Endemic problems: principle agent, perverse incentives, lack of capital.
- Behavioral problems: motivation, inability to assess information or execute actions.

A full discussion of these is beyond the scope of this chapter,[16] but several observations are helpful. First, claims that progressive policy are incompatible with market economics, grounded in laissez-faire economics, should be rejected based on the same progressive principles that were offered in rejecting the broader theory of laissez-faire economics. They involve both the question of social valuation and the analysis of market imperfections that drive markets far from optimum outcomes. Progressive policies can promote market success.

Second, the presence of significant market imperfections should put the use of "price signals" in perspective. "Putting a price on pollution" addresses one market failure—the negative externality. Since price does not address the other market failures, price alone cannot be expected to solve the problem. Indeed, relying on price alone will either lead to a significant shortfall (as other imperfections blunt the effectiveness of price) or an extremely heavy burden (as very high taxes are needed to elicit the necessary response). Sovacool and Dworkin are well aware of this in their presentation of policy. They start with the obvious, pricing of pollution, but add a host of other policies to address other market imperfections and failures (Sovacool and Dworkin 2014, pp. 145–146, 246–255, 280–286).

[16] Cooper (2014a) provides a discussion that links the energy efficiency and climate change literatures.

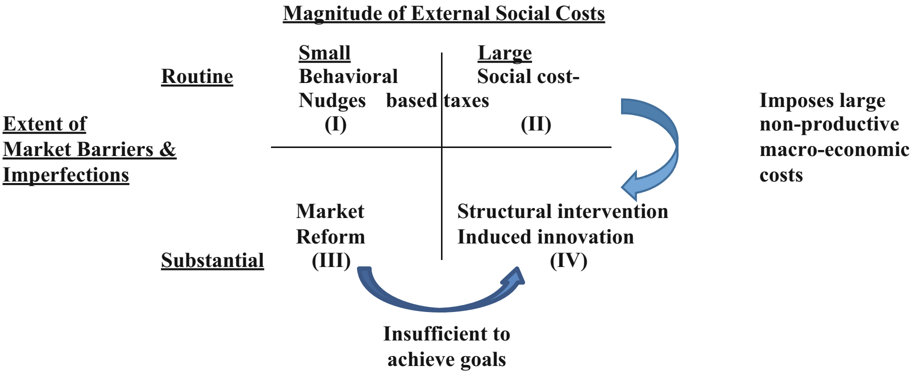

Fig. 28.3 Externalities magnify the importance of policy challenges and responses

The larger the externality and the more important and pervasive the market failures, the greater the need for other "complementary" policies. Since climate change is such a large externality that requires the complete displacement of the incumbent energy system, these other market failures become paramount. Price is still important, but it is the "complementary" policy. The same is true of energy poverty. The full array of market imperfections and market failures, and then some, afflicts, and many are magnified, in the low-income segment of the energy market.

At a high level, the most important implication of this broadening of the framework to include large externalities is to underscore the need for vigorous policy action to address a problem that is now seen as larger and more complex than it was in the past (see Fig. 28.3). It is the combination of substantial market imperfections and large externalities that demonstrates there is an urgent need for vigorous policy action.

If market imperfections are routine and the social costs of poor market performance are small (cell I), modest policies like behavioral nudges may be an adequate response. If market imperfections are small and costs are large (cell II), then price signals might be sufficient to deal with the externalities. If market imperfections are substantial but costs are small, market reform would be an appropriate response (cell III), since the slow response and long time needed to overcome inertia does not impose substantial costs. If both market imperfections and social costs are large (cell IV), more aggressive interventions are in order. The challenge is to choose policies that reduce the market barriers in an effective (swift, low cost) manner.

Over the course of the last decade, the climate change analysis has come to highlight the question of the extent to which market processes through the reaction to price increases can be relied upon, or policies that seek to direct, target and accelerate technological innovation and diffusion are needed. The evidence suggests that the cost of inertia is quite large, whereas targeted approaches lower costs and speed the transition (Acemoglu 2012). There are three parallels in the energy poverty policy arena. First, the positive externalities associated with reducing energy poverty are very large in terms of improved utilization of human and local resources. Second, the costs are small relative to the large investment made in maintaining the energy sector.[17] Third, the decentralized nature of the new technologies yields substantial positive externalities for the local economy (Sovacool 2014; Palit et al. 2014; Bordoff 2014. Benali and Barrett 2014; LaRocco 2014).

The challenge is to choose policies that reduce the market barriers in an effective (swift, low cost) manner. Given the importance of energy poverty, the magnitude and nature of climate change and the extensive nature of market imperfections, reinforced by inertia that must be overcome rapidly, each of the policy approaches has a role to play and an "all of the above" approach is in order. But, the structural change is vital because it influences how effective the other policies can be. The sequence is important because addressing severe market failure that have large social costs can impose an extraordinary burden on society. The farther and faster structural change is implemented, the easier it is for the other policies to work.

The Welfare Economics of Policy to Address Energy Poverty

An analysis by Madrian (2014) of the value of bringing behavioral economics into the policy picture provides a useful framework to summarize this argument (see Fig. 28.4). While much of welfare economic analysis, particularly with respect to climate change, focuses on why people consume too much and policies to suppress demand. She considers the opposite situation. Using vaccination as an example, she focuses on why people do not consume enough, since vaccination has both private and social (public) benefits. This is analogous to the problem of energy poverty, where increasing consumption would have both private and public benefits. Interestingly, she starts with a situation that is analogous to the World Bank observation on the willingness to pay:

[17] There is a strain in the energy poverty literature that points out that while the gross cost of a comprehensive response may seem large, relative to the massive amounts of capital put into maintaining the current structure, it is quite small (see Sovacool 2014; Bazilian et al. 2014). The implication here is that the positive externalities do not have to be large to yield substantial net social benefits.

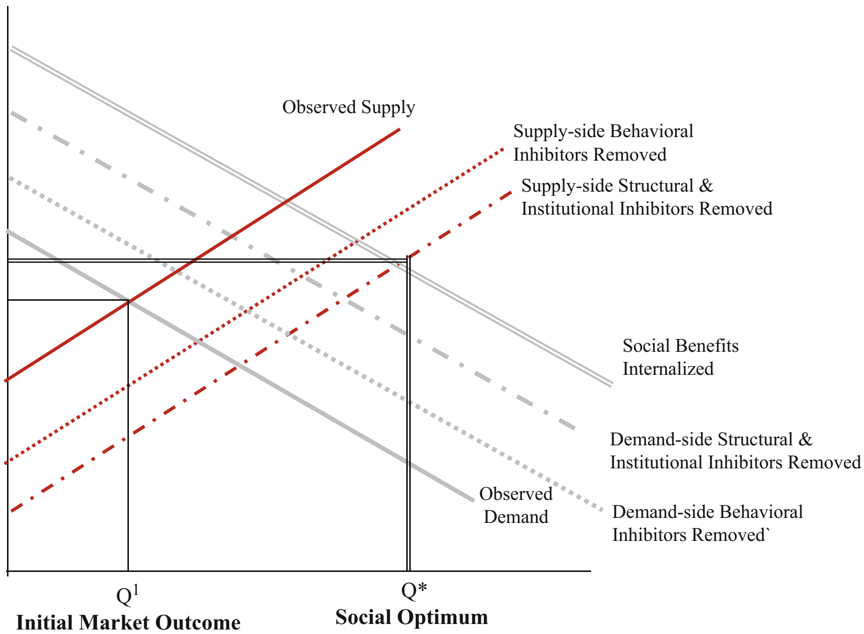

Fig. 28.4 A welfare economic view of market barriers and positive externalities incorporating all demand and supply-side sources of market failure

> Sometimes individual preferences may be much closer to the social optimum than what is observed in the market. If so, there must be some barrier to behavior change other than the private marginal cost exceeding the private marginal benefit; in this case, helping individuals execute on their preferences may go a long way toward social efficiency (Madrian 2014, p. 10).

The many market imperfections we have identified above are "other barriers." However, she also identifies the situation in which the marginal cost exceeds the marginal benefit, which also applies to energy poverty.

> If, alternatively, there is a significant wedge between what is individually and what is socially optimal, then there may be a role for policy in changing the cost-benefit calculation. In some cases, this may be best accomplished through the traditional tools of public policy. In others, there may be more cost-effective approaches to increasing the private marginal benefit or decreasing the marginal cost to effect behavior change (Madrian 2014, p. 11).

Madrian is focused on behavioral barriers that shift the demand curve to reduce that amount of a good that consumers buy with a positive externality.

Behavioral nudges can move consumers closer to the social optimum. In this analysis, I have identified market structural, transaction cost and institutional barriers in addition to behavioral factors that drive consumer purchases farther from the optimum.

In Fig. 28.4, I identify supply-side market barriers that inhibit investment in and output of the good, moving it away from the optimum. I have constructed Fig. 28.4 to generally reflect the magnitude of effects suggested by the literature on both energy poverty and climate change.

- Behavioral factors are a modest part of the problem.
- Structural and institutional factors are at least as important as behavioral and they affect both the supply and the demand sides.
- The supply side is at least as important as the demand side.
- The externality market failure is a large cause of the underinvestment, although smaller than the market structure, institutional and behavioral.
- The increase in price at the optimum would be modest. If the array of market imperfections is addressed, the cost is much lower than expected.

Figure 28.5 focuses this welfare analysis on energy poverty. It provides a welfare economic conceptualization for the concepts offered in Table 28.1. The upper graph in Fig. 28.5 locates the concepts in terms of the three supply curves implicit in the Table 2, above. The current approach to pricing (dashes), correcting misguided subsidies and applying progressive cost allocation principles (plain text), socially responsible pricing that includes well-targeted and carefully implemented subsidies (bold). Real world examples include linkup programs that subsidize or eliminate the connection fee, lifeline programs that subsidize the monthly bill, with specific discounts and/or percentage of income caps. The latter enables the subsidy to shrink as income grows. All this is built on an increasing block rate structure, with an initial block that covers the basic needs—that is it is sufficient (Sovacool and Dworkin 2014, pp. 246–255, 358–366,; Januzzi and Goldenberg 2014).

The lower graph shows the net increase in consumer surplus and total social surplus in welfare economic terms. The difference in value between low-income households and others is captured by showing two different demand curves. Under current pricing, many low-income households are priced out of the market, a problem that is compounded by other market barriers. Raising prices for middle- and upper-income households reduces usage, but does not result in much cord cutting. Lowering prices for low-income households increases penetration. The gain in consumer surplus and total surplus resulting from the latter exceeds the former by a wide margin. The deadweight efficiency loss is quite small.

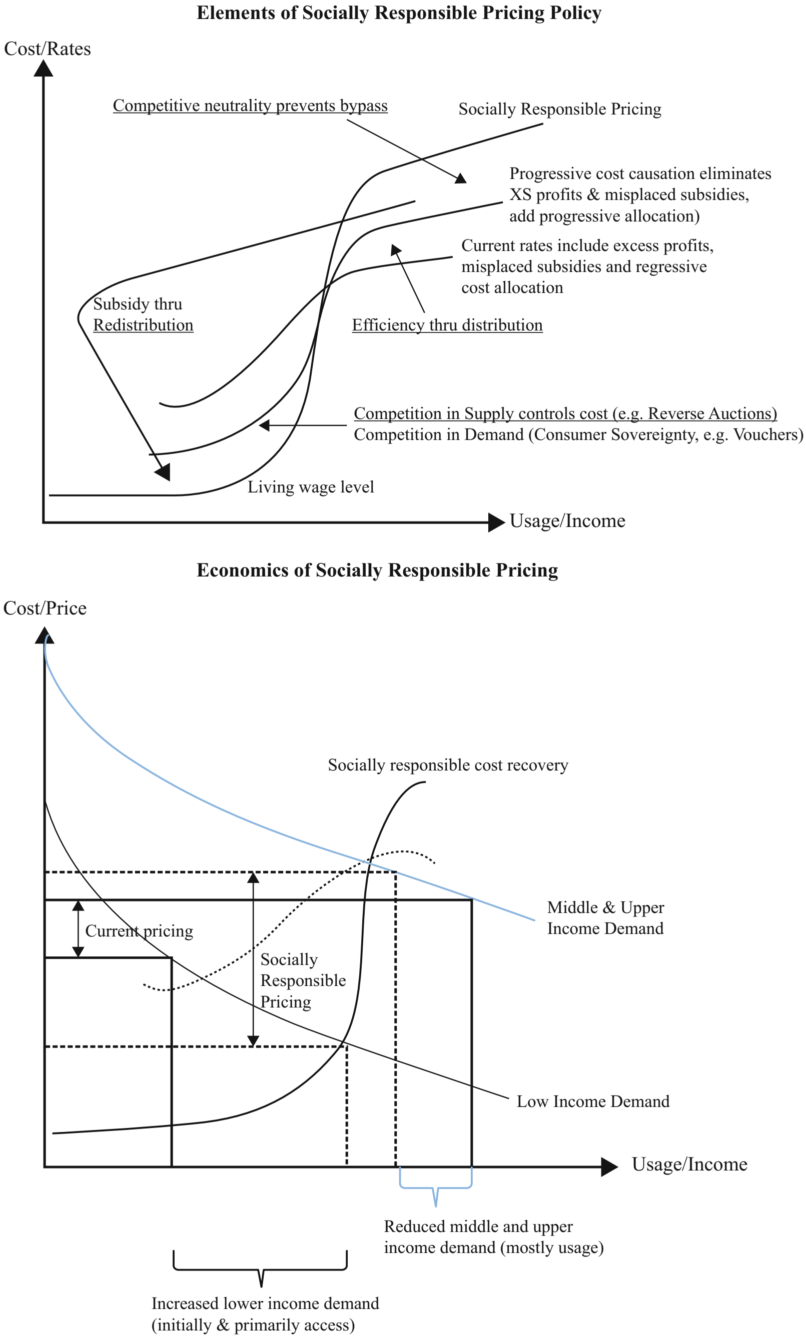

Fig. 28.5 Social pricing to achieve energy justice and maintain market discipline

5 Conclusion

In this chapter, I have embedded the burgeoning literature on energy poverty and energy justice as summarized in two recent comprehensive reviews into a broader framework of economic progress and distributive justice.

In Sect. 1, I have shown that the capitalist and industrial revolutions have yielded remarkable improvement in the material condition of human society, so much so that they have transformed the terrain of distributive justice. In the short span of a quarter of a millennium, humans have been liberated from 11 millennia of grinding poverty. They now aspire and expect conditions to improve.

In Sect. 2, I have argued that the dramatic increase in material conditions reflects the fundamental progressive nature of capitalism. Distributive justice is not an afterthought or adjunct to the capitalist system, it is a central and crucial component of sustained capitalist success. In each of the three great industrial revolutions there was a "turning point" or "critical juncture" in which capitalism turned in a progressive direction to achieve a stable growth trajectory. The third industrial revolution is at its turning point.

Energy justice fits squarely within this framework. Energy is a prime or basic commodity that is essential to economic and social development. Energy use is one of the central factors that define the mode of production. Without energy justice, there can be no social justice. Moreover, the third industrial revolution has laid the groundwork for deployment of decentralized technologies that not only have the potential to replace the dominant energy source of the second industrial revolution (fossil fuels), but also the character of these technologies, which are smaller in scale and more reliant on local resources, reinforce key thrusts of the direction that distributive justice must head.

After building a stronger analytic and empirical base for confronting energy poverty from within the theory of distributive justice, Sect. 3 elaborates on the nature and implementation of policies to achieve energy justice in two ways. First, more precise and comprehensive definitions and measurements of energy justice are articulated. Second, the article shows that the claim that there is a fundamental conflict between progressive policies and economic efficiency overblown and, in general false. Using a welfare economics framework, I show that correcting market failures and targeting subsidies with progressive policies can advance the cause of energy justice with small subsidies that result in increases in the welfare of those living in energy poverty more than the decrease in welfare imposed by taxes (to fund subsidies) on those above the poverty line. The result is in an improvement in energy justice and an increase in total social surplus.

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