Sustainable Management, Wertschöpfung und Effizienz

In dieser Schriftenreihe stehen insbesondere empirische und praxisnahe Studien zu nachhaltigem Wirtschaften und Effizienz im Mittelpunkt. Energie-, Umwelt-, Nachhaltigkeits-, CSR-, Innovations-, Risiko- und integrierte Managementsysteme sind nur einige Beispiele, die Sie hier wiederfinden. Ein besonderer Fokus liegt dabei auf dem Nutzen, den solche Systeme für die Anwendung in der Praxis bieten, um zu helfen die globalen Nachhaltigkeitsziele (SDGs) umzusetzen. Publiziert werden nationale und internationale wissenschaftliche Arbeiten. Die Reihe *Sustainable Management, Wertschöpfung und Effizienz* wird von Gregor Weber, Markus Bodemann und René Schmidpeter herausgegeben.

More information about this series at http://www.springer.com/series/15909

Gregor Weber

Sustainability and Energy Management

Innovative and Responsible Business Practices for Sustainable Energy Strategies of Enterprises in Relation with CSR

Springer Gabler

Gregor Weber
Breunigweiler, Germany

Bucharest University of Economic Studies, Doctoral School in Business Administration, Bucharest, Romania, 2016

PhD supervisor: Prof. Univ. Dr. Marieta Olaru

Sustainable Management, Wertschöpfung und Effizienz
ISBN 978-3-658-20221-7 ISBN 978-3-658-20222-4 (eBook)
https://doi.org/10.1007/978-3-658-20222-4

Library of Congress Control Number: 2017959554

Springer Gabler

Printed on acid-free paper

This Springer Gabler imprint is published by Springer Nature
The registered company is Springer Fachmedien Wiesbaden GmbH
The registered company address is: Abraham-Lincoln-Str. 46, 65189 Wiesbaden, Germany

Dedication

To my loved family

To my dear wife Rita and my precious children Jasmin and Miriam who always were so supportive and patient with me while working on this research and "dreaming up crazy ideas".

And to my parents, Mathilde and Alois, without whom this project ever would have been worked on.

Table of Contents

List of Abbreviations

AA 1000	Standard Account Ability, a standard for ethical performance constructed by the organization ISEA
ACT-ORANGE	sustainability initiative founded and operated by the author
AHK	German chamber of foreign trade (Außenhandelskammer)
AIPM	Australian institute of project management
AöR	Public law institution (Anstalt öffentlichen Rechts)
ASE	Academia de Studii Economice din Buchuresti (Bucharest University of Economic Studies)
B2B	business to business
B2C	business to customer
BAFA	German Federal office for economic affairs and export control (Bundesamt für Wirtschaft und Ausfuhrkontrolle)
BCOT	Benefits-Cost-Opportunities-Threats analysis
bdew	Federal Association of the German energy and water industry (Bundesverband der Energie- und Wasserwirtschaft)
BDI	Federation of the German Industry (Bundesverband der Deutschen Industrie e.V.)
Bet	Institute for energy economics and technical consulting (Büro für Energiewirtschaft und technische Planung)
BMF	German Federal Ministry of Finance (Bundesministerium der Finanzen)
BMU	German Federal Ministry of Environment (Bundesministerium für Umwelt)
BMW	Bayrische Motorenwerke (German car manufacturer)
BMWi	German Federal Ministry of Economy and Energy (Bundesministerium für Wirtschaft und Energie)
Bn	billion
CCI	Chamber of Commerce and Industry
CEO	Chief Executive Officer
CHP	Combined heat and power
CO_2	Carbon dioxide
corp.	corporate
CR	Corporate Responsibility
CRI	Corporate Responsibility Index
CRR	Corporate Responsibility Rating
CS	Corporate Sustainability
CSI	Corporate Social Innovation

CSP	Corporate Social Performance
CSR	Corporate Social Responsibility
CSUD	Council of Doctoral Studies
dena	German energy agency (Deutsche Energieagentur)
DENEFF	Initiative of German enterprises for energy efficiency (Deutsche Unternehmensinitiative Energieeffizienz)
DIHK	Deutscher Industrie- und Handelskammertag (Association of German Chambers of Commerce and Industry)
DIN	German industry norm (Deutsche Industrie Norm)
DIW	Deutsches Institut für Wirtschaftsforschung (German Institute for Economic Studies)
DJSI	Dow Jones Sustainability Index
DLR	German Institute for aerospace (Deutsches Institut für Luft- du Raumfahrt)
DNK	German Sustainability Codex (Deutscher Nachhaltigkeits-Kodex)
DWD	Deutscher Wetterdienst (German Weather Service)
EBM	Energy consulting for SME program of the German government (Energieberatung Mittelstand)
EC	European Commission
ECO	Ecological
EDL-G	German Energy Service Law (Energie Dienstleistungs-Gesetz)
EEA	European Environment Agency
EED	European Energy Efficiency Directive
EEG	Renewable Energy Law, Germany (Erneuerbare Energien Gesetz)
eff.	efficient
EFQM	European Foundation of Quality Management
e.g.	exempli gratia (for example)
EMAS	European Environmental Management and Auditing Scheme
EnEff	Energy Efficiency
EnEV	German Energy Saving Ordinance (Energie Einspar Verordnung)
EnMS	Energy Management System
EnPI	Energy Performance Indicator
EMS	Environment Management System
EN	European industry norm
EPBD	Energy Performance of Buildings Directive
EVPG	Energy related product laws (Germany)
et al.	et alii (and others)

etc.	et cetera (and so forth)
ETS	Emission Trading Scheme
EU	European Union
Euro/a	Euro per year (Euros per annum)
ewi	Institute for energy economics (Energiewirtschaftliches Institut Uni Köln)
FHL	Frankfurter Lohenheimer Leitfaden (CSR rating guideline by the universities of Frankfurt and Hohenheim, Germany)
FSC	Forest Stewardship Council
FÖS	Green Budget Germany (Forum Ökologisch-soziale Marktwirtschaft)
GDP	Gross Domestic Product
GER	Germany
GHG	Greenhouse gas
GRI	Global Reporting Initiative
GWh	Gigawatt hours
GWh/a	Gigawatt hours per annum (per year)
gws	Institue for economic structure research (Gesellschaft für wirtschaftliche Strukturforschung)
HR	Human Resources
HVAC	Heating-Ventilation-Air Condition
ICB	Internet Citizen's Band (internet conferencing)
ICMLG	International Conference on Management, Leadership and Governance
ICT	Information and communication technology
Ifeu	Institute for energy and environmental research (Institut für Energie- und Umweltforschung)
IHK	Chamber of Industry and Commerce (Industrie- und Handelskammer)
ILO	International Labour Organization
IÖW	German institute for ecological economy research
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
ISEA	Institute for Social and Ethical Accountability
ISO	International Standardization Organization
ISR	Individual Social Responsibility
IT	Information Technology
iza	Institute for the study of labour
KfW	German Bank for Reconstruction (Kreditanstalt für Wiederaufbau)
KIBS	Knowledge Intensive Business Services

KMU	Kleine und Mittlere Unternehmen (= SME: Small and Medium Enterprises)
KPIs	Key Performance Indicators
kWh	kilowatt hours
kWh_{el}	kilowatt hours – electrical energy
KWK-G	German law for combined power and heat (Kraft-Wärme-Kopplungs-Gesetz)
LED	light emitting diode
LEEN	Learning Energy Efficiency Network
LOHAS	Lifestyle of Health and Sustainability
min.	minutes
Mgmt.	Management
MS	Management system
MSC	Marine Stewardship Council
MTOE	Mega Tons Oil Equivalent
NAPE	simultaneously used to NEEAP: German National Energy Efficiency Plan (Nationaler Aktionsplan für Energieeffizienz)
NEEAP	simultaneously used to NAPE: German National Energy Efficiency Plan (Nationaler Aktionsplan für Energieeffizienz)
NGO	Non-governmental Organization
OECD	Organization for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
OPM3	Organizational Project Management Maturity Model
P2M	Project management for enterprise innovation
P&R	Peschla & Rochmes (company)
PA	Planned level of Activity
PDCA	Plan-Do-Check-Act cycle
PEC	Primary Energy Consumption
PEI	Primary Energy Intensity
PM	particular matter
PMBOK	Project management body of knowledge
PMCDF	project manager competency development framework
POS	Point of Sales
ppm	parts per million
PQ	per quantity
PR	Public Relations
Prince2	Projects in controlled environment (project management methodology)
PU	per unit

PV	Photovoltaics
QMS	Quality Management System
QUT	Queensland University of Technology (University in Brisbane, Australia)
r2b	r2b energy consulting
R&D (RND)	Research and Development
RASI	Responsibility-Approval-Support-Information
RE	Renewable Energy
ROI	Return on Investment
RO	Romania
RMIT	Royal Melbourne Institute of Technology (University in Melbourne, Australia)
SA 8000	Auditable social certification standard
SAAS	Social Accountability Accreditation Services
SCADA	Supervisory Control and Data Acquisition
SIM	Subscriber identify module
SMART	Specific-Measurable-Achievable-Relevant-Time bound
SME	Small- and Medium sized Enterprise
SMS	Security Management System
SOI	Sustainability Oriented Innovation
SSM	Security Management System
SR	Standard Romania
SRU	German Advisory Council on the Environment (Sachverständigenrat für Umweltfragen)
SWOT	Strength-Weaknesses-Opportunities-Threats analysis
tCO_2	tons of Carbon dioxide
TEHG	German greenhouse gas and emissions law (Treibhaus- und Emissionsgas Gesetz)
TQM	Total Quality Management
UBA	Umwelt Bundesamt (German Federal environment Agency)
UN	United Nations (New York, USA)
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNGC	United Nations Global Compact
US	United states of America
USB	Universal serial bus
VAT	value added tax
VCI	Federation of the German Chemical Industry (Bundesverband der Deutschen Chemieindustrie)

VDMA	Association of the German engineering and plant construction industry (Verband Deutscher Maschinen- und Anlagenbau)
VW	Volkswagen (German car manufacturer)
WBS	Work breakdown structure
yr.	year
znes	Center for sustainable energy supply (Zentrum für nachhaltige Energieversorgung)

List of Figures

List of Tables

Introduction

Climate change and other crisis are more and more dominating today's life. As a consequence, the CO_2 concentration in the atmosphere is rising along with extreme weather. The current refugee phaenomenon is mainly caused by war and terror, however with increasing water shortages and draughts, many more people will prospectively be on the run for a place to survive and further increase the current scenarios. Besides other effects, as a consequence the energy economics are changing world wide impacting the way enterprises used to do their business. Elements such as energy efficiency, renewable energies, resource efficiency, sustainability and Corporate Social Responsibility (CSR) more and more get on the agendas of today's enterprises.

But how do enterprises deal with these changes, which measures do they execute, which are there major threats, are they aware of legal changes coming along with these changes, how do they judge the ongoing trends and how does their wish list look like for politics - questions which so far were not investigated and evaluated yet.

In this context, there are also many other elements impacting and influencing enterprises as well as the national economies. Some of which were selected to additionally be studied or to allow for a deeper dive into specific energy related topics. Cyber security for power plants, smart homes, e-mobility and energy storage systems is in this context as important as sustainability in transport, Corporate Social Responsibility (CSR) or the role of Knowledge Intensive Business Services (KIBS) and Key Performance Indicators (KPIs). In addition to the pure energy economics, also those were evaluated in the context of innovative and responsible business practices and sustainable energy strategies for enterprises, as well as the roles of innovation and change management as supporting factors.

As laid out in Figure 1, part I of this thesis is focusing on the theoretical aspects and the current state of knowledge in the respective areas. Part II represents the "practical" and "empirical" section of the thesis. The main research evaluates the correlations between changes in energy economics and counteracting strategies & behaviours of enterprises. In that context, more than 2,000 enterprises in Germany (2013-2015) and Romania (2013) were interviewed each year with specific questions related to the changing energy economics.

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4_1

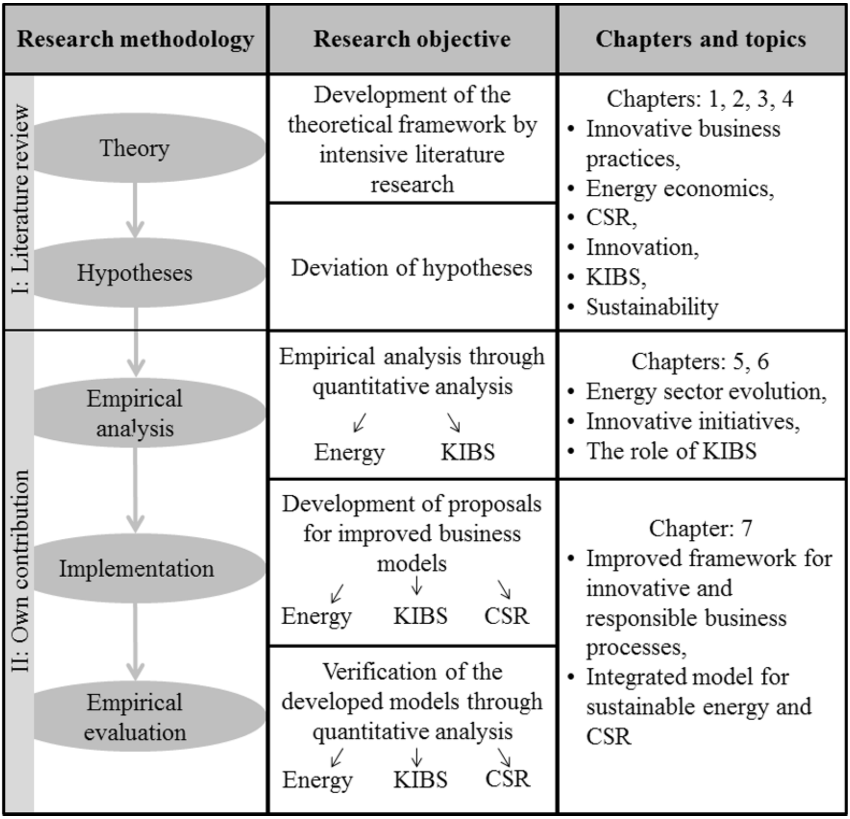


Figure 1: Structure of research and document
(Source: by author)

The underlying research was conducted by the author with the support of the Association of the German Chambers of Commerce and Industry – DIHK[1] and with the support of the German-Romanian Chamber of Commerce and Industry (CCI), Bucharest. The objective was to collect data, comparable between the enterprises in Germany and Romania. This data was to be evaluated and compared in order to find out whether enterprises in Romania and Germany assess changes to the energy system / energy economics differently.

[1] DIHK: Deutscher Industrie- und Handelskammertag (***DIHK, 2014), represents a total of eighty Chambers of Commerce and Industry in Germany and covers hereby for more than three million entrepreneurs in companies of all sizes in Germany.

In parallel four smaller studies were conducted, focusing on the role of leadership for sustainability, the situation for energy KIBS in Germany, the chances for corporate efficiency networks and the role of the private people to CSR strategies of enterprises. Finally, two models/frameworks were developed to improve energy efficiency as well as the next generation CSR.

The following key scientific research areas are addressed in the thesis paper:

- correlations between changes in energy economics and counteracting strategies & behaviours of enterprises
- tendencies regarding energy economics, related effects and the relevance of sustainable energy and knowledge intensive business services in this context
- approaches and tendencies in sustainable energy economics in relation to CSR
- roles of KIBS in the context of changing energy economics
- approaches of innovation and innovative initiatives in the context of energy economics
- evolution of the energy economics in Germany
- opinions and judgement of enterprises regarding the evolution of the energy sector
- proposal for an improved framework for innovative and responsible business processes for sustainable energy
- proposal for an integrated model for sustainable energy and social responsibility

Before and during the time of the research, the author of this paper has had profound insights into various elements of energy economics, sustainability and related stakeholder demands. He is running a small consulting business in the energy and sustainability sector in Germany himself. He also supports innovative start-ups developing sustainable business plans and strategies. Being actively involved in the subject investigated in the research, he was able to experience in the field of investigation and to test the practicability of the proposed models first hand. Additionally he is a member of the supervisory board of the "energy concepts donnersberg AöR", a state owned institution focusing on sustainable municipal energy strategies.

In his role as developer and lecturer of seminars and university courses as well as concept developer, moderator and leader of congresses in the field of energy efficiency and sustainability he was in a position to cross-check and to evaluate many information and ideas first hand with academics and experts from the industry.

Having been invited to deliver expert speeches at several events and conferences at international universities, chaired by the *German Federal Ministry of Econo-*

my and Energy, the author was able to widen the viewpoint of his studies by discussing the topics also with academics and industry experts internationally.

The initiative for sustainability "*ACT-ORANGE… save our planet*" founded by the author was affiliated by the UNESCO as UN-world decade project "education for sustainable development" and nominated for several awards.

During the course of the research, the author was involved in many projects accompanying the study including intensive discussions with top management and experts in the research field. Those helped the author to understand the actual needs and perceptions of the target groups; where possible the findings and learnings from these projects and discussions were integrated in the research.

His research topics were presented at several international conferences and published in several internationally recognized and ISI web of knowledge indexed scientific journals; one of his conference papers was awarded in the category "Best PhD paper Award" at the 3rd ICMLG 2015 conference at Massey University and Auckland University in New Zealand.

Turning his learnings and findings into practice, the author developed a concept for a consulting and research institute in the field of sustainability in order to

- further research the context and impacts of ISR to enterprises, society and individuals
- develop and offer training programs addressing these dimensions
- develop and consult companies on sustainable ISR concepts and strategies

In cooperation with universities and enterprises, this institute is currently in process of being set-up. Details can be found on www.ecoistics.institute.

This research builds on correlations with several people which were patient, inspiring and supporting, but also critical and challenging which helped to push for innovation, creativity and quality throughout the research process. Throughout this entire process, my scientific coordinator and supervisor Prof. PhD Marieta Olaru patiently answered all my many questions. In addition she was inspiring, supportive and challenging for which I'm really grateful.

With their support in the data collection process and contacts to the many interviewed enterprises, Mr. PhD Sebastian Bolay (DIHK, Germany), Mrs. PhD Roxana Clodnitchi and Mrs. PhD Ilinca Pandele (both German-Romanian Chamber of Industry and Commerce, Bucharest) have helped to make the field studies happen; without the data from these studies the research would not have been possible.

A special thank also to numerous discussion partners within my network, at conferences, congresses and seminars, as well to selected customers who took their

valuable time to critically discuss and comment all my questions and ideas developed during the last 3 years.

Finally, I'm much obliged to my family who always were (almost) endlessly patient with me "living in another world" and tried their best to keep my back free – they certainly not always had an easy time with me. To them I dedicate this work.

1. Current tendencies regarding sustainable energy strategies and knowledge intensive business services

1.1. Conceptual framework of today's innovative business practices

1. 1. 1. Defining elements of the concept of innovative business practices

Innovative business practices are defined more and more by Corporate Social Responsibility (CSR), efficiency and innovations. If in addition they need to be sustainable also, they take many stakeholder interests in account too. Those include economical, but also ecologic and social interest. In that context, Brocken at al. (2014) introduced archetypes for sustainable business models in order to describe their mechanisms and solutions (Figure 2). That they placed the maximisation of material and energy efficiency into the technological group is been seen critical by the author. Efficiency in these areas is not just technology related but also depending strongly on the individual's behaviour. A similar argument can be debated for the grouping of other archetypes also.

groupings								
technological			organisational		social			
related archetypes								
maximise material and energy efficiency	create value from waste	substitute with renewables and natural processes	repurpose for society/ environment	develop scale up solutions	deliver functionality rather than ownership	adopt a stewardship role	encourage sufficiency

Figure 2: Sustainable business model archetypes
Source: Brocken et al. (2014)

The innovation of business practices is going along also with change. With the energy transition being a process coming along with massive change potential for concerned parties, enterprises need to change their processes, strategies and structures, need to develop new business models (Abrell, 2012). These changes are required in order to achieve improvements in such systems; on the other hand, change mostly requires a paradigm shift (Kolbusa, 2013), (Kreutzer, 2014).

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4_2

Changes, such as the energy transition are understood by many organisations as opportunity, by others as crisis. As such risk management is a helpful tool in order to shift risk into opportunities (Kronenberg et al., 2010) or as Kres (2015) says: "organisations, able to build a bridge out of know-how and creativity towards innovation and new perspectives will always be able to be sustainably productive". In the context of changes in the energy economics, sustainability is an important factor and motivator. In absence of one generally recommended innovation measurement tool (Eggink, 2012), change management is in this context a suited tool to accompany the change process ensuring that the system modifications are sustainable and make sense for a long time. Schinnenburg and Schambeck (2015) and (Lozano, 2015) differentiate the kinds of change by their external visibility and the degree of the change. Change caused by shifting towards a corporate CSR strategy represents here a high level of change at a minimal external visibility potential (Figure 3).

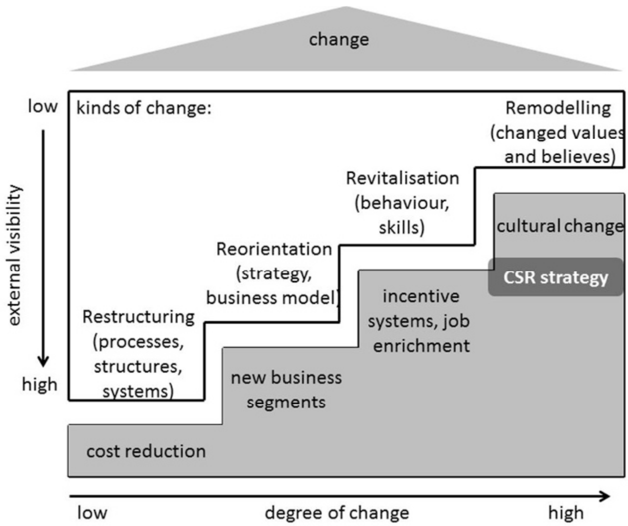


Figure 3: Kinds and motivators for change
Source: by author based on Schinnenburg and Schambeck (2015)

a) Change and innovation

The change management and innovation management processes are directly linked to each other (Figure 4). Whereas innovation management is focused on the elements know-how, the innovation itself (hence the product), the customer value as well the success in the market (change management) focuses on the organisation (its internal complexity) and its business strategy (influenced by external complexity) (see also Werther and Jacobs, 2014).

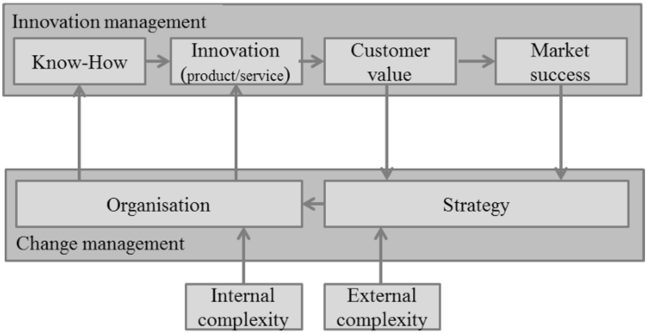


Figure 4: Correlation of innovation management and change management
Source: by author based on Freund (2013)

Changes in organizations are complex (Ehrenmann, 2015). In literature several definitions and explanations can be found. There are several different kinds of change and its interpretation distinguished as visualized in Figure 5, changes related to the energy transition are highlighted (italics).

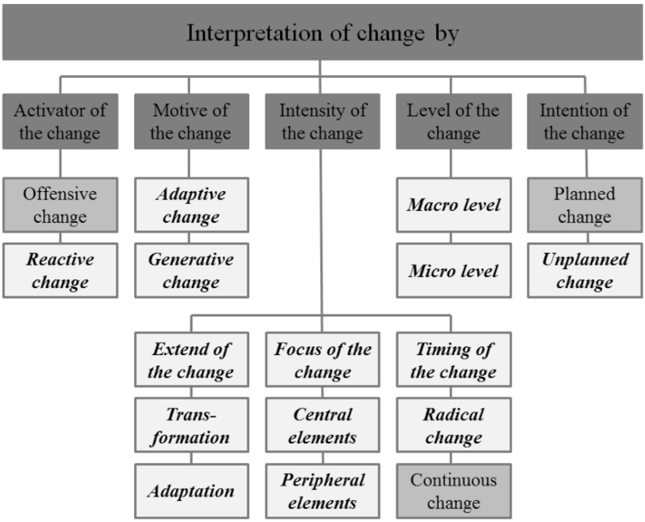


Figure 5: Interpretation of change in energy economics
Changes in energy economics during the German energy transition in italics
Source: by author, based on Pescher (2010)

Looking at its activators, change driven by law, such as change in the energy economics, cause reactive change and the organisation acts as a consequence of external factors (Pescher, 2010). Driven by its motive, adaptive changes are the consequence of an organisation reacting to external environmental factors (Figure 6), which also are related to energy economics. Innovations are good examples for generative changes which are initiated by the organisation and impact the environment.

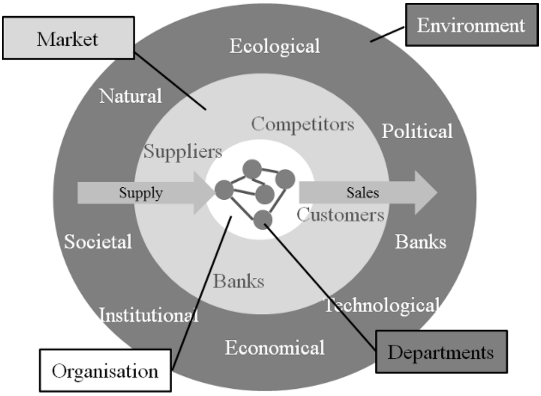


Figure 6: Categories of the organisations surrounding
Source: by author based on Lauer (2014)

In case of adaptive changes only several areas of the organisation are affected, whereas transformations touch the organisation completely. In the case of energy economics adaptive changes as well as transformations can occur.

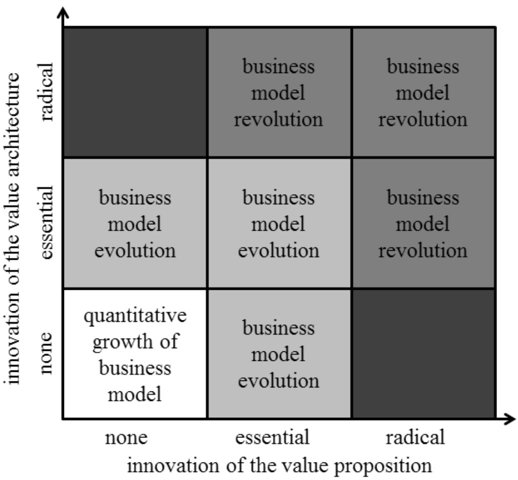


Figure 7: Development approach of the innovation of business models
Source: Steinhauer (2015)

In terms of timing (starting point), the energy transition in Germany resulted in a radical rather than a continuous change. However, the impacts of the changes definitively are on the long-term. As such, these changes in the first place were unplannable and concerned micro (team related) as well as macro (organisation and its environment) levels of the organisations.

In the context of business models, Steinhauer (2015) distinguishes several approaches depending on the innovation levels of the value proposition and the value architecture. In the case of no innovation only quantitative growth can be experienced. The more the innovation levels increase, the evolutionary and the radical business model can be found.

b) Change in times of crisis

Change management serves in order to design an optimal process to successfully get from the starting point to the targeted endpoint (Lauer, 2014; Werther and Jacobs, 2014). Traditionally change management is used proactively in order to steer planned organisational changes, such as mergers and acquisitions; on the other hand change management is used as a reaction to crisis-like events and aspects, such as the energy transition. During crisis-like events, organisations usually pass through three phases (Figure 8).

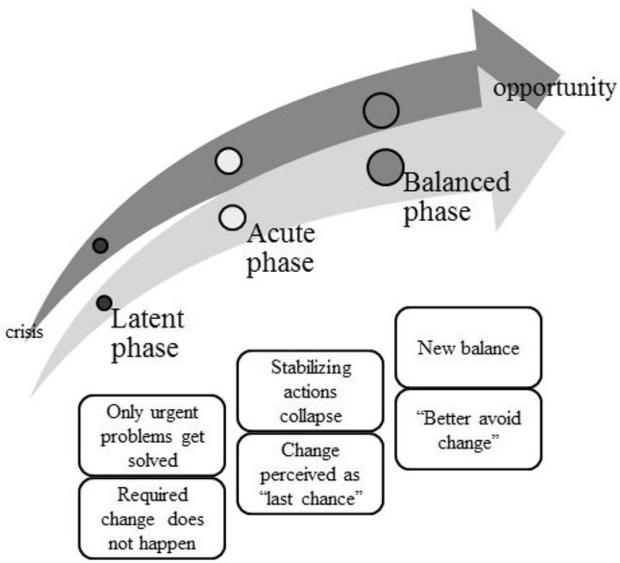


Figure 8: The role of change during the phases of crises
Source: by author based on Lauer (2014)

The first phase is focusing on solving urgent problems. In the second phase stabilising action collapse and change is being perceived as "the last chance". The third phase is characterized by a new balanced position in which change better is avoided. Over time the crises hereby develops to be an opportunity.

People tend to do things as they are used to do them for long; changing habits is associated with inconvenience, pain, additional effort and/or antipathy. For a successful migration towards new, effective procedures, change management is an effective process for organisations allowing lateral thinking (Spindler, 2011; Weber et al., 2014a; Werther and Jacobs, 2014).

Literature does not provide one uniform definition of change management (Namokel and Rösner, 2010; Pescher, 2010). Gerth (2013) as well as Doppler and Lauterburg (1997) describe some principles of change management with target-oriented management being the most important element of the change management process. The change management process follows certain steps being (Figure 9):

- Idea creation or reason for the change
- Definition of the new objectives
- RASI (responsibility-approval-support-information) definition
- Process planning
- Process control

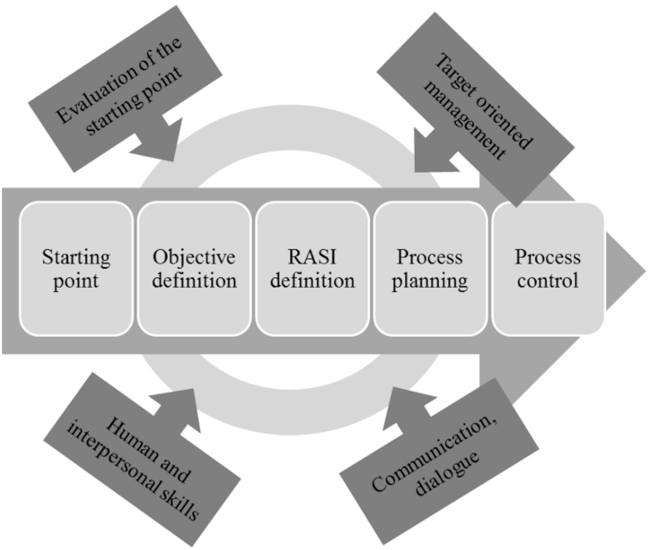


Figure 9: Elements and steps of the change management process
Source: by author based on literature referenced in text and author's own experience

Several management processes are involved in the change management process and need to be applied to it (Figure 10). As change is not a smooth process, conflict management and networking skills are as important as team spirit (Studt, 2013; Rosenstiel et al., 2012; Zehrer and Mössenlechner, 2010).

In the context of changes in energy economics systems in particular external factors such as energy cost, politics, competitors and others are important to be considered (Matuszek, 2013; Petersen, 2011).

With that, the change management process basically follows the PDCA (plan-do check-act)-process (Figure 33 in this chapter), which is the key element in energy management systems according to ISO 50001industry norm (Weber et al., 2014a).

Another set of process elements is the evaluation of the starting point (based on proper data) (Wilfing, 2013), holistic thinking, and consideration of structural, technical as well as economic and ecological aspects. Human and interpersonal aspects complete the element set of the change management process (Lauer, 2014; Weber et al., 2014a). Needless to say that all concerned persons and parties need to be involved in the process and to communicate via dialogue, allowing and ensuring a process-oriented controlling during the execution phase of the initiative (Brauner at al., 2012; Deutinger, 2013; Stolzenberg and Heberle, 2013).

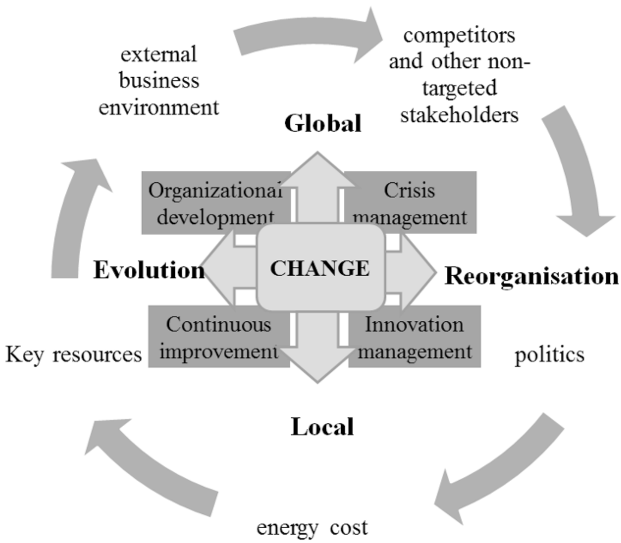


Figure 10: Change management processes and selected surroundings
Source: by author based on his research, ref. to Weber at al. (2014a)

At the end, people are the drivers of the change process. Therefore it is important to select people with social and professional competencies. This is especially important in changes driven by external factors which cannot be influenced from within the organisation. An example is the changes in the energy economics driven by governments (Weber et al., 2014a).

The change management process is a widely used tool to commercialize “green products” by accessing new segments. Thereby new so far unattended customers can be attracted, the economics of value creation for the enterprise can be improved and its network in the context of energy economics expanded (Freund, 2013; Mescheder and Sallach, 2012; Sommer, 2012; Weber et al., 2014a). In the context of the energy transition, organisations are confronted with change process driven by external energy economics. The trend-shift from conventional towards renewable energy sources forces conventional energy suppliers towards a strategic change. This strategic change process builds up on the previously mentioned three step crisis change process and is characterised by the five phase initialisation, conceptualisation, mobilisation, execution, and consolidation and have individual objectives (Figure 11).

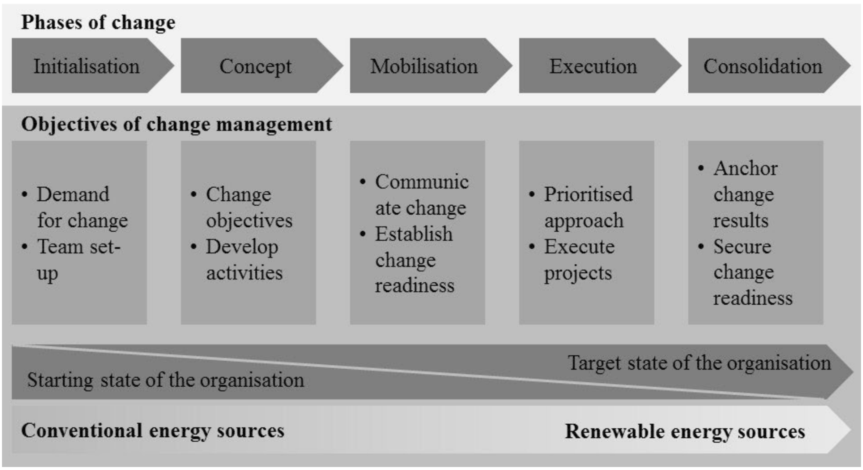


Figure 11: Strategic change management process during changing energy economics
Source: by author based on Krüger (2014)

c) The change management team

Change is not coming for free. As mentioned earlier, change is perceived as “pain”, paradigm shift, leaving the comfort zone, etc. (Zimmermann, 2015). Not only in conservative organisations change requires substantial effort in order to overcome internal resistance and convince the employees on its necessity. Resistance needs to be "changed" into willingness and support. Also change requires an enormous effort for its strategic management. In order to do so it requires leadership, the employees and a project management process (Krüger, 2014). For managing all the related tasks during the change process, Noe (2014) proposes a defined structure of a change team (Figure 12). The steering committee hereby consists of members delegated by the top management. Its objective is to guide the project management team, make necessary decisions throughout the process and be the link to the top management. The project manager is leading the core task force with members from concerned departments and is the connection to the steering committee. In addition, the project team has access to additional support by quality management, controlling, human resources (HR) and the work council. External consultants are accompanying the process, supporting the steering committee and the project management team. In addition process teams can support the core team with specific knowledge of processes, products and/or services. In order to operational, the team needs tools, data, instruments and resources. Key Performance Indicators (KPIs) for instance (refer also to chapter 1.1.3) will be developed in order to compare different proposals. In order to assure effectiveness and success, it is important not to rush through this process but reserve enough time for a good result.

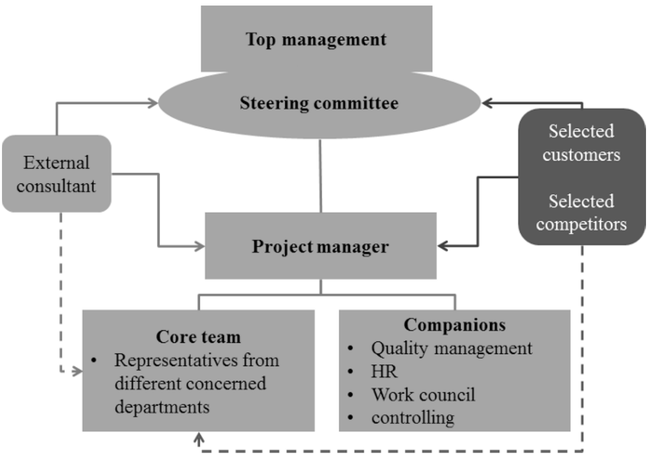


Figure 12: Team structure – change project
Source: by author based on his research and business experience, referring to Noe (2014)

Based on extensive experience of the author in change processes and structures in the automotive sector, Noes (2014) process chart can be confirmed to be used in practice. However in order to be suitable for a wider pool of projects, it was extended by the author adding the groups of "selected customers" and "selected competitors". Especially in view of the previously discussed innovation processes and in the context of KIBS it can be quiet wise and reasonable to invite and consult customers and competitors on a case by case basis throughout the process or for certain steps. Long lasting experience has shown that "independent views" can be very helpful avoiding silo mentality. One could say that consultants do the same job here. However, these groups can bring practical market views; a consultant (being not as deep in the core business of the organisation) usually is coming from the theoretical perspective. Needless to say, that a high level of trust and cooperation is required here. Also it needs to be evaluated carefully, which level of confidentiality shall be selected. Throughout the process it is up most important to involve and motivate the people and employees; it is important to "take them along" (Zink, 2015).

d) Successful and effective change

The success of change processes strongly depends on whether the organisation does things right. The critical success factors hereby are the smallest group of activities, the organisation needs to successfully handle in order to have success (Noe, 2014; Petersen and Witschi, 2015). This group consist of

- vision,
- mission,
- objectives,
- strategy,
- value chain analysis, and
- tools.

The vision is a clear view of the organisations future. It contains for instance information on the target customer, target market, differentiation versus competition, positioning, quality requirements (i.e. "best in class"), potential business partners, etc. The vision needs to allow the employees to identify themselves with the organisation; it needs to be something special. Questions like "who are we", "what do we want", "where are we today and where do we want to go" need to be answered (Noe, 2014).

The mission serves to identify the available potentials for innovation in the organisation. The identification of the strengths and weaknesses of this potential needs to be evaluated throughout the departments (product, production, research & development (R&D), HR, finance, etc.). It also helps to expand the ability of the organisation to learn and to analyse the competition (Noe, 2014).

I terms of objectives, strategic (medium-/long-term) and operational (short-/medium term) targets need to be defined. Objectives need to be measurable and their achievements to be controlled.

The strategy reflects the realisation of vison, mission and objectives into a structure and framework which is able to manage the processes productively.

As the next step, the status quo of the value chain needs to be determined and analysed for potential improvements. Figure 13 shows the value chain process at the example of an innovative energy service, for example in case of a new to market tool to measure and monitor energy consumption, assigning the consumption to each consumer and monitor the development over time, all by one single device at minimal installation effort.

Finally, the right mix of tools needs to be selected in order to achieve the defined objectives. For instance performance measuring, performance improvements as well as benchmarking are options which can be practiced here.

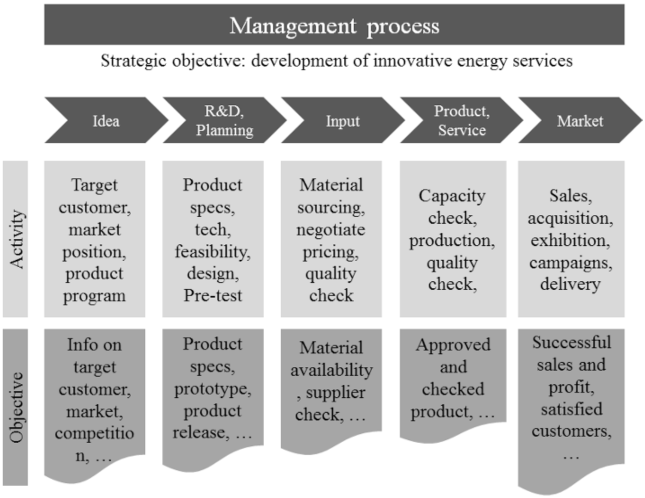


Figure 13: Value chain exemplary on energy services, simplified
Source: by author based on his research and business experience

Successful change relies on an effective change process. As described earlier, this process can be supported by external consultants. However, there is a huge pool of consultants offering their services in the market which makes it difficult for the organisation to identify the "best match". Firstly the consultant needs to be able to proof a defined profile suiting a set of requirements and experience needed to do the job. Mostly, these requirements are not fully known yet at the beginning of the project, making the search for qualified consultants challenging. In addition the consultant needs to meet a set of social as well as methodological competencies, which could be proven on the basis of reference projects. Finally and importantly, there is a cost frame which should be met in order to stick within the approved project budget. The cost factor hereby is a very critical element for small organisations. In addition, there are a few more factors which need to be considered, such as

- time-frame: the consultants need to provide a realistic time frame for the project – which is very difficult to judge. In order to be able to effectively benchmark different offers, a tender process shall to be used during the selection process, ensuring a comparable set of data.
- Own resources: does the organisation have own resources to support the project and does the consultants methodology allow to involve those right from the beginning
- For more ambitious and demanding projects, it might be helpful to involve a team of several (independent) consultants in order to cover all skill levels required in the project.

Besides external consultants, there are several additional factors for success described in literature (Kotter, 1996; Deutinger, 2013; Kreutzer, 2014; Gerth, 2013; Doppler and Lauterburg, 1997; Lauer, 2014; Pescher, 2010; Gerkhardt and Frey, 2006; Noe, 2014; Brauner et al., 2012; ***capgemini consulting, 2015). A selection of those is summarized below.

- Create a sense of urgency
- Establish a coalition in the management team
- Develop vision and strategy
- Enable and empower the employees to participate, contribute and execute
- Push change without losing patience and endurance
- No activity without diagnosis
- Objective focused management
- Communicate actively (dialogue no monologue)
- Select the key persons carefully
- Use a holistic approach, think “out of the box”
- Effective time management
- Process monitoring and controlling
- Create a sense of communality, team spirit, “a crew that wants to win”

Finally change is part of every day’s life. Change can be perceived positively (new opportunity, new exciting project, new phase of life, etc.) as well as negatively (pain, paradigm shift, leaving the comfort zone, “don’t change a running system”, etc.). In the context of the researched changes in energy economics, there is no option for a choice – organisations need to change in order to avoid collapsing. On the other hand, this collapse will come anyway, also without the change – driven by climate change, rising temperatures, effects of green-house- gas emissions, most recently (unfortunately) coming to every one's mind via the refugee crisis. Changes need to be effectively addressed and ideally perceived as opportunities. Also in the context of energy economics and energy efficiency measures, change needs to follow a structured process. As each change is specific, also the change process needs to be customized. There are several tools and process proposals available which can be tailored to the single change project. Energy management offers the PDCA-process (plan-do-check-act) as part of the ISO EN DIN 50001 industry norm which can be found as part of other change management tools mentioned earlier.

Supporting innovative business practices, the change processes is a crucial tool which can be successfully and effectively been managed by considering the success factors concluded previously.

1. 1. 2. Considerations of sustainable energy in today's business concepts

Sustainable energy, defined through renewable energies and energy efficiency, must be a vital part of any energy strategy and contains a huge savings potential; it needs to even be part of any sustainability strategy (Bauernhansl, 2014; Abdallah et al., 2015). "The importance of energy efficiency to attain overall sustainable economic development cannot be relegated to the background. … It is believed that sustainable development with sufficient energy supply can be achieved only if the goal of economic growth and efficiency in energy consumption is balanced. This is because failure to address energy efficiency may lead to a further deterioration of the environment, the impairment of public health, the resource degradation and energy insecurity, which in the long run could lead to slow or declining economic growth." (Apergis et al., 2015)

The options to handle the energy consumption more efficiently are manifold: building envelope, compressed air, lighting, process heat, transport, electric motors, HVAC, etc. Often savings can be achieved already by small measures without investment necessary. But also the use of renewable energies helps to achieve higher energy efficiency, simply through decentralized production ("produce where you need it"-principle) (Wänn et al., 2014), losses of electricity for example over long distances can be avoided (Günther, 2015; Ferreira et al., 2015) and also fossil power stations offer a tremendous potential for energy saving (Palanichamy et al., 2015; Saunders, 2015). As the identification process of energy efficiency potentials required specific knowledge, expert advice is highly recommended. Measures for energy efficiency are mostly requiring investment, which on one hand needs to be funded by the executing organisation, on the other hand is supporting the supplying industries and the bank sector (Bauernhansl, 2014). The capital cost can be absorbed or through a higher product price handed over to the customer (left section of Figure 14). In case other investments are being replaced by energy efficiency investments macroeconomic effects follow through the increase of the overall budget, a process being called crowding-out. Which of those options are preferred by the enterprises in Germany and Romania will be analysed and answered in chapter 5.

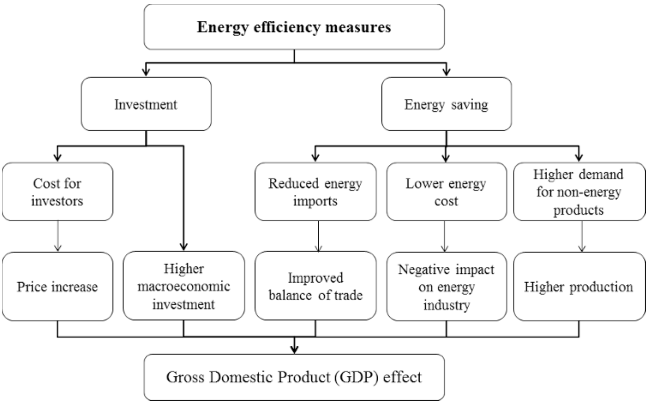


Figure 14: Macroeconomic effects of energy efficiency measures to the industry
Source: *** ewi et al. (2014)

On the other hand (right section of Figure 14), efficiency measures will be leading towards lower energy cost, which on the long-term will be paying out for the capital cost for the investments ending up in an improved balance of trade, a higher production or a negative effect on the energy economics. Consequently energy efficiency measures influence the gross domestic product through its macroeconomic process.

However, there are much more elements affecting the Gross Domestic Product (GDP), considering reduction of environmental impacts, social cost and other benefits of energy efficiency making the structure much more complex, as visualized in Figure 15. These effects can be expanded even more by adding for example the effects of energy audits and energy management systems which make the chart more and more complex by adding correlations into quality and environment management systems. In addition further benefits such as competitive advantages, product and production quality, image effects, increase of employee loyalty and wellbeing, increased profitability, environmental compliance, and many more can be added here. Usually many of those benefits are not being included in the business case calculations and feasibility studies of energy efficiency measures, even they help reducing the return of investment indirectly.

So far the wider impacts of energy efficiency have not been evaluated; the energy commission of the European Union however is in process of developing Europe wide standards for comparing energy efficiency with a first step being done with the EU energy efficiency directive 2012/27/EU dated October 2012 (***EU, 2012), which was transferred into national laws by the end of 2015 (Figure 16).

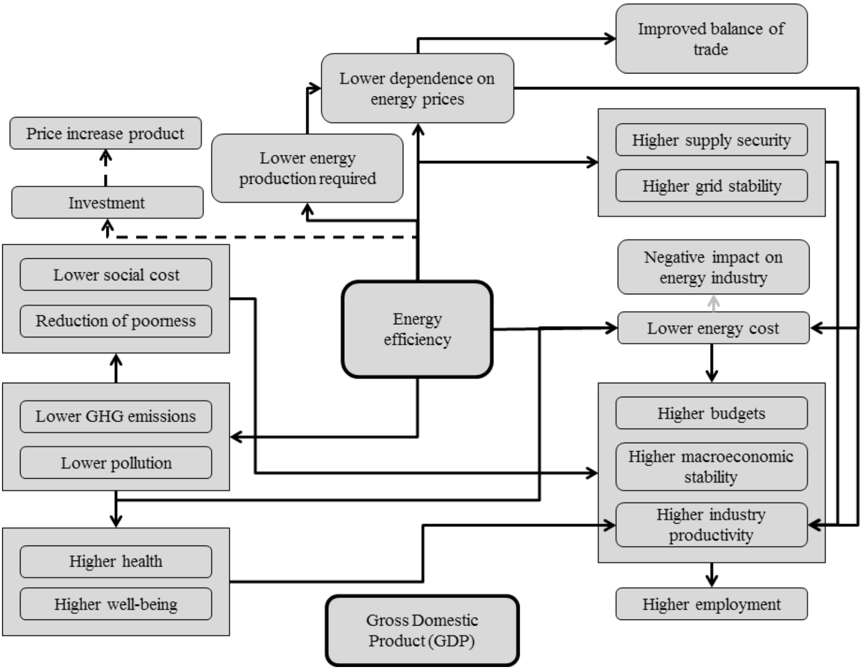


Figure 15: General effects of energy efficiency
Arrows: benefits with solid arrows, disadvantages with dotted arrows
Source: by author

By the directive each of the member states is requested to develop concrete steps in implementing energy efficiency measures. According to §7 the objective is that every member state reduces its energy consumption between 2014 and 2020 by 1.5%.

The implementation status of the European Energy Efficiency Directive varies between the member states. The process of standardization however is not finalized yet, as every member state defines its national standards and procedures differently. Therefore harmonized uniform regulations are urgently required for the European Union (EU) in order to effectively and successfully achieve the climate protection targets.

European Legal Framework	**Directive 2006/32/EC** Energy end-use efficiency and energy services	**Directive 2009/125/EC** European eco-design	**EU ETS** European Union Emission Trading Scheme	**EPBD** Energy Performance of Buildings Directive	**EnEff** Energy Efficiency Directive
National Instruments Germany	**EDL-G** Energy Services and other Energy efficient Measures Law	**EVPG** Energy related products law	**TEHG** Green House Gases Law	**EnEV** Energy Saving Ordinance	**NAPE** National Energy Efficiency Plan

Figure 16: Energy efficiency: legal framework in the European Union and Germany
Source: Wiehl (2014)

This drives a complexity which hardly can be managed by enterprises being operating internationally. Whereas most countries have established the directive, a few are in processing and three still having a long journey in front (Figure 17). In addition, the directive is also differently interpreted and executed (***tenag, 2015). Slovenia for instance defines Small and Medium sized Enterprises (SMEs) differently from the EU putting Slovenian enterprises in a disadvantage compared to the rest of EU. Whereas German and British enterprises need to assign 90% of their energy consumption to their energy consumers, in France this level is at 65% (80% planned for the 2nd audit round) and in the Czech Republic at 100%. In addition the qualification requirements for energy auditors also vary from one EU member state to another (***Beuth, 2014).

Belgium	Finland	Croatia	Austria	Sweden	Slovakia
Bulgaria	France	Lithuania	Netherlands	Hungary	United Kingdom
Denmark	Greece	Latvia	Poland	Cyprus	Slovenia
Germany	Ireland	Luxemburg	Spain	Estonia	Portugal
Italy	Malta	Romania	Czech Republic		
	Level of implementation:		fully	partly	none

Figure 17: Energy Efficiency Directive – status of its implementation in Europe (mid 2015)
Source: Lisson (2015)

The European Environment Agency (EEA) monitored the progress of energy efficiency efforts in Europe by industry sectors showing, that some branches, such as

Chemistry show a tremendous effort in energy efficiency whereas others such as the paper industry were basically stalling during the last years, others, such as the cement industry got worse (Figure 18). Once interpreting this data, it is important to know the base line of the measured energy efficiency. In other words, the shown industries had different levels of implemented and executed energy efficiency strategies, some cared others did not. Obviously realising additional energy efficiency improvements is hard once many energy efficiency measures were implemented already. Once an industry did not care so far and has a bad efficiency profile, it's easier to improve. On the other hand, it is important to understand, that some industries have energy intensive processes requiring a minimum level of energy (i.e. cement industry); for those a further reduction below minimum is almost not possible. Thirdly, the graphs also do not explain the economic development between specific sectors – hence, in times with a high level of utilized production capacity also the energy consumption goes naturally up. Consequently such graphs are to be interpreted carefully. On the other hand it is a major effort to consider all the mentioned aspects in the data structure for such analyses, which might have been one reason for the European Environmental Agency (EEA) to stopping updating those charts.

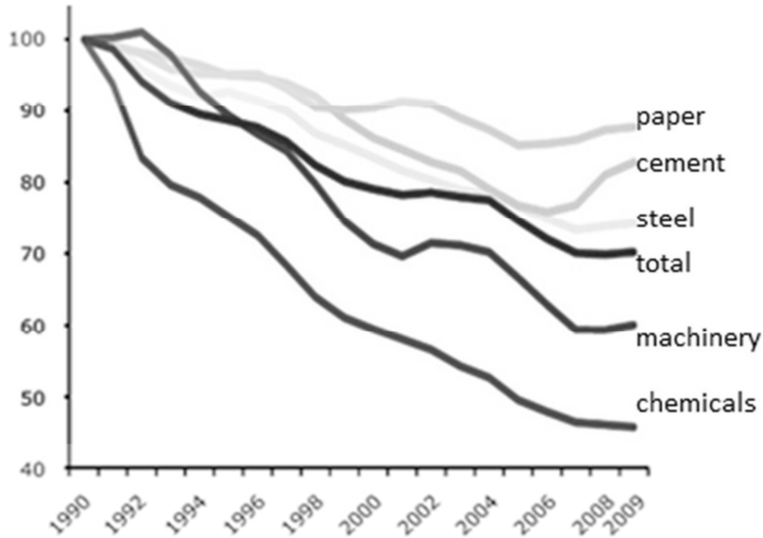


Figure 18: Energy efficiency index in the European Union (EU27)
Source: *** EEA (2012)

Figure 19 illustrates the development and progress being made in Europe in terms of reduction of CO_2-emissions. Comparing the CO_2-emissions from 1990 and

2009, Germany for instance shows here the biggest reduction in direct CO_2-emissons; including the indirect CO_2-emssions however, there is no change. In general this chart shows an improvement in the level of overall EU CO_2-emissions however.

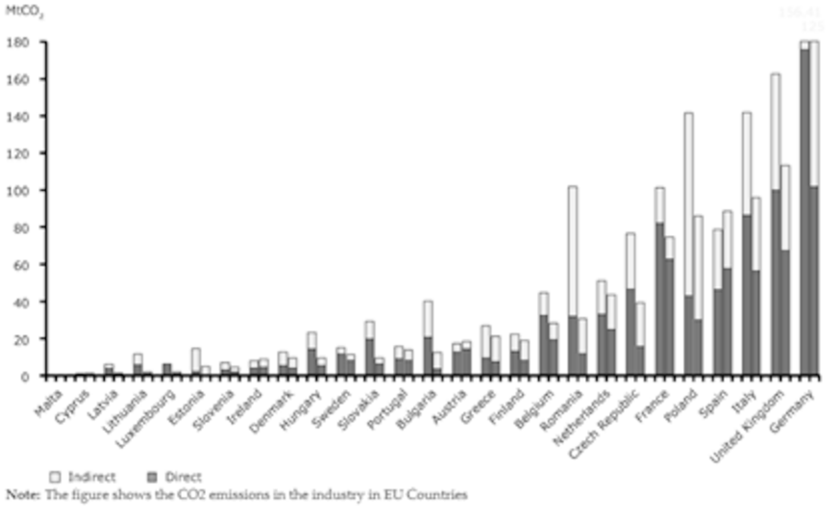


Figure 19: CO_2-emissions in EU-countries 1990 and 2009
Source: *** EEA (2012)

In Germany for instance the installations produced much more emissions compared to other EU countries, hence the potential for reducing the energy consumption through increasing energy efficiency measures seems to be higher than in the remaining countries as shown in Figure 20.

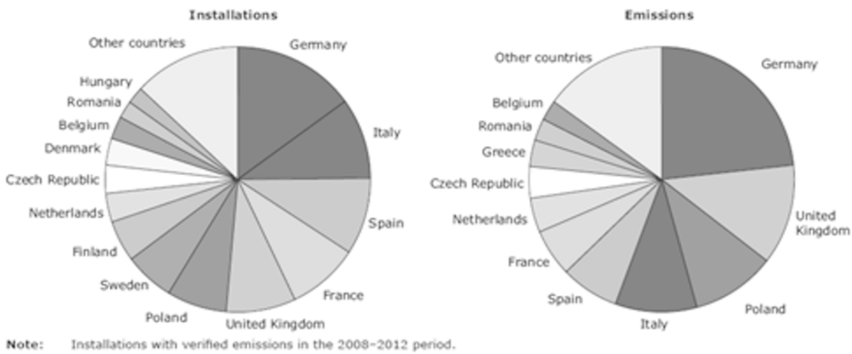


Figure 20: Installations and emissions in EU-countries 2008-2012
Source: *** EEA (2013)

Through a study, the Netherlands Environmental Assessment Agency (Berk et al., 2006) researched several impacts of technological options on various policy objectives. One selected policy objective was the competitiveness, being represented through the two factors EU-innovation and cost.

From an EU-innovation stand-point, most of the effects were rated neutral trending positively, with all items with highest cost and investment requirements being rated positively in terms of innovation (hydrogen, advanced cars, emission control and photovoltaic energy) (Weber et al., 2014). Hereby the technological alternatives were grouped in the clusters carbon capture and storage, efficiency, energy production (nuclear, renewable and fossil) and others (public transport, emission controls, etc.) (Weber et al., 2014). Cost wise, the effects mainly were rated insignificant with a trend to negative.

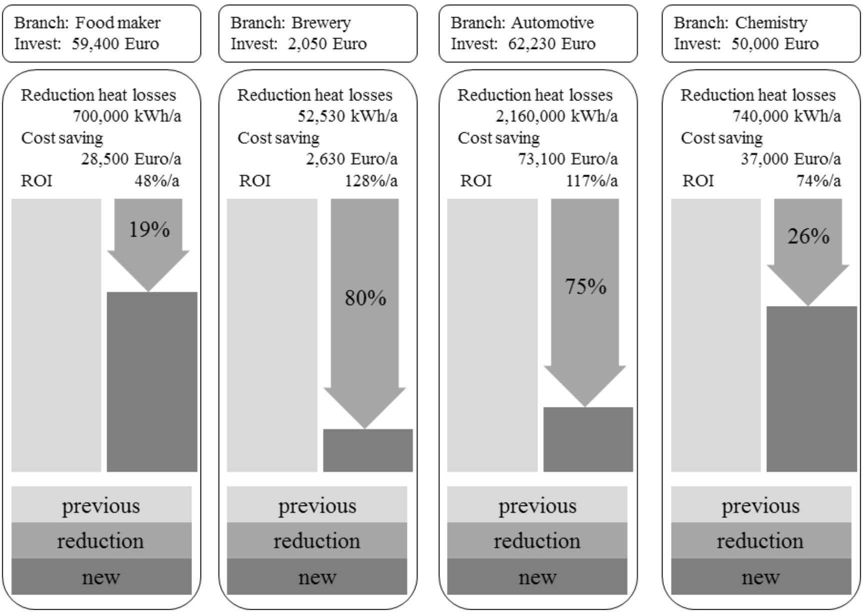


Figure 21: Energy savings through reduction of heat losses, selected examples from Germany
Source: *** dena (2013)

Even being already eight years old, the results of this study are still accurate today. Negatively impacting the competiveness of an economy in the short-term, financial R&D efforts into efficiency measures and innovative energy production are perceived positively in the long-term however, as this invest is going to return through lower cost levels and competitive advantage (Berk, et al., 2006). Energy efficiency measures are an important element reacting to the negative effects of energy price increases. On the other hand, R&D is an important activity in order to keep the level of innovation high (Bureau, et al., 2013; Berk, et al., 2006). As a result a high level of competitiveness and potential market leadership in a key technology will strengthen the organisations stand in a very competitive environment (Weber et al., 2014).

As mentioned earlier, the “Energiewende” (energy transition) is a major project in Germany and energy efficiency is a vital element of it. Energy efficiency thereby offers a substantial chance to organisations to reduce their energy cost on the long-term. At the same time, it institutes business chances for enterprises in the development and highly qualified service sector for new energy efficiency technologies and consulting activities (KIBS). Examples from the Germany industry confirm the sometimes unbelievable savings potentials, four of which are exemplarily illustrated here representing different industry sectors (Figure 21).

As illustrated in Figure 22 the market sectors with the highest energy consumption levels are transport, industry and households; this research will hereby be focusing on the industry sector.

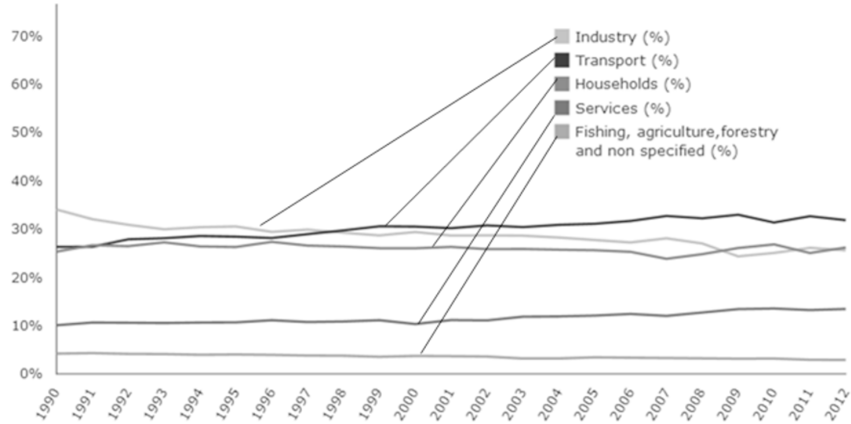


Figure 22: Sector shares of final energy consumption in Europe
Source: *** EEA (2015)

The European Energy Efficiency Directive

The energy efficiency in the industry is being addressed by the European Union through several steps towards the implementation of the EU energy efficiency directive 2012/27/EU dated October 2012 (Figure 23), requiring all member states to transfer energy efficiency into national law (Blesl and Kessler, 2013; Rohde et al., 2015).

Policy	Action	Year
Energy and energy-using products		
Eco-Design Directive (2009/125/EC)	Recast of the Eco-Design Directive 2005/32/EC to extend the scope to other energy-using products	2009
Labelling Directive 2010/30/EU	Recast of the Council Directive 92/75/EEC to extent the scope and align it with the scope of the recast Eco-Design Directive	2010
Directive 2010/31/EU on energy performance of buildings	Recast of the Buildings Directive 2002/91/EC to expand the scope to cover a much larger share of the building stock, to set harmonised MEPS requirements and initiate the development of an EU strategy for low energy buildings	2010
Industrial Emissions Directive 2010/75/EU	The Directive replaces the Integrated pollution prevention and control (IPPC) Directive and several sectoral directives as of 7 January 2014. It creates incentives for the application of best available techniques (BAT) in energy generation.	2010
Energy Efficiency Action Plan 2011	• Leadership role of the public sector to promote energy efficiency • Low energy buildings • Measures in energy generation and energy consumption in industry • Adequate financial support • Energy saving measures for consumers	2011
Energy Efficiency Directive (EED) 2012/27/EU	Repeals Directives 2004/8/EC on Cogeneration and Directive 2006/32/EC on end-use energy efficiency and energy services. Main provisions include: • A requirement for the Member States to establish a long-term strategy for residential and commercial buildings stock; • A requirement for Member States to set up energy efficiency obligation schemes for energy distributors or suppliers, or alternative measures, e.g. a carbon tax, financing schemes, regulations or voluntary agreements; • A requirement to introduce smart metering where proven feasible and financially cost-effective; • A requirement to base energy billing on real consumption and provide complementary information on historical energy consumption; • A requirement to identify the potential for the application of high-efficiency cogeneration as well as for district heating and cooling; • A requirement for Member States to ensure that national energy regulators encourage demand response programmes, and that network tariffs take into account the costs and benefits of energy efficiency measures.	2012

Figure 23: Evolution of the EU policy framework relevant to energy from 2009-2013
Source: *** EEA (2013)

Each national objective is being defined by the member state, resulting in a wide variance of defined targets (Müller et al., 2013). Whereas some countries cap the level of increase of energy consumption, others target the stabilization of their energy consumption. Figure 24 visualizes the final energy consumption in 2011 and the targets for 2020 by member state; the different ambitions can easily be identified.

The European Environmental Agency (EEA) analysed the results, the EU member states achieved so far through energy efficiency measures in 2013. As illustrated in Figure 26, the majority of countries shows some progress in reducing energy consumption, however require specific efforts in order to get back on track.

Several countries make only some progress and require much bigger efforts. Only four countries, namely Bulgaria, Denmark, France and Germany show well-balanced policy packages and make good progress in reducing the energy consumption.

In Germany the National Action Plan Energy Efficiency (NAPE) includes many measures targeting the final objective (***BMU, 2014b). However, according to a study from ***FÖS (2014) there is still a gap that requires attention in order to be addressed (***FÖS, 2014a).

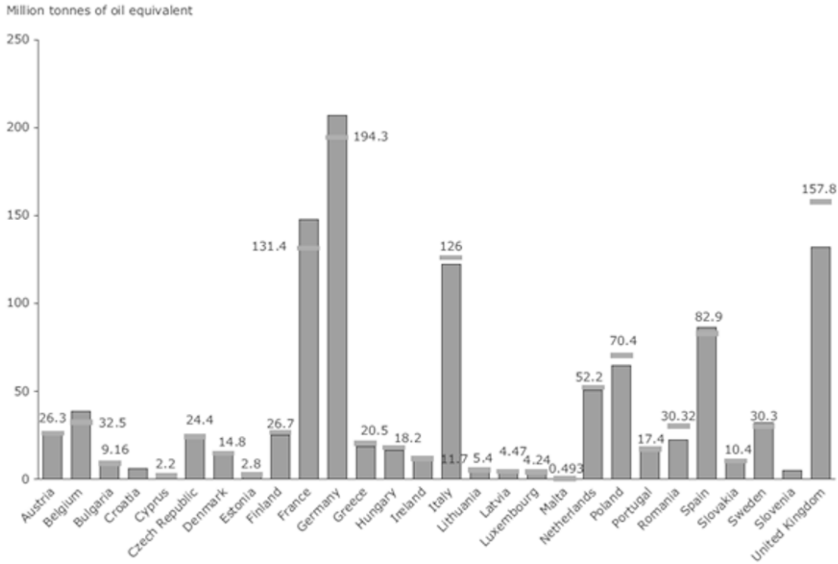


Figure 24: Final energy consumption in 2011 (bars) and the targets for 2020 (lines) by member state
Source: *** EEA (2013)

These gaps were confirmed one year later by the German Initiative of Enterprises for Energy Efficiency (DENEFF). According to their "NAPE-meter" only 182 out of total 446 measures defined by the NAPE to be executed by 2020 to reach the 20% energy savings target were realized by the end of 2015, which is just 41% (***DENEFF, 2015). A study of the mpw-institute, where they analysed the energy service market until 2022, confirms this trend (***ewi, 2015).

Energy concept of 2010	2011	**2020**	**2030**	**2040**	**2050**
Reduction in greenhouse gas emissions (compared to 1990)	**-26.4%**	-40%	-55%	-70%	-80%
Sahre of renewables in gross final energy consumption	**12.1%**	18%	30%	45%	60%
Share of renewables in electricity consumption	**20.3%**	35%	50%	65%	80%
Reduction in primary energy consumption (compared to 1990)	**-6%**	-20%			-50%

Figure 25: Energy efficiency targets and status in Germany 2011
Source: Lendermann (2015) and *** BMU (2015)

Countries	Absolute change PEC 2005–2011 (Mtoe)	Absolute change FEC 2005–2011 (Mtoe)	Annual average change in PEI 2005–2011 (%)	EEA assessment of progress towards improving energy efficiency
Bulgaria	− 1	− 1	− 3.2	↗
Denmark	− 1	− 1	− 0.8	↗
France	− 17	− 14	− 1.9	↗
Germany	− 30	− 22	− 3.1	↗
Austria	0	− 1	− 1.8	→
Belgium	+ 1	+ 2	− 1.1	→
Czech Republic	− 2	− 1	− 3.2	→
Finland	+ 1	0	− 0.8	→
Greece	− 3	− 2	− 0.8	→
Hungary	− 2	− 2	− 1.7	→
Ireland	− 1	− 2	− 2	→
Latvia	0	0	− 1.1	→
Lithuania	− 2	0	− 5.3	→
Netherlands	− 1	− 2	− 1.5	→
Poland	+ 9	+ 6	− 3	→
Portugal	− 3	− 2	− 2.4	→
Slovenia	0	0	− 1.6	→
Sweden	− 2	− 1	− 2.6	→
United Kingdom	− 35	− 20	− 3.3	→
Cyprus	0	0	− 1.1	↘
Estonia	+ 1	0	+ 0.3	↘
Italy	− 16	− 12	− 1.3	↘
Luxembourg	0	0	− 2.6	↘
Malta	0	0	+ 0.4	↘
Romania	− 3	− 3	− 3.7	↘
Slovakia	− 2	0	− 5.7	↘
Spain	− 16	− 11	− 2.7	↘
Croatia	0	0		

Note: PEI: primary energy intensity. Primary energy intensity is calculated as primary energy consumption per GDP (in constant prices, 2005 levels).

Progress is assessed based on the trend in energy consumption and primary energy intensity and the balance of packages of measures in the 2nd NEEAP:

↗ Well-balanced policy package across sectors and good progress in reducing energy consumption and primary energy intensity

→ Some progress in reducing energy consumption but further improvements are necessary either in the implementation or in the policy package or both

↘ Limited progress, further improvements are necessary both in implementation as well as policy package

Figure 26: Implementation progress in energy efficiency by EU member state
Source: *** EEA (2013)

Data from the German federal Ministry of Economy and Energy (BMWi) also confirm this trend, although with slightly different details (Figure 25).

These efforts in energy efficiency are important steps towards the projected objective of lower CO_2-emissions by 2030, as indicated in Figure 27.

For Germany the trend also indicates the right direction. The main contributors until 2012 could be found in industry (-51 mil tCO_2), households (-36 mil tCO_2) and transport (-23 mil tCO_2); in terms of reduction in percent, commerce/trade/services (-48.1%) leads before industry (-33%) and households (-28.2%) (Figure 28).

In Germany different options are available to perform the directions given by the European Energy Efficiency Directive:

- Energy Audits according to DIN EN 16247-1 industry norm
- Alternative systems (energy and environment management systems)

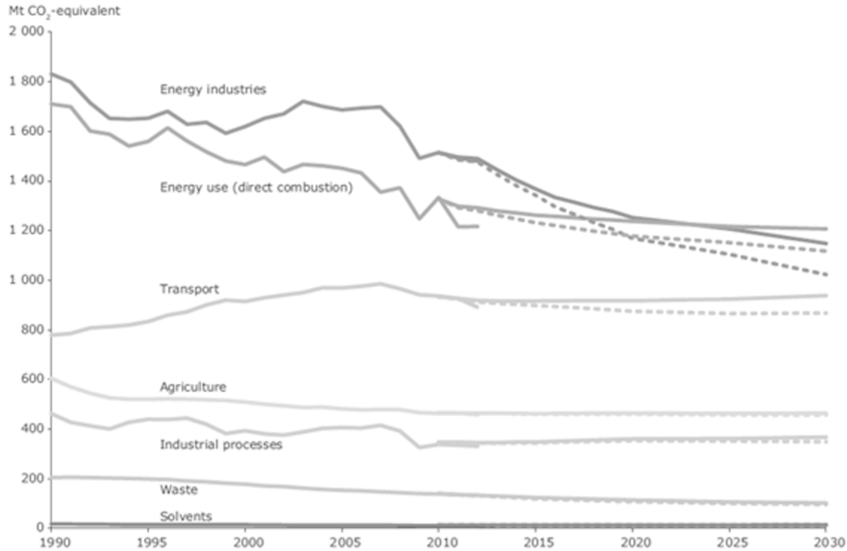


Figure 27: Trends and projections of EU GHG emissions by sector
Source: *** EEA (2013)

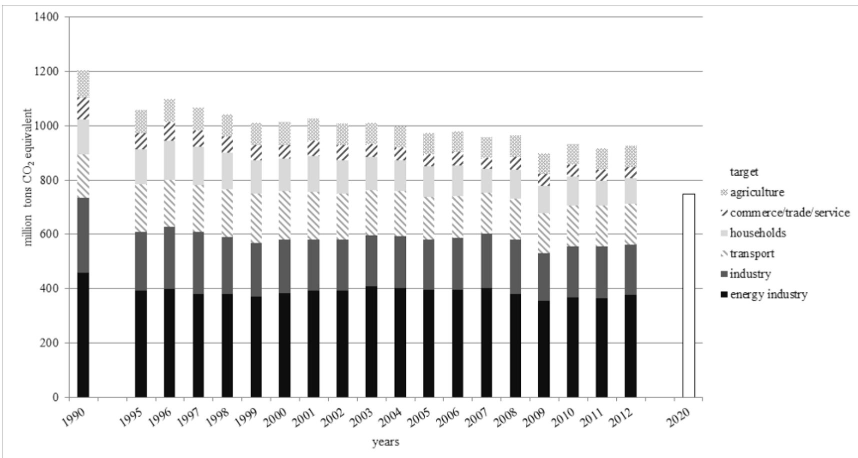


Figure 28: Trends in greenhouse gas emissions in Germany by sector
Source: *** BMWi (2014b)

The selection process for the organizations here is not easy. Figure 29 shows how many factors are to be considered and complicated the energy efficiency landscape can be. The selection process ideally shall be accompanied by an energy specialist/consultant.

	regulation	Mandatory			Refunding								BAFA subsidy
		EDL-G			EEG 2014 exception				energy and electricity tax				EBM
			alternativly	alternatively				alternatively				alternatively	
	frequency	every 4 years 1st by 05.12.'15	yearly	yearly	yearly	yearly	yearly	yearly	yearly	yearly	yearly	yearly	every 2 years possible
SME	not producing	-	-	-	-	-	-	-	-	-	-	-	EA 16247-1 (subsidy up to 8.000 €)
	producing no refunds	-	-	-	-	-	-	-	-	-	-	-	EA 16247-1 (subsidy up to 8.000 €)
	producing electricity < 1 GWh/a	-	-	-	-	-	-	-	EEG exception + attestation	ISO 50001 + attestation	EMAS + attestation	EA 16247-1 + attestation	EA 16247-1 (subsidy up to 8.000 €)
	producing electricity. 1-5 GWh/a	-	-	-	EEG exception + attestation	ISO 50001 + attestation	EMAS + attestation	EA 16247-1 + attestation	EEG exception + attestation	ISO 50001 + attestation	EMAS + attestation	EA 16247-1 + attestation	EA 16247-1 (subsidy up to 8.000 €)
	producing electricity. >5 GWh/a	-	-	-	-	ISO 50001 + attestation	EMAS + attestation	-	EEG exception + attestation	ISO 50001 + attestation	EMAS + attestation	EA 16247-1 + attestation	EA 16247-1 (subsidy up to 8.000 €)
non SME	not producing	EA 16247-1 1st by 05.12.'15	ISO 50001	EMAS	-	-	-	-	-	-	-	-	-
	producing electricity < 1 GWh/a	EA 16247-1 1st by 05.12.'15	ISO 50001	EMAS	-	-	-	-	-	ISO 50001	EMAS	-	-
	producing electricity. 1-5 GWh/a	EA 16247-1 1st by 05.12.'15	ISO 50001	EMAS	EEG exception	ISO 50001	EMAS	EA 16247-1	-	ISO 50001	EMAS	-	-
	producing electricity. >5 GWh/a	EA 16247-1 1st by 05.12.'15	ISO 50001	EMAS	-	ISO 50001	EMAS	-	-	ISO 50001	EMAS	-	-

Figure 29: Energy audit landscape in Germany

Source: by author, chart being used by the author in his respective seminars and trainings

The energy audit process

In Germany two models of energy audits exist. One of which makes energy audits legally binding (for non SMEs) and the other model is set on a voluntary basis (for SMEs).

According to the European Commission, SMEs are socially and economically the dominating size of companies in Europe. In the EU (European Union) SMEs count for 99% of all enterprises and offer jobs to 65 Mio people. SMEs are the essential motor for innovation and the foundation for any national economy (***BMWI, 2014f). With a share on the value creation of the total economy of 24%, SMEs in Germany are amongst the highest in Europe, also being called the hidden champions. Around 54% of them developed a product or market innovation (2008-2010); the European average showed only 34% (***BMWi, 2014f). Consequently, any negative impact on the financial health of the SME sector is to be carefully analysed and taken serious as it would drive any national economy into a disaster (***BMWI, 2014e).

The energy audit process for "Non-SMEs"

In Germany the transfer of the EU energy efficiency directive took place in April 2015 when the EDL-G (energy service law) became effective - 2.5 years after the EU directive became effective. The EDL-G-law requires all enterprises larger than a SME (small medium sized enterprise) to perform a specific energy audit by December 5th, 2015 the latest; in case of failed performance penalties of up to 50,000 Euro are announced (***BAFA, 2015a). The issue that came up mid 2015 in Germany was, that a huge number of enterprises needed to be audited according the EDL-G law; this number of concerned enterprises varies between 50,000 and 90,000 companies in Germany. This extraordinary wide spread of numbers resulted from the absence of a general database listing enterprises by SME status which is argued by different parties (***FÖS, 2015b). In parallel, due to the strict quality requirements for authorized auditors (***BAFA, 2015b), there was not enough audit personnel available in order to fulfil the "sporty" lead-time left until the given deadline - just around eight months (April to December 2015). Considering that it takes a minimum of two weeks in the case of "smaller" enterprises to perform the energy audit correctly and the low number of available qualified auditors, it was mathematically not possible to match the given deadline. In order to allow for a certain relief in this context, the responsible Ministry informed about a fair balance process until end of April 2016. After this deadline, the penalties would be coming without exceptions (***IHK, 2016).

The energy audit process for SMEs"

For SMEs in Germany there is no obligation to perform energy audits; however SMEs can under certain conditions receive subsidies of up to 80% of the energy audit cost, in case they undertake an energy audit voluntarily. This program replaced an older variant and is effective since January 01, 2015.

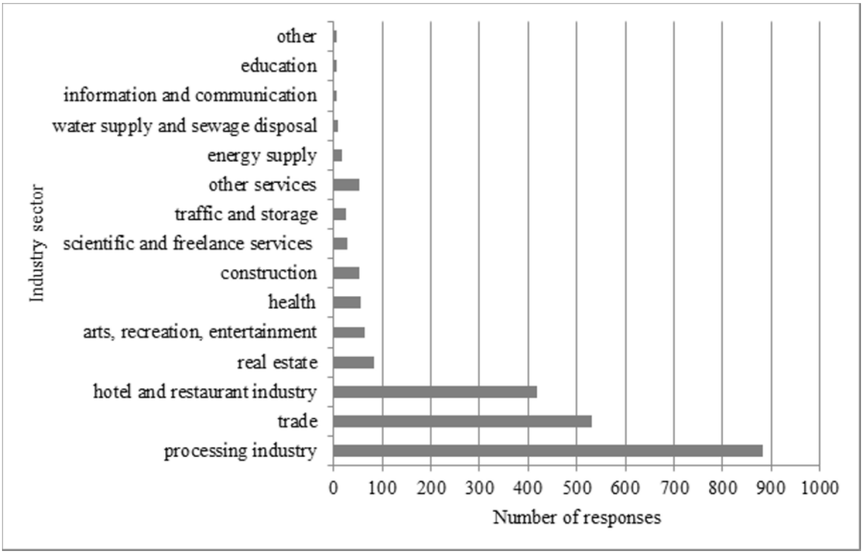


Figure 30: Number of energy audits by industry sector in German SMEs in 2015
Source: *** BAFA (2016)

The support program differentiates between SME with more or less than 10,000 Euro/a energy cost; above this line, max. 8,000 Euro are available as subsidy, below, only 800 Euro. After the first year, the responsible ministry conducted a survey in order to find out how this program performed in its first year (***BAFA, 2016). Accordingly 2,238 subsidized energy audits were performed in German SMEs in 2015 with a strong focus in the processing industry, trade and the hotel sector (Figure 30).

Looking at technologies, LED lighting and heating systems were the mostly proposed energy efficiency measures in these audits (Figure 31). The statistics also revealed that SMEs with low energy cost (below 10,000 Euro/a) only a marginal number of 150 enterprises performed an energy efficiency audit. This was not surprising but below expectations. In order to increase the motivation, the subsidy was increased to 1,200 Euro as of January 1st, 2016. This program change however might not bring the expected increase in performed audits. In order to achieve that, a process linking the subsidies in a more staggered approach to the energy cost would increase the perception of the current system with a more randomly defined break line.

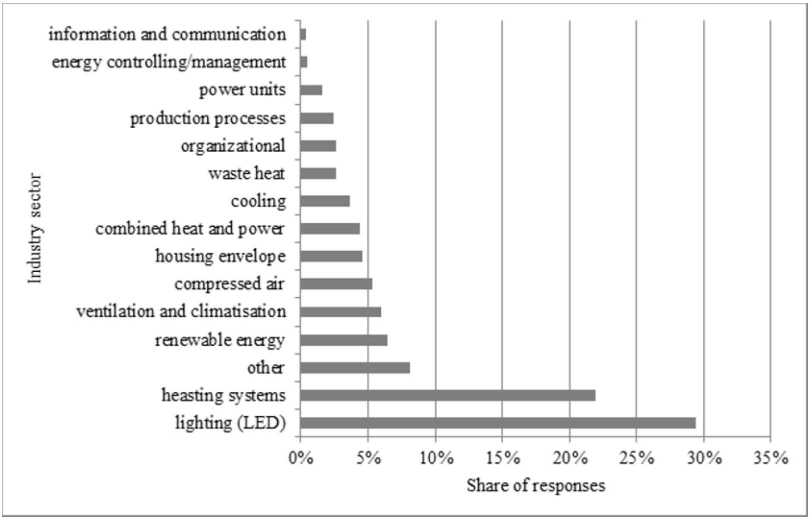


Figure 31: Share of proposed efficiency measures in German SMEs in 2015
Source: *** BAFA (2016)

Alternative Systems to the energy audit process

There are different alternative systems offered in order to comply with the energy efficiency law:

- Energy Management Systems (EnMS) according to ISO 50001 industry norm
- Eco-Management and Audit Scheme System (EMAS)
- Others.

Eco Management and Audit Scheme (EMAS): is a system combining *Environment Management Systems* and *environmental auditing* for organizations intending to improve their environmental performance. These can be enterprises, service providers, administrations and other organizations. Attending certified organizations need to declare its direct and indirect effects on the environment, its environmental performance and objectives. These declarations are assessed by certified experts and need to be update on a yearly basis (Jasch, 2015; Hentze and Thies, 2014; ***BMU, 2014a).

Energy Management Systems (EnMS): usually certified according to ISO 50001industry norm management systems are designed to continuously monitor, control and improve energy efficiency in organizations. Energy management systems can be embedded in existing management systems which eventually already exist in the organizations in the sectors of environment (EMS), quality (QMS), security (SMS), etc. (Figure 32).

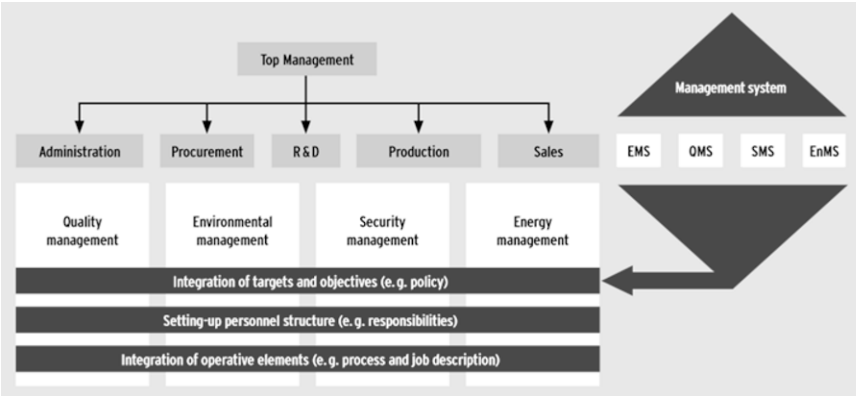


Figure 32: Integration of Energy Management Systems (EnMS)
Source: ***UBA (2012a)

EnMS offer a platform supporting energy efficiency activities by documentation, monitoring and information throughout the organization.

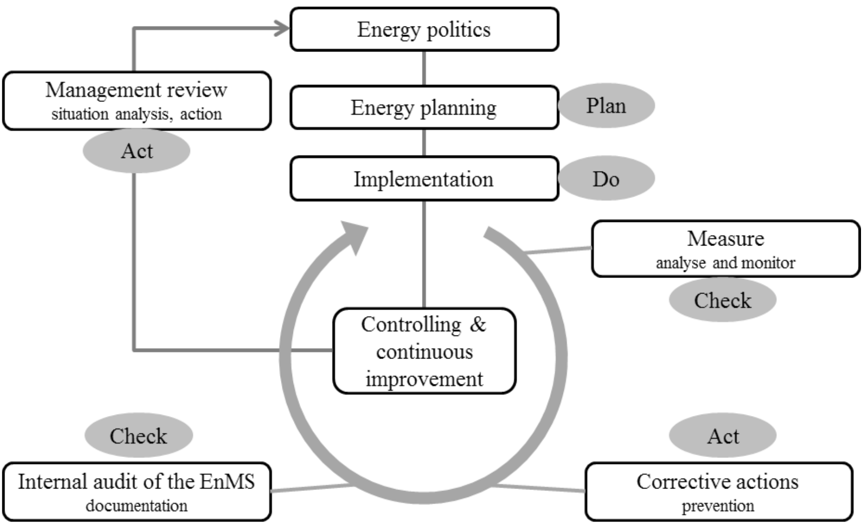


Figure 33: PDCA process of EnMS
Source: author's design, based on ***UBA (2012a)

The advantages of EnMS are cost reduction, protection of the environment, sustainable management, improve the organizations image and allow the use of financial benefits. In addition EnMS are an important tool for the government to register reductions in greenhouse gas emissions for their reporting process to the EU authorities (***UBA, 2012a; Wallikewitz and Schymczyk, 2015).

EnMS strictly follow the PDCA-cycle (Plan-Do-Check-ACT), according to ISO 50001 industry norm (Figure 33). The four phases of this process are characterized as follows (***Beuth, 2011; ***UBA, 2012a; Wallikewitz and Schymczyk, 2015).

Plan:

- Development of the energy policy of the organization by the top management.
- Definition of the energy efficiency targets and objectives
- Definition of roles, responsibilities and processes
- Legal obligation check
- Definition of the energy performance indicators (EnPIs – refer also to chapter 1.1.3)
- Definition of energy management program and action plan

Do:

- Assignment of tasks
- Operational structuring and resources
- Raising awareness and training
- Documentation
- Communication
- Implementation and operational control

Check:

- Monitoring, measurement and data analysis
- Legal obligations check
- Corrective action and prevention
- Internal audits and documentation
- Planning and structuring records

Act:

- Management review
- Situation analysis
- Improvement activities

Management systems (MS) enable enterprises to benefit through refunds of energy and electricity taxes, as well as eventually by the participation of the exception model of the EEG described in chapter 4. Another benefit is the continuous cost reduction. Even a certain investment is required in the installation phase, over the years significant cost reduction by reduced energy consumption but also reduced life cycle cost will pay back the investment quickly (Figure 34). Besides providing cost and energy benefits, EnMS also support the quality assurance process by sending alert messages supported by individually definable process parameters.

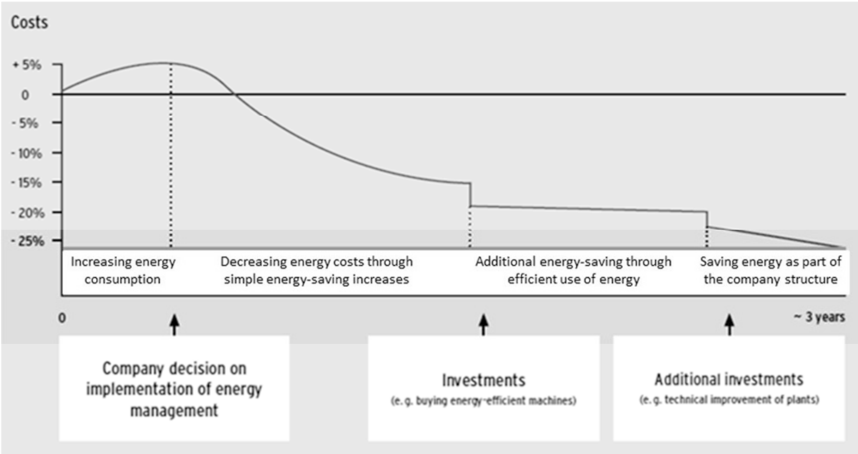


Figure 34: Continuous cost reduction by EnMS
Source: ***UBA (2012a)

Sustainable energy is an important factor not only in today's business world and energy economic systems. Even though, regulations and procedures in the EU are not harmonized between the member states and hinder effective progress in reducing energy consumption. The process of synthesizing and generating deeper insights to the energy savings potentials and installations of renewable energy plants in all regions on earth is urgently required in the process fighting climate change (Kermeli et al., 2015).

1. 1. 3. Characteristics of business performance indicators in the energy economics

In today's global world consumers require and expect a growing level on products and services performance. In addition, an increasing number of regulations include specific requirements for business, human health and environment protection, including energy efficiency. The entirety of these requirements must be followed by any business (Olaru et al., 2014).

In this context, coordination of all players including management is a must. Through this condition it is ensured that all involved parties are working towards the same one major objective. In the literature, this process of project integration is characterized and evaluated as the integration of management systems (Sandru et al., 2014). Hereby it is irrelevant whether management systems in the context of for example quality (ISO 9001 industry norm), environment (ISO14001 industry norm), energy management (ISO 50001 industry norm), energy audits (ISO 50002 / DIN EN 16247-1 industry norms) or combinations are being used (Francesschini et al., 2007).

The current economic context of globalization requires continuous adaptations and improvements as well as efforts to coordinate diverse projects with different objectives. In this context, projects are faced with a hard and global competition within companies but also external. Today's organizations therefore are pushed to carefully analyse every aspect of their decision making processes. Here it is obligatory to implement and use an efficient resources management. The development and use of performance indicators is here an important element setting the targets for the company's project portfolio (Sandru et al., 2014). Resulting from this context, the Key Performance Indicators (KPIs) were developed. Usually performance indicators are developed reflecting financial contexts; however, in order to be able to compare enterprises also in aspects other than financials, also non-financial criteria need be indexed (Schuster et al, 2015; Heesen et al., 2014). This is particularly important once these companies are different in size, organizationally differently structured or even acting in a different branch or sector. In order to manage companies successfully, performance indicators are an irreplaceable, important tool (Posselt, 2014).

a) Performance measurement system

A powerful and adequate performance measurement system can be characterized as follows (Levinson et al., 2002; Giese, 2012):

1. The KPI performance measurement system has to support the projects owners in fulfilling the performance targets.
2. Performance management system is to be an open system, available to and manageable by the project partners
3. Measurement tools are to be distinct, explicit, precise, neutral and measurable with adequate data.

In that context, leading personal through management by performance indicators can be a very helpful tool, once management is successful in winning their employees attention. This can be easier achieved once the team is convinced that the objectives are reachable (Posselt, 2014; Kühnapfel (2014).

In order to gain from knowledge, one needs to assess the available data. This analysis can be done static or dynamic (Botsis et al., 2015; Becker et al., 2014). In contrast to the static approach, the dynamic evaluation analyses the data by comparison against conventional values (Figure 35).

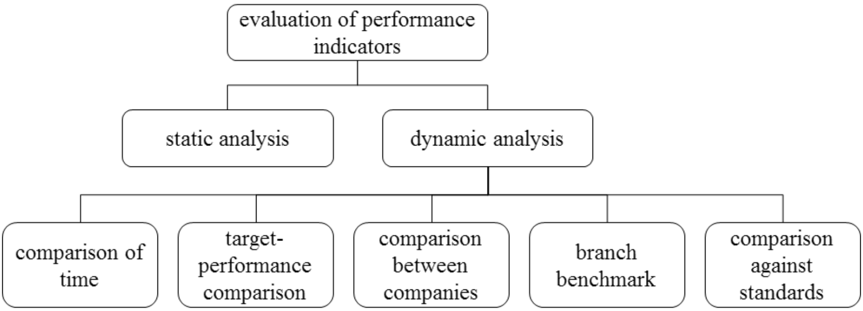


Figure 35: Evaluation of performance indicators
Source: by author based on Botsis et al. (2015)

With the time comparison, data of the same object at different times are compared, such as the energy consumption of a process in summer compared to winter. The target-performance comparison compasres objectives against achieved data, a set-up being used in energy efficiency audits for example.

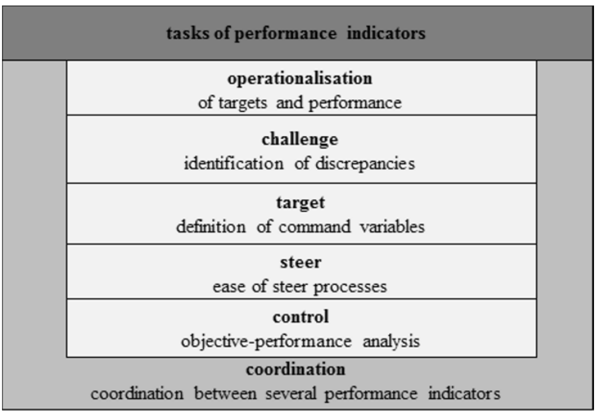


Figure 36: Tasks of performance indicators
Source: by author based on Weber et al. (1995)

The comparsion between companies is used to find out how different companies perform, for instance the energy consumption for comparable processes between several subsidierries can be compared. The branch benchmark is being used to compare businesses within the the same industry sector, hence the energy consumption with the competition could be compared. The comparison against standards finally is being used in order to find out whether standards, such as energy efficiency targets provided by the government are being met.

The tasks of performance indicators can be manifold (operationalisation, challenge, target, control, coordination) as explained in Figure 36.

Today’s business environment is characterized by openness, inconsistency and complexness followed by a high degree of instability (Mihic, 2011). The changeable nature of business, going along with changing customer demands, new developed technologies, and more complex structures of enterprises during the last decades resulted in a more and more complex business environment.

b) Multi project management and KPIs

Forced by this increasing demand for flexibility and performance improvements, companies started to implement the project management concept (Hobday, 2000; Mihic, 2011). In the recent years, this concept of project management, shifted from being an operational tool towards being an integrated key element within the strategic structure to be globally competitive (Kerzner, 2011; Sandru et al., 2014).

According to the literature, several approaches on performance indicators all merging to the same objectives are standardized today. The ones mostly used and standardised are summarized in Table 1 four of which focusing on project portfolios.

Table 1: Comparison between project management standards in multi project management
Source: Gilles et al. (2004)

Projects focused	Single Project	Program	Projects portfolios
ICB	X	X	X
PMBOK® Guide	X		
PMCDF	X		
OPM3	X	X	X
AIPM	X	X	X
PRINCE 2	X	X	
P2M	X	X	X

According to the literature, several approaches on performance indicators all merging to the same objectives are standardized today. The ones mostly used and standardised are summarized in Table 1 four of which focusing on project portfolios.

There are several definitions the term of KPI which can be found. However there is no generally approved definition available yet, for example:

- Todorovic et al. (2013): As a first step in defining KPIs, the specific characteristics they should achieve are to be defined.
- Kerzner (2011): The exact understanding is in the meaning of each word:
    - Key – a major contributor to the success or flop of the project;
    - Performance – a factor being qualified, adjusted, measured, controlled;
    - Indicator – a reasonable representation of performance (now and in future).

In that context, it is utmost important that the company uses the performance indicators in order to judge its individual projects as part of the overall project portfolio investment program (Olaru et.al, 2011). This will ensure that in the context of today's global and complex business environment project decisions are made focusing on strategic goals of the enterprise.

The first step in the project decision process, the strategic objective of the organisation needs to be defined and in a second step through the use of the right KPIs its reach is to be ensured. Classically KPIs are defined by using a management framework such as the balanced scorecards. The KPIs are hereby defined by a dataset used to compare planned against measured.

These datasets are combined to focus on different elements and will establish the structure of the KPIs to be implemented throughout the performance objective analysis process. The indicators in this process can be generically clustered as (Sandru et al., 2014; Kühnapfel, 2014; Gladen, 2014):

- Quantitative indicators – related to budgeted work to be done
- Qualitative indicators – related to the quality issues
- Financial indicators - to measure financial flows
- Quality of work done – to measure waste rates
- Temporal indicators – related to the time schedule
- Output indicators – to measure process activities
- Input indicators - to measure resources needed to achieve the planned outcome

KPIs are high-level snapshots business processes based on predefined measures and are visualized using reports, tables or charts. (Parker, 2012)

KPIs need to create information which is measurable, reliable, and exact and to be usable for corrective actions in case the performance of the process is not in line with the objective defined. According to SR EN ISO 9004:2010 industry norm, such information must take into account (Sandru at al., 2014):

- requirements of customers and other stakeholders
- importance of the products to the enterprise
- efficiency & effectiveness

- effective & efficient use of resources
- financial performance
- legal compliance

Based on these generic primary characteristics, more detailed KPIs need to be developed (Figure 37).

Figure 37: Generic elements of KPI's
Source: Sandru et al. (2014)

Key Performance is defined as ways to frequently measure and control the performance of projects and is different from business typology and investment objectives. It is important to exclude non-controllable fulfilment factors in their definition and to structure them in a meaningful, measurable and understandable way (Drosse, 2014).

Figure 38: Defining elements of KPI's
Source: Sandru et al. (2014)

That's why the KPIs should follow the SMART criteria. SMART is an abbreviation for a set of criteria reflecting complex objectives. SMART (**S**pecific, **M**easurable, **A**chievable, **R**elevant and **T**ime-bound) stands for elements focusing on objective setting and configuring KPIs, attributed to Peter Drucker's management by objectives concept.

The driving elements of KPIs (Figure 38) thereby follow the PDCA (Plan-Do-Check-Act) principle, also being used in DIN EN ISO 50001 industry norm of energy management systems.

In order to keep individual projects under control, performance measurement is a consistent challenge in companies (Olaru et al., 2014b). The principal issues of project controlling hereby are connected:

- Measuring performance of an entire portfolio of projects
- Prioritisation of secondary objectives
    - Merging these to the main objective
- Comparing dynamic processes with a fix reference

The performed research surveyed models of performance indicators used in a multi project management environment and the performance measurements of project portfolios.

The focus was to define and develop an environment for multi project management allowing for a cross project performance evaluation as well as supporting the decision making process providing a structured and concentrated information analysis (Sandru at al., 2014).

In a multi project environment, a single project can be interpreted as a single piece of the investment portfolio program of the enterprise.

Using primary performance indicators do hereby simply not offer the entire concentrated information needed. Hence a more complex, scope adjustable performance evaluation is required in combination with a weighting system for each of the KPIs in order ensure receiving precise data.

Building a sustainable portfolio of projects, covering the individual objectives of all projects is key and can be reached by a common Work Breakdown Structure (WBS) through its basic tasks (Sandru at al., 2014).

In the daily business, an industrial site generally will focus on

- Forecast analysis (planned vs. actual)
- Project timelines
- Project resources
- Output

and illustrate those in progress curves (Figure 39).

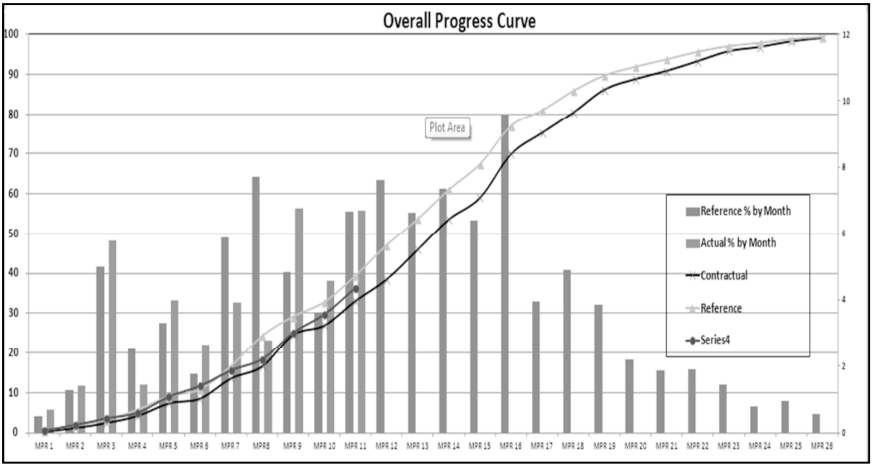


Figure 39: Portfolio, overall progresses curve
Source: Sandru et al. (2014) – diagram here exemplarily, details not important

Whereas an overall project curve serves to illustrate the overall project status and trend, it is suggested to detail out as many S-curves as the number of critical elements, processes or disciplines the project needs to observe. These can be S-curves by output, by time, by department, etc. S-curves hereby give a global overview on the considered scope (Figure 40).

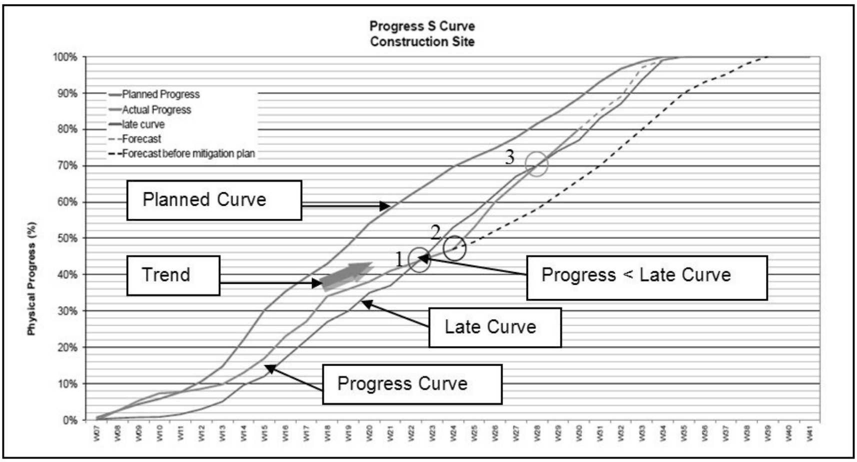


Figure 40: Portfolio evolution analysis based on time related KPIs
Source: Sandru et al. (2014) – diagram here exemplarily, details not important

The arrow indicates the trend of the actual project progress. Pointing towards the line crossing with the late curve (Figure 40), the arrow serves as an indicator towards potentially upcoming problems (alarm bell) (Sandru at al., 2014).

- Circle 1 (analysis point) indicates that the progress is running behind the late curve requiring adjustments in order to get back to right track.
- Circle 2 indicates a trend change – hence to corrective actions show improvements, whereas the dotted curve shows the path without the moderation
- Circle 3 indicates that the corrective action was successful, the project is back on track (between planned and late curve).

It is important to understand whether the project in on track. Therefore the KPI process is an important element for each enterprise.

c) KPIs and EnPIs

In literature, there are many types of KPIs mentioned and explained, such as indicators on liquidity, solvency, flow measures, cash flow rates etc. as detailed out for example by Krause et al., 2010; Dietzfelbringer, 2015; Giese,2012). Those mainly miss out the EnPIs (Energy Performance Indicators) which developed along with the implementation of energy management systems and are a key element in the DIN EN ISO 50001 industry norm (Energy Management standard).

EnPIs hereby indicate the level of energy consume during a specific activity related to a defined reference, i.e. energy consumed [kWh] per produced product [kg].

machine hourly rate = $\frac{D+I+M+O+E}{PA}$
D = depreciation = $\frac{\text{replacement cost}}{\text{machine life}}$
I = interest = 0,5 x replacement cost x interest rate
M = maintenance = replacement cost x maintenance rate
O = occupancy cost = floor space required x cost x 12
E = energy cost = energy demand x energy cost x utilisation level
PA = planned level of activity = workdays/year x work hours / day

Figure 41: Calculation of machine hourly rates
Source: Stollenwerk (2012)

Table 2: Examples for Energy Performance Indicators (EnPIs)
Source: *** BMU (2012)

Key data	Description	Unit
total energy consumption	absolute	kWh, MWh, Euro
specific energy consumption	$\frac{\text{total energy consumption [kWh]}}{\text{production quantity/units}}$	kWH/PQ kWh/PU
percentage of energy source	$\frac{\text{consumption per energy source [kWh]}}{\text{total energy consumption [kWh]}}$	%
energy intensity	$\frac{\text{energy of a process (field) [kWh]}}{\text{total energy consumption [kWh]}}$	%
percentage of energy from internal circuit	$\frac{\text{energy from internal heat recovery [kWh]}}{\text{total energy consumption [kWh]}}$	%
percentage of renewable energy sources	$\frac{\text{use of reneweable energy [kWh]}}{\text{total energy consumption [kWh]}}$	%
total energy cost	absolute	Euro
specific energy cost	$\frac{\text{energy costs [Euro]}}{\text{production costs [Euro]}}$	%
industry-specific energy performance indicator	$\frac{\text{total energy consumption [kWh]}}{\text{turnover [Euro]}}$	kWh/Euro
specific cost per energy source	$\frac{\text{cost per energy source [Euro]}}{\text{consumption per erngy source [kWh]}}$	Euro/kWh
cost savings	absolute	Euro

The EnPIs on one hand can be used to analyse the energy efficiency of the production process; on the other hand they also can serve as process alert; thirdly they can be an important element in the purchase process of energy as well as energy efficient pre-products, products and/or services (Stollenwerk, 2012; Gladen, 2014); energy cost are an important element in that context (Figure 41). In case the EnPI "energy/produced product" is increasing without producing more produced, this can be an alert for malfunction in the production process hence a signal to avoid the production of low quality products or even waste. According to Schenk et al. (2010), EnPIs are also a crucial element in in the factory planning process.

Using energy management systems (EnMS) EnPIs are an important element. It is important that these are representative enough to be used to track the energy politic statement of the companies' management. It is important to base them clearly on certain system boundaries and defined operating conditions. Generally there are several different EnPIs possible, depending on their primary use (Table 2).

EnPIs can be used in the product development process (plan values) as well as during the production cycle (measures values). As illustrated in Table 3 the EnPI "energy cost/unit" can serve in order to compare energy consumptions per machine or facilities or between different products and provide information for the production planning process. On the other hand, this EnPI can also be used to define and control energy efficiency measures.

Table 3: Energy cost / unit
Source: by author, exemplarily

	product 1			product 2		
	units [kg]	energy cost/unit [Euro/kg]	energy cost [Euro]	units [kg]	energy cost/unit [Euro/kg]	energy cost [Euro]
machine 1	14,500	2,00	29,000	10,000	1,70	17,000
machine 2	6,000	1,50	9,000	7,000	1,80	12,600
machine 3	12,000	1,80	21,000	9,500	1,70	16,150

The EnPI information ordered according to size and evaluated using the ABC-analysis can be used in the management decision process (Lorson at al., 2013).

EnPIs are being used in enterprises, politics and service providers. For enterprises, EnPIs help to control and increase energy efficiency as well as production output, quality and profitability. Governments use EnPIs in order to define and control energy targets, to check whether substitution conditions are met and to compare branches. Service providers use EnPIs in order to identify energy reduction potentials, to proof energy reduction results, as quality proof (efficiency targets of products) and proofs during the certification process of energy management systems (EnMS). Usually EnPIs depend and rely on different determining factors, such as the context, a machine is being installed for. In this context, EnPIs are being used to represent single products or processes, but also product / process groups up to entire facilities/ companies.

In general EnPIs shall be usable to monitor the energy consumption of a defined system. In this context the timely development of energy consumption is being controlled. The energy consumption of the system is being compared with itself over time. A second objective of EnPIs is to support the evaluation of the energy consumption of a defined system. In this case the energy consumption of the system is being benchmarked with other comparable systems (see also Table 3). The overall objective of EnPIs is to control and evaluate the energy consumption of an entire system. As for example a system "production" contains of several sub-systems, EnPIs for each of the relevant subsystems need to be defined. For each of the subsystems, their sub-efficiency will be defined. Adding all the sub-efficiencies up will result in the energy efficiency of the defined system. During this process, it is important to understand the influence of external factors, which cannot be influenced by the system. Those can be for example outside temperature and outside humidity which have an influence on the performance of heating or cooling systems for instance. Comparing heating or cooling systems using established EnPIs it is therefore important to know and understand these external factors and to include these parameters in the calculation of the EnPIs (Figure 42).

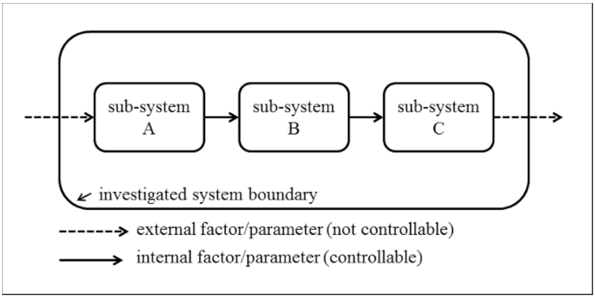


Figure 42: EnPIs and system parameters
(Source: by author)

As mentioned, the objectives of EnPIs are (Gladen, 2014):

- to evaluate the energy relevant effort
- to compare the energy consumption with other systems.

Based on the author's experience, the efficiency of several additional areas can be improved by combining the benefits of EnPIs (Figure 43).

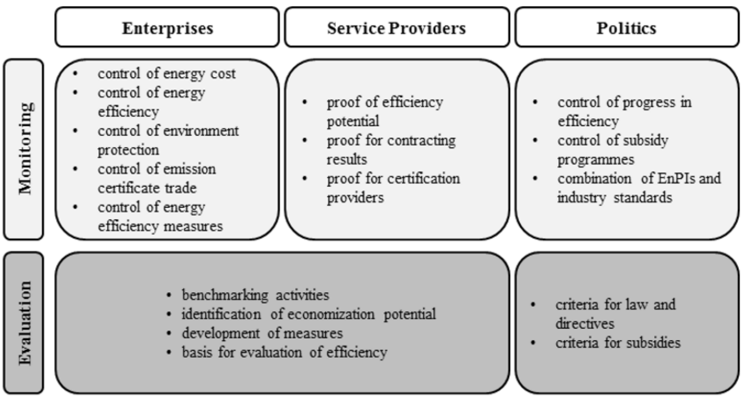


Figure 43: Benefits of EnPIs
(Source: by author)

	S - strengths	W - weaknesses
O - opportunities	focus on chances matching the strengths of the company, i.e. positive market share development	eliminate weaknesses in order to benefit from new chances, i.e. speed up launch of energy efficient product
T -threats	focus on strengths in order to fend threats, i.e. prepare in time for new legal energy efficiency requirement	Develop defence strategy to avoid weaknesses to develop towards threats, i.e. hire energy manager

Figure 44: SWOT analysis by the example of energy efficiency
Source: by author based on Stollenwerk (2012)

EnPIs as any other performance indicators can also be used to support strategic management decisions, usually being visualized through SWOT-analysis. The SWOT is an acronym for strengths, weaknesses, opportunities and threats (Stollenwerk, 2012). In this SWOT-analysis its four elements are opposed to each other indenting to identify focus areas for a future strategy, which also forced by legal directives in more and more companies includes a focus on energy efficiency and energy management. Figure 44 for example illustrates exemplary a SWOT-table using the example of energy efficiency.

d) The EFQM model

The EFQM-model of the European Foundation for Quality Management (EFQM) presents an excellent frame for an integrated CSR management (Olaru et al., 2011b; Lotter and Braun, 2014) and as such it also can be used in the context of energy management systems. Through its elements, it illustrates in an easy way which levers an organization needs to pull in order to perform on all its levels and how these levers can be controlled. The model is based on eight pillars with the objective to provide excellent results in view of performance, customers, employees and society through a leadership (Figure 45).

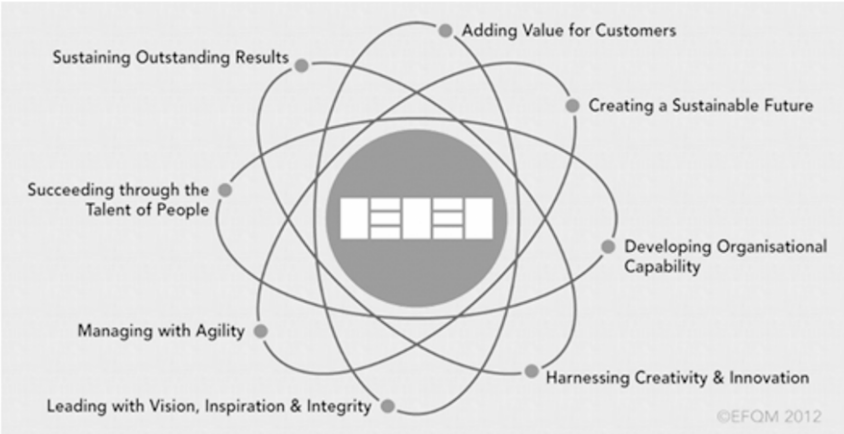


Figure 45: Fundamentals of the EFQM model
Source: *** EFQM (2016a)

The EFQM model provides 3 main pillars (learning, creativity and innovation) and 9 criteria (enablers and results) (Figure 46). The EFQM model provides an excellent base for an integrated CSR management, as it allows catching and registering processes and their results followed by a structured review process. By that it enables excellent results on an economic, ecological and social basis.

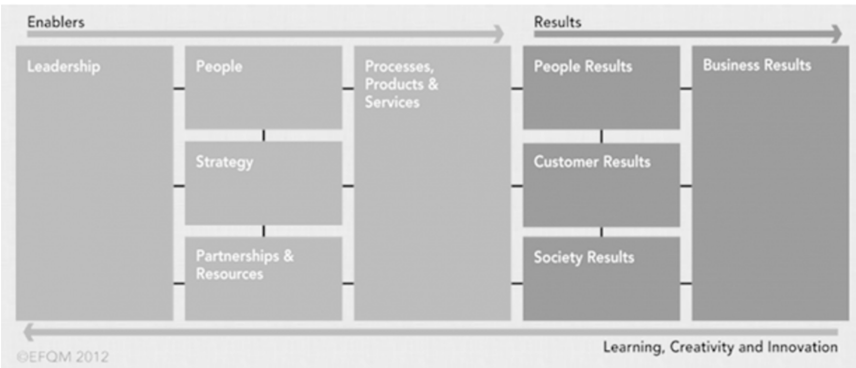


Figure 46: Criteria of the EFQM model
Source: *** EFQM (2016b)

1.2. Actual approaches and perspectives in the development of sustainable energy strategies

1. 2. 1. Definition of energy economics

Energy economics combine production, distribution and use of energy by societies. By that it's strongly related to energy engineering, politics, ecology, economy, etc. As such several disciplines nowadays come on focus while debating energy economic issues: climate change and policy, sustainability, risk analysis, security of supply, energy audits and energy efficiency, energy policy, energy management, specialization on energy services, e-mobility and sustainable transport, renewable energies, load management to name the mostly used terms (Sweeny, 2013; Kanndemir and Görgülü, 2010).

1. 2. 2. Factors of energy economics influencing responsible business practices

As mentioned climate change became to be one of the key words today and will be even more important in the very close future. The global warming effect is increasing, undoubtable being pushed also by the energy use and green-house gas emissions worldwide. The *"5th Climate Change 2014 Synthesis Report"* of the IPCC confirms the human influence with a probability of 95-100% to be the main factor of the temperature increase on earth since the 20th century (*** IPCC, 2014).

The human influence was confirmed in the heating of the oceans and the atmosphere, the changes in the global water cycles, the rise of the global average sea-levels as well as the decreasing levels of snow and ice on earth. As a consequence the IPCC claims a 100% resignation from the use of any fossil energy sources. In Germany for instance brown coal power plants contribute substantially to a high level of green-house gas emissions, as a study by the DIW[2] revealed (Reitz, 2014).

The world energy demand is mainly satisfied using fossil sources, releasing masses of green-house gases to the atmosphere in a much shorter time as it took them to be stored (Weber et al., 2014a). In 2013, the quantified atmospheric concentration of CO_2 in the Northern hemisphere reached a level of 400ppm (Figure 47), a value which was lastly achieved in the era of the Pliocene, which was three Mio years ago (Fell, 2013; ***BMU, 2015).

[2] DIW = Deutsches Institut für Wirtschaftsforschung e.V., Berlin – German Institute for Economic Research

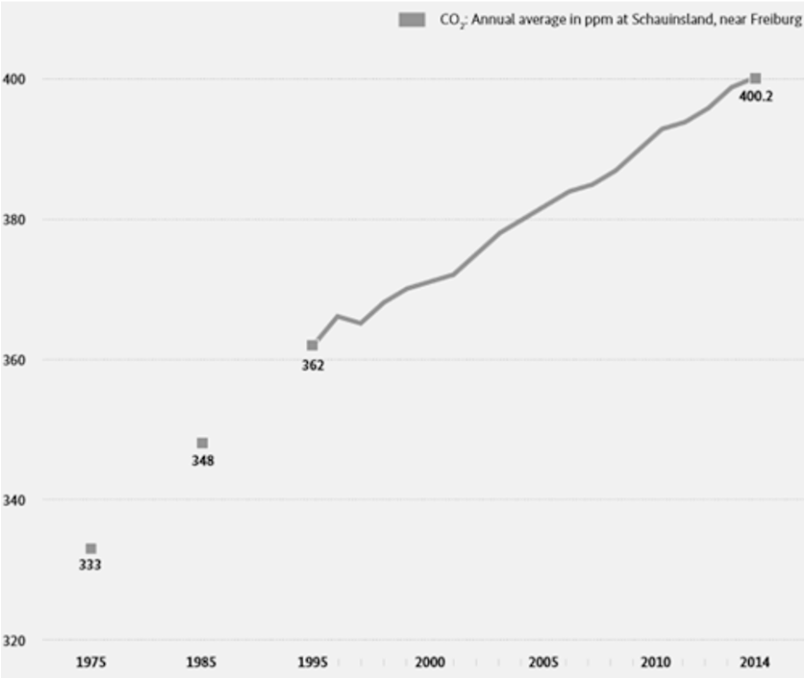


Figure 47: Development of the CO_2 concentration in the atmosphere (German city of Freiburg)
Source: *** BMU (2015)

As a physical effect, the temperature on our planet (Figure 48) follows the atmospheric CO_2 concentration with a short time delay (Schabbach et al., 2012).

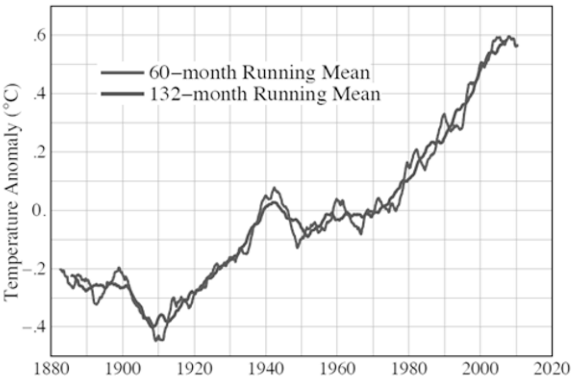


Figure 48: Global average temperature anomaly relative to the 1951-1980 base periods
Source: Wara (2014)

Prior the industrialization, this atmospheric CO_2 concentration levelled at 280ppm, in other words, since the industrialization, the atmospheric CO_2 concentration rose dramatically - grown to a level which urgently requires corrective action to keep planet earth in a liveable condition (Weber, 2015), factors with crucial influence on energy economic strategies.

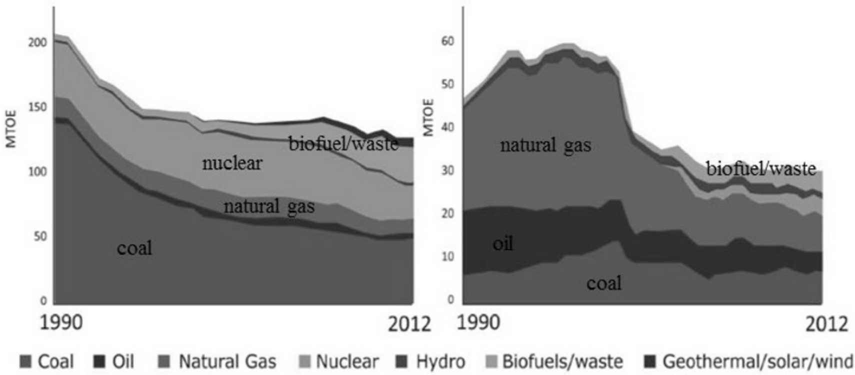


Figure 49: Comparison of energy production mix in Germany (left) and Romania (right)
Source: Calota (2015)

A comparison of the German and Romanian energy production mix shows how different the countries produce their energy. Whereas in Germany coal is the main CO_2 emission source, it's a mix of oil, natural gas and coal in Romania (Figure 49).

With the energy consumption and along going green-house gas emissions and pollutions being a main driver of climate change, strong efforts need to be put on the main energy consumers. Those are identified as the household, transport and industry sectors, with transport serving both, household and industry sectors (Figure 50). The energy demand hereby can effectively be reduced introducing energy efficiency measures and energy management systems. By sourcing the energy demands left after implementing efficiency measures through renewable energy sources, the CO_2 emissions could almost be zeroed out (Weber, 2015).

According to a study from 2011 (*** Greenpeace, 2011), the energy potential through renewable energy sources could have supplied over 3,078 times as much energy as the energy demand on earth in 2003. As a side effect the dependency from other countries supplying fossil energy, which can become a serious issue in times of political unrest and instability (Kausch, et al., 2011; Barbian, 2001; Mükusch, 2011) could have been eliminated. For example, 54% of Germany's primary energy consumption is based on gas and oil with 94% of which being imported (Andruleit, et al., 2013). In addition, fossil energy sources are ultimate and with the increasing energy demand on earth, this effect will strengthen going forward (Kausch et al., 2014; Schabbach et al., 2012). Based on the fossil energy sources known today and the energy demand of 2013 on earth, the fossil energy sources will end in around 76 years (averaged) (Andruleit, et al., 2013).

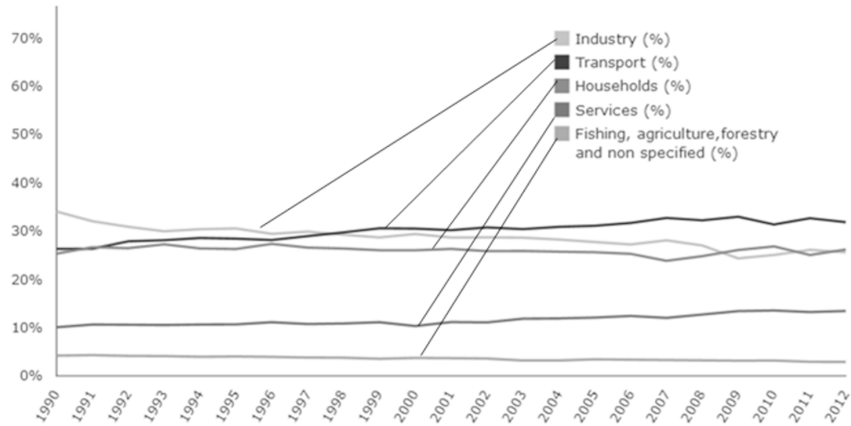


Figure 50: Sector shares of final energy consumption in Europe
Source: *** EEA (2015)

On top, there is a risk factor linked to fossil and nuclear energy sources driving towards increasing social cost (health, insurance, weather extremes, etc.) (Langeheine, 2012; MacDonell et al., 2014). The social costs caused by electricity production (Table 4) are substantial, led by the use of brown coal. The emissions of brown coal power plants in Germany are hereby responsible for a calculated loss of 33,000 years of life, statistically around 3,100 dead persons per year, as a study by the University of Stuttgart, Germany revealed (Preiss et al., 2013). In addition, a recent study by Kiesewetter et al. (2015) confirms that particulate matter (PM) has remained a critical issue for European air quality and will not become under control in close future. PM, emitted mainly by coal power plants and fossil powered transport, is one of the main causes for lung cancer.

Turning this trend into a reduced energy demand on earth and a "green" energy production for the remaining energy demand is a critical path for the strategy of future climate protection and sustainability – this is being recognized and acknowledged generally. Without reductions of green-house gas emissions and global warming, far beyond todays activities, global warming will guide to massive, global and irreversible changes in the climate on earth by the end of the 21st century (*** IPCC, 2014). Already now in 2015, the effects of global warming can be experienced in

Germany – the summer 2015 showed with temperatures around 40°C new heat records since weather data are being recorded. Clinical studies revealed, that due to the consequences of climate change new kinds of pollen invade Germany and cause major issues to allergic persons (*** DWD, 2015). Furthermore the DWD (German Weather Agency) expanded its early-warning-system by newly installing heat warnings for high in-house temperatures (due to the historic climate and temperatures, air-condition systems are not popular in Germany).

Table 4 Social cost resulting from electricity production, Germany [€cent$_{2010}$/kWh$_{el}$)]
Source: *** UBA (2014)

Electricity production by	Emissions to the air	Green-house gas	Total social cost
Fossil energy			
Brown coal	2.7	8.68	10.75
Stone coal	1.55	7.38	8.94
Gas	1.02	3.90	4.91
Oil	2.41	5.65	8.06
Renewable energy			
Water	0.14	0.04	0.18
Wind	0.17	0.09	0.26
Photovoltaics	0.62	0.56	1.18
Biomass	1.07	2.78	3.84

In the context of a constantly growing world population, the human race will naturally secure its current level of economic wealth, in case economic growth is attended by a reduced use of short and expensive resources including energy. Consequently, economic growth is to be disconnected from the shift from fossil and nuclear towards the integration of renewable energies (Weber, 2015; MacDonell et al., 2014; Wellmer, 2014).

This will on one hand ensure a more cost effective production of energy henceforward, and simultaneously reduce the level of the before mentioned "social cost". Social cost put pressure on to the national economies through

- increasing cost for coping with more and more extreme forces of nature,
- increasing health cost (for example increases the pollution through coal and nuclear power plants cancer and the cost going along with it),
- Cost, caused by the consequences of increasing emissions of greenhouse gas etc.

Resulting from these scenarios, there are good reasons for a worldwide energy transition, such as (Weber, 2015):

- Responsibility towards future generations;
- Climate protection and nature preservation;
- Security of supply (in general not just of energy), competitiveness and cost stability;
- Booster for economic growth and employment (*** BMU, 2012a; *** BMU, 2012b);
- The increased level of public participation.

In the context of the ongoing cost discussion, the prevention cost need to be seen jointly with the cost savings through the benefits from these measures. In the year 2007, the economic effects of climate change for Germany were estimated to almost 1bn. Euro until 2015 and 406 bn. Euro by 2050 (***DIW, 2007). A study by the EU (***EU, 2012a) estimated the yearly cost through climate change for all Europe to 20 bn. Euro in 2020, 90 -150 bn. Euro in 2015, and 600-2,500 bn. Euro in 2080, depending from the level future green-house gas emissions. Adaptations and preventing measures however can help reducing these costs substantially, as the study laid out.

Adaptation to climate change generally covers measures helping to reduce the vulnerability from effects of climate change (*** EU, 2012a; Hennicke, 2010), which can be clustered as:

- Technological measures, such as protection against rising sea-levels, energy efficiency measures, etc.
- Behaviour changes, such as sustainable water and energy consumption, etc.
- Knowledge measures, such as researching the development of climate change and potential effects of the introduction of technical measures and behaviour changes etc.
- Political measures, such as stronger critical values, enforcements to energy efficiency measures, etc.
- Shifting to renewable energies
- Carbon capture and storage

In this context, economical models help to identify the correct ecological measures to counter fight climate change through cost-benefit-analysis.

Potential measures were intensively analysed by the study. For Germany exemplarily three sectors are summarized as follows (***EU, 2012a):

- Traffic/Transport
    - New road covers
    - Adaptations to stronger heat variations
- Industry
    - Prevention from heat caused productivity losses through more air-conditioning
    - Information about climate change
- Energy
    - Designing the power grid for extreme weather
    - Cooling of thermal power stations

Surprisingly, no energy efficiency measures, shifts to decentralized, renewable energy production or development of new energy efficient products were included in this study.

In their study performed back in 2009, Jacobson and Delucchi (2009) came to the conclusion, that renewables could cover the world's energy demand in twenty years already and turn fossil fuels to be completely needless. In addition they calculated the estimated cost for the worldwide energy supply until 2030 and conclude that shifting to renewables by 2030 is half in cost compared to staying with fossil sources (Figure 51).

Estimated cost for the worldwide energy supply [US$]	
oil	3,350-4,475 bn
gas	550-830 bn
coal	150-300 bn
electricity	1,490-2,150 bn
total/year	5,550-7,750 bn
total: year 2010-2030 (+20% per year)	200,000 bn
total: shifting to 100% renewable energy by year 2030	100,000 bn

Figure 51: Estimated cost for the worldwide energy supply until 2030
Source: Jacobson and Delucchi (2009)

In order to cool planet earth down, the principle of geoengineering is trying to shade the planet in order to reduce the major effects of human made climate change. As confirmed by many studies, artificial interference into the complex natural systems of our planet comes along with unknown risk. A study of the Max-Planck-Institute revealed that as a result of higher air temperatures, the atmosphere can store much more water, consequently the level of rain would be reduced drastically on earth (Kleidon et al., 2013). In the same year, the findings of this study were confirmed by a second study in this research field (Tilmes, 2013). As one consequence, the world community decided end of last year in Paris to limit the increase of the temperature on earth to a level of 1.5 degrees. A variety of measures are required in order to achieve that, all of them with a critical influence to energy economics and related responsible business practices.

1. 2. 3. Explanation of selected tendencies in sustainable energy systems

a) Information Technology (IT) in the context of energy economics

Information technology (IT) plays an essential role in today's life, privately as well as in business. In order to remain competitive in the market organisations have to increase their productivity and flexibility and need to improve their processes to be more efficient in terms of energy and resource consumption.

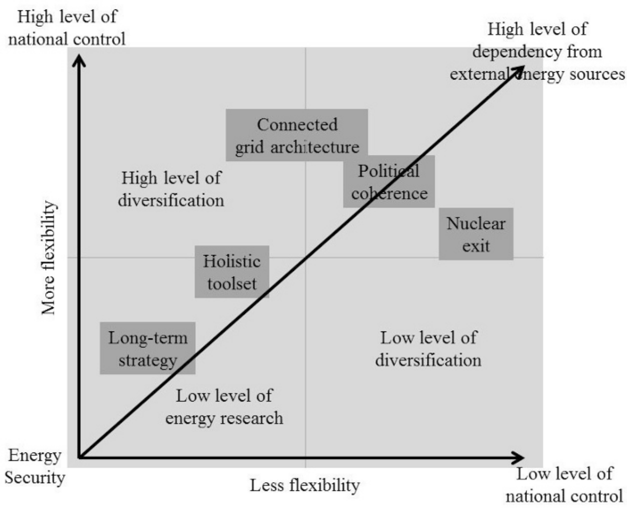


Figure 52: Future of energy security, IT components highlighted
Source: by author based on Mükusch (2011)

Simultaneously the market demand requests for a higher product diversity and individualisation. This development is challenging the way organisation used to operate by increasing the level of computerizes processes and systems. In the global context, market success and competitiveness of organisations will intensely depend on their IT-skills. On one hand this is valid for the development process and for managing the change process; on the other hand IT security is rapidly developing to be a key concern and risk for many organisations. For that reason and due to their complexity IT-services are often outsourced (Burr, 2014). The future of the energy security was described by Mükusch (2011) in its complexity and the view from the energy economical view point. Newly added is the IT-component being represented in several of the shown elements (highlighted, Figure 52). In order to ensure energy security, politics, economy, society and industry need to globally co-work.

Regarding the effects of the energy transition in Germany only limited data is available as development and progress of the energy transition and related energy efficiency results can so far not be accessed by the federal statistics department. In order to ensure a sustainable monitoring and publishing of these data, the IT framework urgently needs to be improved (***ewi, 2014). In addition smart metering becomes an increasingly important role in managing the power grid, power security and grid stability (Di Nucci, 2014) coming along with a huge dependency on Information technology.

Information security management

With the changes in the energy economics during the recent years, the production of renewable energies became an important element of the national economics worldwide. A new sector of business with a large number of enterprises in the wind, photovoltaic and biogas industry developed in a short period of time.

The operation of such plants and businesses heavily depends on a high level of information and communication technologies (ICT). In the global context of cybercrime in particular energy power pants, as crucial elements of todays' business and life, require a specific level of protection against cyber-related risks. (Hohan et al., 2014).

Some of this risk can be addressed by ICT, establishing monitoring and surveillance opportunities to also safeguard against external risks. An additional risk element developed with the remote connection of the power plants via internet (Rinaldi et al., 2001). The smart energy grid is a new potential target for terrorism as well as industry spying. The responsible US agency for cyber emergency reports significant increases in cyber-attacks (***ICS-CERT, 2013), in particular in the energy sector (Hohan et al., 2014), as visualised in Figure 53.

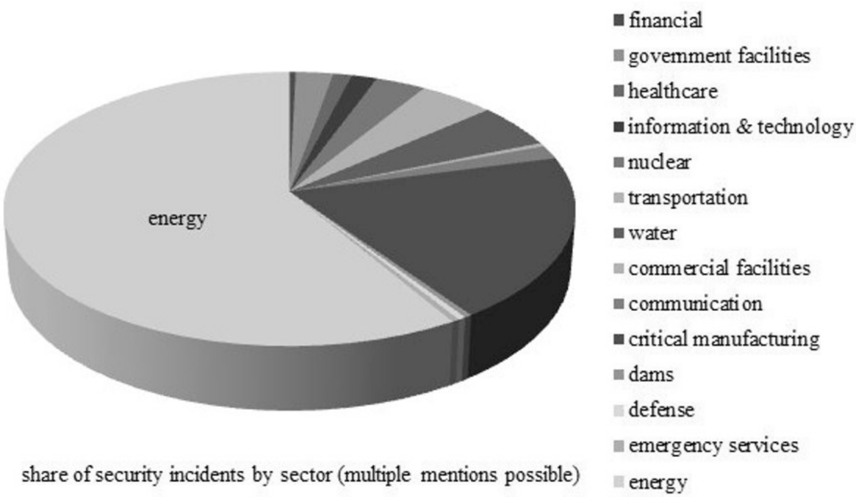


Figure 53: Security incidents reported by origin of incident
Source: ***ICS-CERT (2013)

Hohan et al. (2014) describe the main sources of vulnerability for Energy Industrial Control Systems as follows:

" • People. While the industrial sector prides itself on a highly skilled workforce focused on automation systems, such expertise does not translate into adequate expertise in security of industrial IT networks (Fernandez, 2013). Lack of (or insufficient) available specific ICT security expertise can result in improperly configured, insecure systems, but also in a low organisational awareness of the risks, both at management and operational levels.

• Network access vulnerabilities. SCADA systems are traditionally designed to operate in isolated environments. The requirements for remote access to data led to increased interconnection of SCADA and business systems and increased openness of industrial control networks, often leaving industrial control networks vulnerable to network-level attacks.

• Communication vulnerabilities. Also a legacy of the origins of SCADA systems, communication protocols are specifically designed for operation in low-bandwidth, high-interference transmission media. The focus for industrial control systems being availability, integrity of data communications, and costs, these are being achieved at the expense of the confidentiality and authenticity requirements, normally achieved through encryption techniques.

- Off-the-shelf devices and systems. The generalisation of supporting ICT technologies was accompanied (and partially driven) by the availability of cost-efficient, off-the-shelf devices and systems. Such systems are often installed and fully functional with default configurations, leaving open known vulnerabilities for attacks. Such vulnerabilities were for instance the enabler of Stuxnet (computer worm from 2010), probably the most famous attacks targeting Industrial Control Systems, which exploited known vulnerabilities in the Siemens S7-300 Programmable Logic Controller (Langner, 2011).

- Physical security vulnerabilities. Due to remoteness of Industrial Control Systems devices, direct physical interference is harder to prevent, detect and respond to. Such interference can go unnoticed for long periods, generating misleading data or offering pathways for complex attacks.

- Organisational vulnerabilities. Lack of clear policies, resource allocation and proper planning, operation, verification, and improvement procedures result in improper addressing of relevant risks. Also, a lack of visibility of ICT related risks at management level (very often the case in such industrial organisations built around specific technologies with very specific associated risks) lead to a lack of clear objectives and allocation of resources of ICT security."

The context and the correlation of attacks and vulnerabilities were summarized in Figure 54.

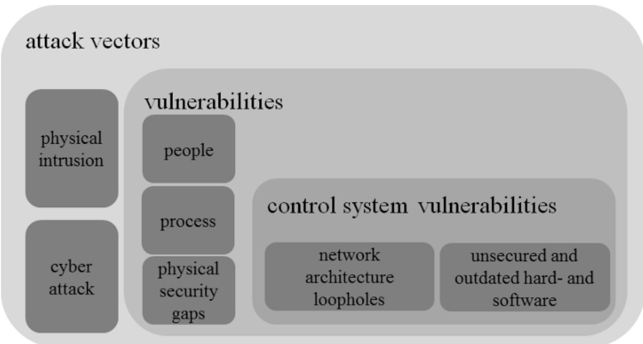


Figure 54: Correlations between cyberattacks, vulnerabilities and control systems
Source: by author based on Fernandez (2013)

The attack vectors usually are caused by competitive, economic, social or political reasons. Those cannot be controlled by the organisation. Vulnerabilities the organisation could have influence on are people, processes and physical security (access control, unsecured gates, etc.). The vulnerability of control systems cover networks, unsecured remote access through tablets, smart-phones, laptops, USB sticks, etc.

In this context Hohan et al. (2104) researched the state of the art on cyber security of smart grids and developed based on existing guidelines and the specific level of required protection a framework for an information security management for grid-connected renewable power plants. The study revealed that the energy sector is a potential primary target.

Another example for potential cyberattacks is the electric transport sector – in particular automobiles. More and more vehicles are equipped with wireless internet connection, car-to-car-communication and car-to-device-communication (= communication with traffic control and management systems) features. An additional cyber-risk which becomes more and more important is electric-drive vehicles, also connecting the transport sector with the smart-grid sector. Electric vehicles often have telephone SIM-card installed in order to be reachable for the manufactures for battery research; in addition they are being charged via cable or induction – both potential "entry tickets" for cyberattacks (Bettzieche, 2015). Successful attacks to vehicles from BMW, VW, General Motors, Fiat-Chrysler, and Tesla are reported (Bettzieche, 2015). Consequently car manufacturers need to react to such developments with much shorter development cycles. As this is a serious challenge for the manufacturers, some are liaising already with specialized B2C companies (KIBS) in order to address this threat.

Besides the transport sector, also the building sector is concerned by potential cyberattacks. Smart home concepts and integration of homes into the smart grid concept open the same challenges as being described for the transport sector (Bettzieche, 2015).

The commonality between the cited examples smart grids, electric transport and smart homes is their connection to the power grid. This closes the loop to the earlier describes sector of the PV-power generation plants. These are all connected and through that, the risk for attacks to the national power grid is increasing more and more through its complexity.

In general, any internet access point to the energy grid, be it smart home, electric car, remote controlled PV and wind power plants are possible attack points and require security devices prior installation. So far most smart meters in Germany provide the access point only (Quaschning, 2016).

Information technology

The innovation cycles of today's products and services are rapidly developing towards shorter and more demanding processes. Also the products and the services need to match much more ambitious requirements in order to survive in the market (Russwurm, 2013).

Especially the energy sector has high level requirements to be fulfilled. Supply security on one hand but also efficiency measures in order to reduce cost and save the environment. In today's production, integrated automated processes need to be efficient (including energy efficiency), flexible and productive which only can be realized through measuring and control technologies (software) (Russwurm, 2013). Looking at the KIBS energy sector, tailored service concepts are developing to become the all-dominant success factor. The integration of such services can be simplified, if they build up on the database of concerned process steps.

IT-systems are increasingly dominating today's industry. Hereby information security management, energy monitoring and energy service systems are closely linked. In this context information security is the basis not only to secure energy power plants, but also assuring data security in monitoring and control processes in the industry. Whereas the electrical energy sector is already a high-profile target for cybercrime and cyber terrorism, the increasing access to the industries energy monitoring service sector opens the doors to criminals also to the industry, consequently both areas need to be seen in context. As the industry in the context of demand-side-management gets more and more connected to the energy grid, attacks to the industry can indirectly harm the energy grid and cause problems with the grid stability and even blackouts.

The monitoring tools and monitoring software analysed and benchmarked in the study primarily focuses on user friendliness, easy to access and providing data for the energy management process. The tools focusing on energy audits instead are standalone systems which are not directly connected to the industries IT system. Energy data from the industry can be used, however not via an automated process, instead the data needs to be uploaded individually. By that, these tools do not provide any access to the IT-system and the energy grid of the organisations. The only concern here is that sensitive data such as energy consumption, energy efficiency, energy cost, KPIs etc. could be accessed via those portals.

Going forward, the energy audit systems will certainly be closer connected to the industries IT and energy management systems in order to allow for automated process and quick system analyses "at a click of a button". As a result from the interviews with the experts on the Frankfurt energy efficiency fair 2015, the sector is focusing already on the combination of IT security and energy management and audit systems. New innovative products and services shall be close to enter the market.

Monitoring the energy transition currently still is an issue, due to missing access to data. In order to ensure a sustainable monitoring and publishing of these data, the IT framework between industry and the federal statistic authorities urgently needs to be improved.

b) Sustainability in transport

In today's world, transportation is an indispensable element of private as well as business related activities. On the other hand transport is also being criticized for the damage and implications it does to the environment (Joumard and Gudmundsson, 2010; McManners, 2014). These impacts are described and analysed in many studies, which through development of KPIs, as also described in chapter 1.1.3, tried to help identify measures to support improving this situation (Surugiu et al., 2015; Marin et al., 2014). In parallel many activities and efforts were undertaken to reach a higher level of sustainability and effectiveness. I this context Marin et al. (2014) state: "It is interesting to note that the environment is not only a limit for future development, but also a source of new opportunities for the local development. A healthy life and working environment, in a place where insecurity and air and sound pollution have been reduced, can increase the economic, social and cultural attractiveness of that territory."

Transport still consumes (and will in future) a huge share of resources while meeting also the requirements of economy, society and environment (Abdallah et al., 2013). As outlined in Figure 55, transport is with a share of more than 30% of the energy consumption the biggest energy consumer in Europe in 2012, followed by the industry and households with 25%. The environmental impacts are hereby in direct correlation with their infrastructure, their emissions and the energy consumption (Rodrigue, 2013). Consisting of noise emissions, health impacts, consequences on landscapes, ecosystems, wildlife and the society, these environmental impacts of transport also contribute to pollution and climate change (Doll et al., 2008) and require a stronger focus on its efficient use of energy (Bauernhansl, 2014).

On the other hand transport is an essential factor for economic growth, global markets, supports effective production and distribution of goods. The relationship between energy consumption, economic values and impact to climate change through CO_2 emissions was investigated in studies on the example of road transport (Kolb et al., 1995) and in general by Ziolkowska and Ziolkowski (2015). They found out that several elements of the transport process impact sustainable energy consumption most. Those were identified as vehicles, road conditions and surface, drivers (Surugiu et al., 2015). The effects of transportation to the environment measured by its CO_2 emissions hereby mostly match the levels of its energy use. Hereby it is of upmost importance which kind of transportation is being used.

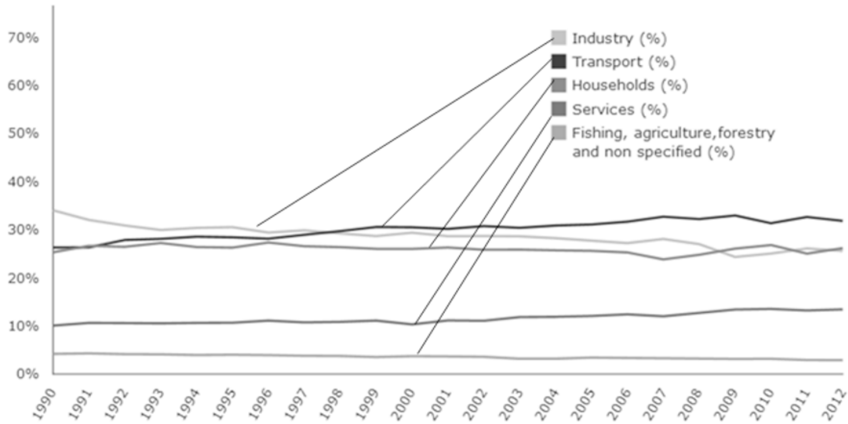


Figure 55: Sector shares of final energy consumption Europe
Source: *** EEA (2015)

Related to road transport, a study conducted in 2013 revealed that the use of alternative propulsion systems, such as gas, electric drives, hybrids, etc. would contribute an important part towards reducing the levels of green-house gas emissions in transport (***ewi, 2013). But there are more ecological benefits, alternate propulsion systems provide, such as lower noise levels and reduced levels of air pollutants. The fact that such propulsion systems however are not better established in the market is related to a lack of information on one hand and higher cost and a marginal infrastructure for energy supply on the other. The cost element hereby could be eliminated by improved financial benefits such as tax reductions, the infrastructure challenge by installing a wider supply grid. The study confirms in addition, that the benefits of alternate propulsion systems outweigh conventional drives. Political obstacles need to be overcome in order to see a wider spread of such systems coming (***ewi, 2013).

Sustainability in transport

Transportation consists of generally four main sections: road transport, rail transport, sea transport, air transport. In Europe road transport is consumes by far the most energy, followed by international sea shipping and rail transport (

Table 5). According to the data, the year 2007 shows a peak year for road, air and rail transport (2008 for sea shipping and domestic) with a decreasing trend in the following years which is expected to continue (Surugiu et al., 2015 (updated); Bretzke, 2014).

Table 5 European energy consumption by transport mode [Mega Tons Oil Equivalent (MTOE)]
Source: *** EEA (2015b)

YEAR	INTERNATIONAL SEA	RAIL	ROAD	DOMESTIC	INTERNATIONAL AIR	DOMESTIC AIR	TOTAL
2002	45.949	8.214	305.674	38.724	6.852	6.909	412.321
2003	46.409	7.994	308.194	39.786	7.097	7.787	417.267
2004	49.807	8.119	314.716	42.827	7.400	7.833	430.701
2005	52.063	7.937	315.893	45.079	7.758	7.995	436.725
2006	54.699	7.597	323.537	46.584	7.772	8.690	448.879
2007	54.929	7.719	330.077	47.839	8.431	8.344	457.339
2008	55.757	7.545	325.224	49.153	7.960	6.959	452.598
2009	50.164	7.194	317.142	45.712	7.202	6.856	434.270
2010	50.619	7.316	316.545	44.993	7.020	6.539	433.031
2011	50.241	7.224	313.778	46.401	6.635	6.166	430.445
2012	46.479	7.227	307.552	45.231	6.320	5.728	418.537

Peak years highlighted in grey

In the context of sustainability as well as energy effectiveness and economy, shifting goods from road to rail results in better fuel (=energy) consumption, lower CO_2 emissions and a higher level of productivity (=economy) (Spraggins, 2010). This benefit is reduced once more fuel efficient trucks are being used, especially as trucks still being required for getting the goods from factory to rail and from rail to the customers (Brehends, 2012).

In that context, the International Energy Agency proposes a set of several criteria to be considered simultaneously during the development of KPIs for sustainable transport (Surugiu et al., 2014):

- Support the use and development of transport technologies with better energy efficiency, such as bio fuels, electric motors (powered by renewable energies), hydrogen fuel cell, hybrid vehicles
- Implementation of behaviour changes towards lesser fuel consumption
- Selecting the most sustainable transportation alternative
- use of larger carriers (minimizing the number of trucks)
- introduction of lower speed limits
- introduction of traffic management systems
- introduction of fuel management systems

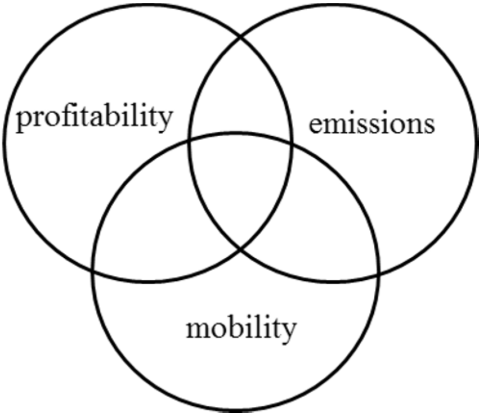


Figure 56: Three dimensions in transport
Source: Bretzke (2014)

A research conducted by Marin and Weber (2014) identified four types of policies helping to achieve a sustainable development in the transport sector, confirming the criteria listed before:

- Policies focusing on demand, aiming behaviour changes in transport such as a) variable transport cost realized by road taxes, fuel taxes, fees for peak periods, etc., b) the use of regulatory measures, such as standardizing exhaust emissions, noise reduction, speed limits, etc., c) different transport modes, d) communication and information campaigns
- Policies focusing on offer, aiming for example a) more efficient management of existing transport modes, b) traffic management measures, c) more traffic lanes, d) increasing frequency, etc.
- Technological policies, for example a) focus on new more efficient technologies, b) automation solutions such as automatic speed control, c) traffic light management, d) car to car and traffic light communication, etc.
- Physical planning policies, such as redistribution of activities to influence the mobility system

Leading to a lower level of greenhouse gas emissions and lower levels of noise emissions, for the transport sector energy efficiency and a proper fuel management finally could be confirmed to be a highly effective regulatory screw of achieving and sustaining long-term objectives towards minimizing global warming and sustainability. However, the intensity these levers can be used are defined also by the correlation between its three elements economy, mobility and low emissions (Figure 56). Options for energy efficient technologies in transport were summarized in (Table 6).

Table 6: Overview of energy-efficient technologies by mode of transport
Source: by author, based on *** BMWi (2010)

	mode of transport				
technology	maritime shipping	inland shipping	rail	road	aviation
alternate fuels (H_2, gas, bio)	c	u	c	c	c
lightweight construction			u	c	c
hydrodynamics	u	u			
aerodynamics			c	c	c
braking/heat energy recovery	u		u	c	
alternate drive technologies	u			c	c
diesel direct injection	u	u	u	c	
hybrid technology			u	c	
fuel cell	c	u	c	u	c
efficient capacity increase	u		u	u	
speed optimisation	u		c	u	u
load optimisation	u	u	u	u	u
driver training			u	c	
optimised logistical processes	u		u	c	u
optimised infrastructure	u		u	u	u
intelligent telematics	u		u	u	u

legend: c: commercial realisation, u: under development, no claim to be exhaustive

In order to reflect the importance of the transport with regard to energy efficiency sector, in Europe transport was included in section four of the European industry standard “DIN EN 16247” by the technical committee “CEN/CLC/JWG 1 - energy audits” (***Beuth, 2012). This industry standard was created as energy audits can support organizations identifying energy efficiency potentials in their business. In the case of energy management systems (EnMS), energy audits are as essential part of the DIN EN ISO 50001 industry standard a mandatory element throughout the process. Due to the mobility of transportation elements (cars, trucks, etc.), auditing the energy status of transport is a specific challenge. In order to compensate this fact, the industry norm DIN EN 16247-4 describes and balances the processes and procedures in transport, which are different for each of the fore mentioned elements of transport (road, rail, sea and air) (Figure 57).

Aspect	Road	Rail	Air	Sea
planning, logistics, route	x	x	x	x
air coefficient	x	x	x	x
rolling restistance	x	x		
other disturbing resistances	x	x	x	x
combustion loss	x	x	x	x
weather conditions	x	x	x	x
surrounding temperature	x	x	(x) frost	(x) frost
vehicle / carrier age	x	x	x	x
accessability / flexibility		x	x	x
load capacity	x		(x)	

Figure 57: Specific aspects of the elements of transport
Source: by author based on *** Beuth (2012)

Road vehicles are characterized by a high level of accessibility and mobility and can be fuelled at any place / country during their normal operation; on the other hand, empty drives are frequently unavoidable. The energy audit needs to include indications on several conditions such as air pressure in the wheels (***Beuth, 2012). The norm provides specific requirements how each of the transport elements needs to be audited.

In the case of sea transport, each vessel of the company needs to be inspected, in case all vessels are identical, the inspection of one shall be representative. The auditor is required to check the general condition of the vessel, the main engine, as well as the management processes required to run the ship. In minimum, the following evaluations are to be performed (***Beuth, 2012):

- Power of the vessel
- Power of main and auxiliary drives
- Load
- Differentiation between electricity sourced from the land grid, energy consumption in the harbour as well as on tour
- Lighting
- Fuel quality and supply systems
- Rotating machines
- Boiler and steam systems

For inland water transport in addition traffic jams before water gates are to be considered.

The example of sea transport was selected in order to demonstrate how complex and comprehensive an energy audit for transport is. This results in very specific requirements for the audits process of transport operations, defined by chapter 4.2 of the Norm DIN EN 16247-4; the most relevant demands are outlined below (***Beuth, 2012):

- There is high level of coordination required in order not to interrupt or disturb the operational processes. The organization as well as auditor therefore needs to coordinate and harmonize each party needs and duties very detailed.
- The auditors require direct access to the personnel being responsible for thefollowing areas:
  - Planning of logistics and route management
  - Operational business (transport management)
  - Maintenance
  - Technical purchasing (sourcing of the transport carriers)
  - Human resources (qualification of the workforce)
  - Operators (main influence on energy consumption)
  - Finance (access to energy bills and data)
- The data collection is also specific for transport sector. Several elements need to be considered:
  - Criteria for the planning of transports
  - Descriptions of the selected routes and the planning criteria therefore
  - Inventory of the entire transport fleet
  - Transport specific requirements regarding training
  - Criteria for the carrier specifications
  - Mileage or operating hours of the carriers
  - Rate of utilization for the last year

During the energy audit, the collected data is to be verified and evaluated. Based on the findings, proposals for energy efficiency measures and improvements are to be developed and calculated in terms of their financial feasibility. Specific key performance representing all kinds of transport being used within the organization are to developed and used; examples are: consumed energy / distance; consumed energy / distance x net weight); consumed energy / (distance x number of passengers). The proposed measures finally are to be prioritized to support a proper management decision process.

Transport is a critical element in the energy consumption in Europe followed by the industry. With the implementation of the EU energy efficiency directive and its implementation in national laws of the member states supported by the DIN EN 16247-4 industry norm (***Beuth, 2012), energy efficiency measures are a vital part of todays' management decisions and business processes and good progress was already achieved. For further improvements in future, the development of new energy efficient technologies, as well as alternate propulsion systems such as hybrids, electric drives, and others needs to be pushed.

1.3. Today's classification of knowledge intensive business services (KIBS) in the energy business

In the context of changing energy economics in Germany, Knowledge Intensive Business Services (KIBS) play an important role. KIBS operating in the field of energy audits require a special high level of specialized skills being legally mandated (***BAFA, 2015b; 2015c). In general, KIBS cover a wide spread of business sections, mostly requiring a high level qualification (Miles, 2001; Osterloh and Boos, 2001). Services in general are structured in three main phases: potential orientation, process orientation and result orientation (Haller, 2015). Energy services hereby mostly are provided in the process and result orientation phases. The potential orientation phase tends to be neglected; however it shall always be considered also as in the early production development process the basis for the future energy consumption of a product is set. Even some of the KIBS are operated a specialized departments with the company (Bartussek, 2013. However, most of them are outsourced so the companies can focus on their core businesses, instead of having to maintain a very specialized team, as an example can the IT services be named (Burr, 2014).

Outsourcing hereby is defined as a combination of outside, resource and using, combined meaning the use of outside resources (Ortner, 2015; Haller, 2015). This outsourcing strategy reduces extra effort, extra personnel, extra budget and a special focus on the continuous development in the market (Esser and Seiter, 2015). Sourcing these specialized services from outside ensures the organization receives a high quality and in relation to technology and regulations an up-to-date service by the KIBS (Weber at al., 2016). Bröker (2014) as wells several other authors (Willocks and Lacity, 2006; Barthelemy and Quelin, 2006; Shah and Bandi, 2003; Howells, 2006; Chiesa, Manzini and Pizzurno, 2004) identified KIBS in the sectors of business process (such as research and development), information technology, technical support services, and others. Catoiu et al. (2016) and Miles et al. (1994) arranged these in two sections (Table 7).

Table 7 Grouping of KIBS
Source: by author, based on Miles et al. (1994)

KIBS group 1	KIBS group 2
* Management consultancies	* Information Technology services (IT)
* Environmental services	* Technology intensive business process services
* Legal services	* Financial services
Accounting and Bookkeeping	* Research and development services (R&D)
Marketing services	* Telecommunication services
Human Resource services	* Technical engineering services
Public Relations services	

Traditional KIBS such as information technology services, technical engineering services and research and development were listed, KIBS in the area of energy as we know them today however did not exist at the time yet. Some of them however, either have strong relations to field of energy or belong to today's energy sector KIBS (both marked with "*" inTable 7) (Weber et al., 2016).

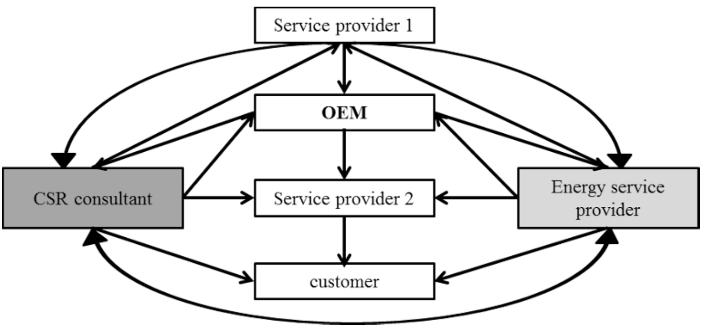


Figure 58: Energy and CSR KIBS in the context of Industrial Service Networks
Source: by author based on Esser and Seiter (2015)

As such, industrial services historically are well established sections in the producing industry. As Esser and Seiter (2015) found out the share of industrial services on the total revenue of the German machine and plant construction sector is around 20%. On a European level, almost every producing company offers industrial services. These numbers relate to the traditional industrial production branches. The energy sector however just recently developed to be part of the industrial services sector. As it is a very specific sector, it cannot be integrated into the traditional industrial services, but no industrial service provider can exist without the energy services sector. As a logical consequence traditional industrial service providers and the energy service providers need to co-work. With that a new variant of the concept of industrial service networks was created. As Figure 58 illustrates, there can be very close relations between industrial service providers, manufacturers, energy service provider and the customers. The wind energy market can be taken here as an example. KIBS focusing on servicing wind mills need to be highly specialized as Weber (2015d) confirms. On the other end, also CSR consultants are valid examples of KIBS in this context. Besides cross organizational special knowledge they also need to be trained and skilled in organizational relevant subjects form the areas of environment and social (Lotter and Braun, 2014). As such they are directly connected to the energy service KIBS and serve as a kind of key coordinator /umbrella for all environmental aspects.

Some of the OEMs producing wind mills also have service departments. However, looking at the number of around 35,000 installed wind mills in Germany alone (2014) there is a strong and increasing demand for KIBS servicing wind mills. Those need to be in close contact and communication with the OEM, the operator as well as with the grid operator in order to ensure that no financial losses at the operator side occur nor grid instability would jeopardize the regional power supply. As Tantau and Nichifor (2014) confirm, new sustainably business models in the wind industry in order ensure sound investment prospects of enterprises in the wind energy business.

Due to the complexity of the energy sector in terms of "frequently changing" national regulations and procedures, especially in the international context such networks and partnerships play an important role (Müller-Seitz, 2015; Engel et al., 2015; Bröker, 2014). This importance is resulting from the aforementioned complexity in each national market and the differing regulations between the markets, forcing the producing company to focus on their core business and letting the energy service sector be handled by nationally specialized KIBS. Müller-Seitz (2015) as well as Hogreve and Velleuer (2015) underline the complexity of managing, steering and controlling such networks (Figure 59), especially once there are more than two partners involved.

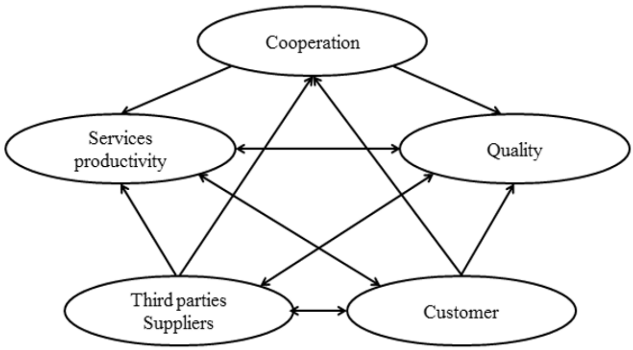


Figure 59: Actors and influence factors in Industrial Service Networks
Source: Hogreve and Velleuer (2015)

Hogreve and Velleuer (2015) define the fundamental management functions of Industrial Service Networks as design, activation, mobilization and synthesis. Their model describes these factors for managing Industrial Service Networks from viewpoint of the producing company and the prospect of the network. Even though they mention the need for creation of trust in the network as well as for establishing a network wide knowledge base, they are not explicitly mentioning confidentiality agreements and the process of handling this network wide knowledge, but mention the demand for additional research focusing on the differentiation of the provided services (Hogreve and Velleuer, 2015).

Especially in the context of energy services, the energy KIBS need to experience "open books policies" with the companies they consult. This includes receiving financial data, exact process information, historical as well future strategy information – all very sensitive data which needs to be carefully and trustfully be dealt with; in particular once competing companies are members of the networks, so called branch-networks.

In Germany, such branch-energy-efficiency-networks exist and their formation is under certain conditions even sponsored by the federal government. Seiter and Marquard (2015) conclude in their research that incentive schemes can be a central steering instrument in managing Industrial Service Networks. Being in process of setting such a network in the automotive car dealer sector up, the author's practical experience shows that governmental incentives are indeed a magic element during the designing process of such networks in the energy services sector. His practical knowledge also confirms that once the right partners are being brought together, strict rules and guidelines are defined and precisely followed, competitors can become cooperation partners.

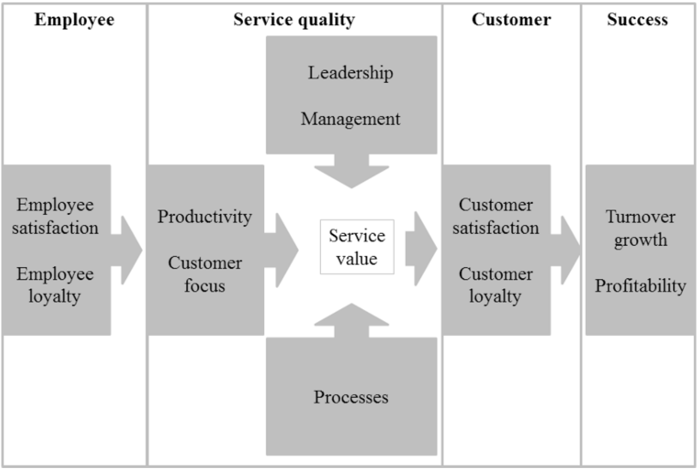


Figure 60: Service value chain
Source: Eller (2015)

In any of the shown scenarios, service quality and customer focus factor are key for a successful set-up a KIBS network as Eller (2015) and Meffert et al. (2015) point out. Only if all elements work nicely together, the success of the set-up can be ensured on the long-term (Figure 60). Hereby the employee section only works out successfully, if the internal service quality (such as work surrounding, training options, employee recruitment process, compensation, etc.) supports the employee satisfaction. This though will lead into employee loyalty and performance which both are closely connected and influence each other. The customer loyalty on the side is a result from the customer's satisfaction, turning into repurchases and recommendations of the service provider (Eller, 2015; Bruhn and Hadwich, 2015).

KIBS as Energy Consultation Services in Germany

Today's energy economics is characterized by a complex legal structure, resulting in the need for intensive management consultation as in terms of process, technology as well as legal. As a result several law offices in Germany developed also to KIBS in the energy sector, being specialized on the approval processes for power plants, which is extremely complex in the case of wind and solar PV power generation. Another area of activity for them is the sector of contracting (Weber et al., 2016).

With the growing number of decentralized renewable energy plants, on the other hand, the management of virtual power plants, the management of the power grid and the operation processes became more and more complex. Accordingly, smart and flexible software and hardware packages are required in order to keep the power system steady and stable, requiring specialized KIBS. As more and more power generation plants grow decentral, they need to be connected to the grid, require special alarm systems to avoid illegal access, damage to the system and theft. Consequently highly specialized KIBS in the area of telecommunication are required to care of that. Another sector for KIBS in the energy context is informatics, as special tools and software are required to ensure a stable power grid and protection from cyberattacks (Hohan et al., 2014).

In literature KIBS are being differentiated from other services by two attributes: intangibility and interaction (considered by Den Hertog, 2000; Miozzo and Grimshaw, 2005; Grimshaw and Miozzo, 2006; Miozzo and Grimshaw, 2006; Leiponen, 2005; Leiponen 2006;). Hereby intangibility describes the evaluation process of the services provided by KIBS. With no objectivity in the process, both, the KIBS service receiver as well as the service provider need to develop a high level of trust and goodwill. On the other hand, as both partners depend on each other, interaction describes during the developing process of the service product the need for close cooperation between the KIBS service provider and service receiver (Kohleick, 2008).

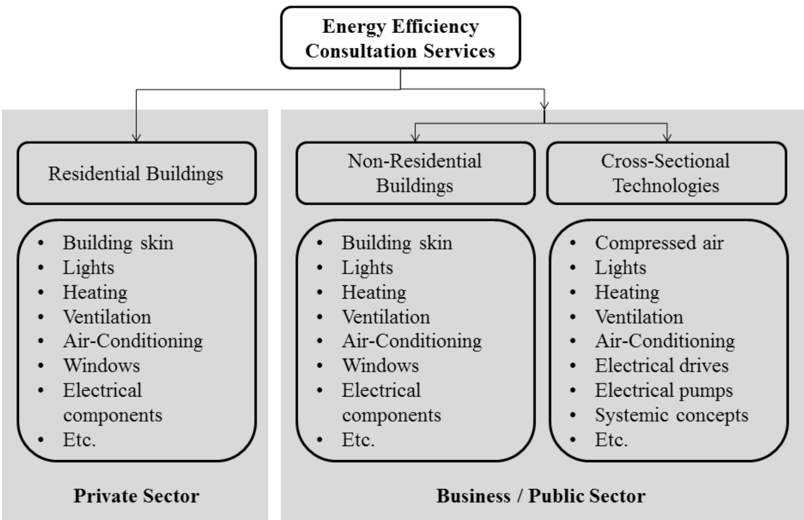


Figure 61: Energy Efficiency Consultation Services in Germany
Source: by author based on his research, ref. to Weber et al. (2016)

In the context of outsourcing services to KIBS, Cuganesan at al. (2006) and Barthemely (2003) describe the risk to fail as well as the potential success of the outsourced business service. The risk for failure hereby is higher, in case the outsourcing organization benefitting more from the deal as the KIBS. ***Deloitte Consulting (2005), ***Outsourcing Times (2005) and Preston (2004) researched that around 50% of the outsourced KIBS faced an early end by being insourced again.

In Germany Energy Efficiency Consultation Services exist for some years already. Herby two main services can be identified: buildings (residential and non-residential) and cross-sectional technologies (industry). In the case of customer groups, also two groups can be found: private households and enterprises (Weber et al., 2016).

As Figure 61 lies out, the Consulting Sector in the area of energy efficiency in Germany benefits from three areas of business activities with specific requirements as a result from this constellation resulting from the different requirements in each of the pillars.

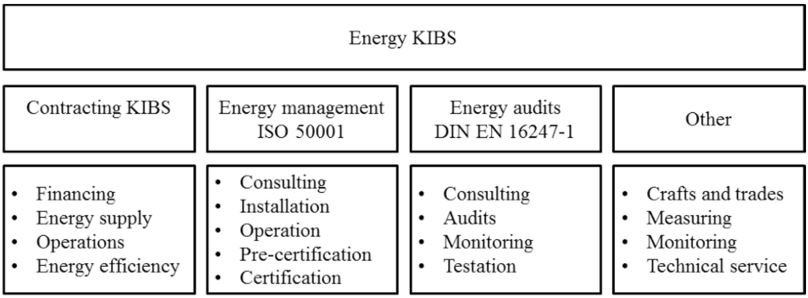


Figure 62: Kinds of energy KIBS
Source: by author based on his research

Public buildings hereby differ from residual homes as they serve as working places. As such they need to fulfil besides the energy efficiency policy also additional requirements such as workstation requirements in terms of light intensity and quality as well as industrial safety regulations (Weber et al., 2016).

The European Energy Efficiency directive (2012/27/EU) was implemented by the German government in 2014 with the *National Energy Efficiency-Action Plan (NEEAP) 2014* becoming effective. Consequently, the market for KIBS in the area of energy services in Germany was reorganized. This new layout supported a further transparent, competitive and manifold development of the energy services sector.

Going along, the energy service sector was composed by three several main segments (***BMWi, 2014c):

1. Contracting services
2. Energy management services
3. Energy audits / energy consultancies

On top, a much wider network of specialized services (KIBS) connected to the aforementioned sectors, such as:

- Communication technology
- Facility management
- Network engineering
- Software development
- Insulation services for buildings
- Monitoring, measuring and metering services

Each of these services can only survive in coexistence and cooperation and require their own special set of knowledge themselves (Weber et al., 2016) (Figure 62).

Contracting KIBS

Contracting is in accordance to the DIN 8930-5 industry norm defined as, dealing on its own account, the temporal and areal defined transfer of responsibilities regarding energy allocation and supply to a third party. Four types of energy contracting are laid out (***BMWi, 2014c; Weber et al., 2016):

- Financing Contracting: the contractor funds, plans & builds an energy production site. He benefits through the provided financial service. The system is being operated by the contracting partner.
- Energy Supply Contracting: the contractor funds, plans, builds and operates an energy production site. The contracting partner receives the energy at beforehand agreed conditions.
- Operating Management Contracting: the contactor operates an already existing power production site.
- Energy Saving Contracting: the contractor funds, plans, executes and operates measures on energy efficiency. The contracting partner benefits through a beforehand agreed share of the saved energy cost.

With a share of 84%, Energy Efficiency Contracting was the contracting version mostly setup in Germany in 2014. Growth rates of 8 to 14%, make contracting to the growing business models in the energy services sector in Germany (***Prognos et al., 2013; ***VfW, 2015; Weber et al., 2016).

Energy management services KIBS

The industry norm ISO EN DIN 50001 defines energy management services globally. The services in this sector comprise energy management systems for production processes, buildings as well as for combinations of both, software development, evaluation and measuring of energy consumption data, concept development, installation of energy management systems and certifications as well as consulting (***Prognos et al., 2013). According to a study the number of 3.240 certified energy management systems was registered by March 2014 in Germany. This reflects around 1% of the registered enterprises registered in Germany at that time (***BMWi, 2014c).

Energy audits / Energy consulting KIBS

There is no central register administering consultation services in Germany. In lieu thereof a variety of databases is on the market for energy consultants and auditors to register. As being independently operated, some of them concentrate on certain sectors such as industry, or buildings, others combine several. Consequently, one searching for a consultant is being challenged during the process of identifying a qualified energy efficiency expert. With the beforehand mentioned implementation of the EU Energy Efficiency Directive, two databases operated by German authorities in charge of managing the energy audit process (BAFA and dena), developed to be the place to go to find a qualified energy expert. Prior being listed in these databases, energy consultants and auditors had to proof qualification and experience following a clear set of requirements. In addition, only these auditors are, according to the EU Energy Efficiency Directive, accredited to apply for governmental subsidies supporting the execution of energy efficiency measures of their customers. On top and under certain conditions, their consultation service is proportionately being subsidized by the government. (***BAFA, 2015e).

During an energy audit, information of the actual energy consumption profile of industry processes, buildings, and/or industry sites is being systematically collected in order to quantify potential energy efficiency measures. In a next step, these need to be evaluated and the results are to be summarized in a specific report (***BMWi, 2014c). Energy audits are also obligatory requirement prior installing certified energy management systems according to the DIN EN ISO 50001 industry norm. Details for energy audits in general are defined in the DIN EN 16247-1 industry norm.

According to Prognos et al. (2013) the market of energy consulting service providers in Germany is mastered by the small enterprises (75% of which with up to five employees). Their latest research revealed that in 2011 around 370,000 to 410,000 energy consultations were managed in Germany resulting in an estimated turnover between 264 and 457 Mio. Euro (***BMWi, 2014c). Surprisingly, subsidized energy audits were with 19,271 in the same year at a much lower level with a decreasing trend. In addition, 95% of the energy audits were done in the building sector, leaving only 5% for the industry sector (***BMWi, 2014c). KIBS specialized on energy audits in buildings however face a very competitive price market and struggle making any profit (Weber et al., 2016). I order to turn this decreasing trend around and to motivate companies to put more effort in energy efficiency activities the subsidy program was renewed with January 2015.

BCOT analysis of energy KIBS

In general businesses are being evaluated by using the traditional SWOT analysis, detailing out their strength (S), weaknesses (W), opportunities (O) and threats (T). In the context of energy KIBS, strength are more benefits (B) and as weaknesses the cost (C) factor is dominant. Therefore, ***ewi (2014) studied several energy related businesses in their BCOT-analysis (benefits (B), cost (C), opportunities (O) and threats (T). Focusing on the energy KIBS in their study, the sectors of smart metering and energy efficiency monitoring can be identified. In all those they identified the lack of qualified employees as a key threat. The qualification element is also a key cost factor, as special knowledge needs to be acquired. This cost factor concerns hereby employers as well as future employees. In consequence this leads also to higher personnel cost as higher qualified employees require higher salaries. As an example for higher education cost Eiselt (2012) refers to the heating sector where the correct execution of a hydraulic calibration of heating systems is legally required. Other costs occur through the necessary installations of hard- and software for proper smart metering and energy monitoring processes. These threats and cost however face certain benefits. The market demand for high energy efficient products is rising on one hand; legal regulations require the installation of monitoring systems on the other hand. In addition, effective monitoring and smart meter systems also help the producer in his own manufacturing processes to reduce energy consumption ergo cost. Own research by the author confirmed these findings.

In Germany, the implementation of the European Energy Efficiency Directive (2012/27/EU) followed a two-group approach differentiating SMEs and non-SMEs. In October 2014 the German Directive for Energy Efficiency Consulting for SMEs was legally approved and became effective January 2015. This concept replaced and improved the previously available KfW-program for SMEs. It ensures that energy audits to SMEs under certain conditions are now supported with 80% of the consulting fee. In the first wave, this subsidy program was approved until end of 2015 only, being recently expanded for another four years. Besides the general procedures for energy audits, the directive also precisely defined the required sets of qualification, experience and requirements for energy auditors. Accordingly, the auditors need to validate their qualifications through diplomas as well as a professional work experience and history, backed-up by relevant reference projects throughout the last three years (***BMWi, 2014d; ***BAFA, 2015c).

Mid-April 2015, the novel of the German law for energy services (EDL-G) for non-SMEs became effective. It defines the set-up, auditor qualification requirements and procedures for energy audits for non-SMEs in Germany (***BAFA, 2015d). Legally, all concerned companies were to perform an energy audit latest by December 5th, 2015 (***BAFA, 2015e). These EDL-G energy audits have to be renewed every four years, a chance for KIBS in the energy business.

2. Present approaches and tendencies in sustainable energy strategies in relation to CSR

2.1. Specific aspects regarding corporate social responsibility (CSR) in energy economics

In the context of climate change and increasing globalization, the current business environment has led to more and more norm and society focused business practices specifically pushed by the most recent development in energy economics described earlier. Business networks, business ethics, sustainability, social entrepreneurship and especially social corporate responsibility experience an increasing focus (Olaru et al., 2011b; Loew et al., 2011; Altenburger, 2015). Corporate Social Responsibility (CSR) occasionally also titled as Corporate Responsibility (CR) hereby is the responsibility enterprises voluntarily take on for people as well the environment and the society above existing legal obligations (Suchanek, 2015).

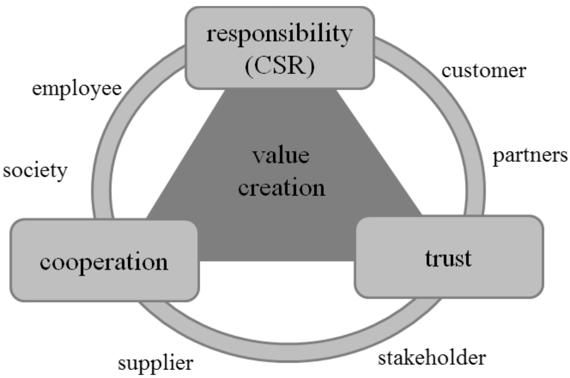


Figure 63: Value chain in organizations
Source: by author based on Suchanek (2015)

This includes a basket of measures which can be captured by the company individually and harmonized to its core business with a focus an economic, ecologic and social activities and principles (Kuhlen, 2005; Hentze and Thies, 2012; Enste and Wildner, 2014; Oerkermann, 2015). As such, it goes far beyond CO_2-reduction, social engagement and climate protection – it represents a triple bottom line model for an integrated management process following economical, ecological and social criteria along the value chain (Schulz, 2015; Schleer, 2014; Mory, 2014).

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4_3

A generally accepted definition however does so far not exist. CSR is often being used by organizations by selecting CSR elements fitting their primary communication objectives (Schneider, 2015). CSR-measures are an integral concept which includes corporate visions, environmental characteristics of products and services as well as the social cooperation within the enterprise (Bruton, 2011). As such CSR is an integral part of the corporate value creation process (Figure 63) and in future one primary reason for being of organizations (Suchanek, 2015; Suchanek, 2015b; Schulz, 2015).

Enterprises with a clear CSR strategy can be characterized by having an expanded view on developments in their periphery and therefore can take their decisions on a much better basis. They are more sensitive on environmental issues and realize long-term implications related to sustainability such as climate change, resource shortages and the demographical development much earlier than their insensitive competitors (Bruton, 2011).

In Germany, the federal government adopted "CSR in Germany", an action plan to address the challenges of a globalized world, including global fair labour conditions, climate change, global social standards, … and sustainable consumption. This "CSR in Germany" plan was composed in order to allow the integration of CSR into public administration and business, push the visibility and importance of CSR, expand the use of CSR in SMEs, improve the political support for CSR as well as to contribute to the efforts in integrating social and ecological elements in the global markets (***BMA, 2012; Pittner, 2014).

2.2. Using specific elements and instruments of CSR to support sustainable energy activities

The CSR-concept usually is developed, communicated and maintained by the CSR-Manager and documented in the CSR report. With that, the CSR-Manager as specialist in environmental, economic and social matters (Lotter and Braun, 2014) serves as the interface between the enterprise and its stakeholders, such as employees, NGOs, neighbours, etc.

The idea of CSR goes back to the eighteenth century, when European entrepreneurs took responsibility for their employees by improving their working and living conditions for example building houses (Teucher, 2013; Schneider, 2015). Since the nineteen-nineties, CSR and sustainability melt more and more together by enterprises considering social and ecological aspects equally in economic performance indicators (Kuhlen, 2005; Geisendorf, 2001; Teucher, 2013). Sustainability describes the long-term, caring and responsible use of resources and combines the social, ecologic, economic and cultural dimensions (Figure 64).

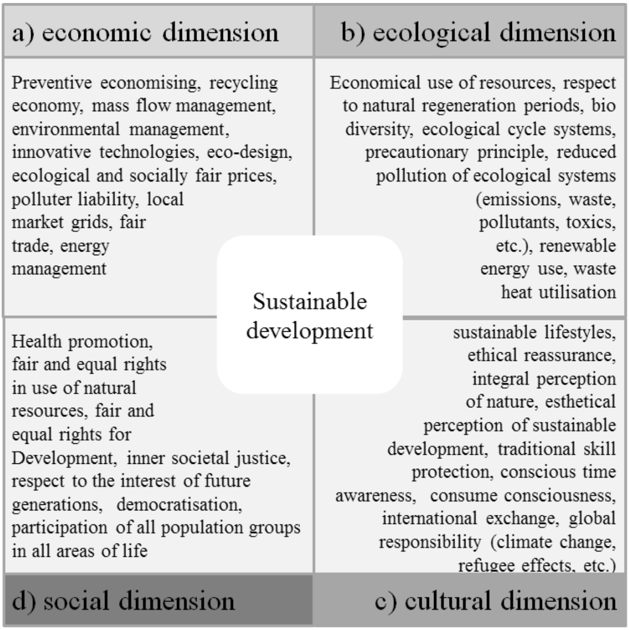


Figure 64: Four dimensions model of sustainability
Source: by author based on Michelsen and Adomßent (2014)

Originally it was developed in the forestry and described the principle only to fell as many trees as can grow again (Pittner, 2014; Michelsen and Adomßent, 2014). Hentze and Thies (2012) illustrated sustainability and its relation and interaction to society, environment and economy in different scenarios (Figure 65). After intensive literature research they finally conclude that none of these concepts are ideal, simply as by political, social, economic or other changes weighting and emphasis of the single elements the balance will shift towards promoting one or the other element more than the others. Similar finding made Schaltegger (2014) is his study on sustainability report systems. Consequently, a further developed model is required in order to address these issues (further details in chapter 7). The unbalance of the actual refugee phenomenon and the fight against climate change in Europe for instance is very differently weighted in the different EU member states, which proves this conclusion. Adding to that point, CSR strategies are in most organizations set in order to strengthen the financial performance. Financial value is in this context mostly defined by stock value or other profitability measures (Morrison-Paul and Siegel, 2006).

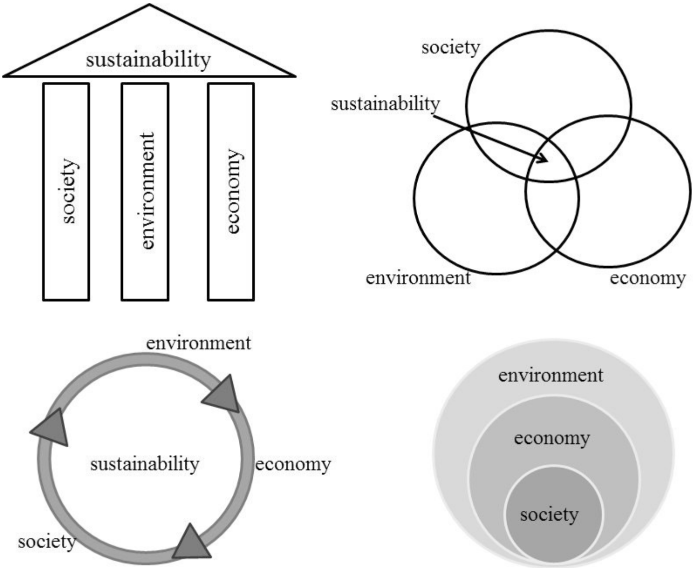


Figure 65: Sustainability in relation to its elements
Source: by author based on Hentze and Thies (2012)

Enterprises have values which can be purely monetary aspects or in addition also ethic, social and ecologic aspects. Consequently CSR is not to be mixed with benefaction or common welfare (Suchanek, 2015). CSR always is linked to the core business of the company through arrangement and organization of the entire value chain including the product, the service, production processes, working conditions and so forth (Bruton, 2011; Suchanek, 2015b). As one consequence the enterprise saves money and resources, reduces the waste production or increases sales by offering a more accepted product in the market (Kuhlen, 2005).

The willingness of enterprises to focus besides economic and ecological aspects also on the social dimension requires the existence of ethical values in the corporation. Ethics describes the relation of the human being towards himself, towards other people and towards the environment (Kuhlen, 2005). In this relation, legal requirements need to be overachieved. In the development of the CSR strategy of an organization, several steps need to be performed and several internal and external factors influence this development process (Figure 66).

Feedback from the market and the stakeholder perception in this connection has an important role (blue boxes in Figure 66). Only if the Corporate Social Performance (CSP) shows benefits, stakeholders will be motivated to further support the CSR activities.

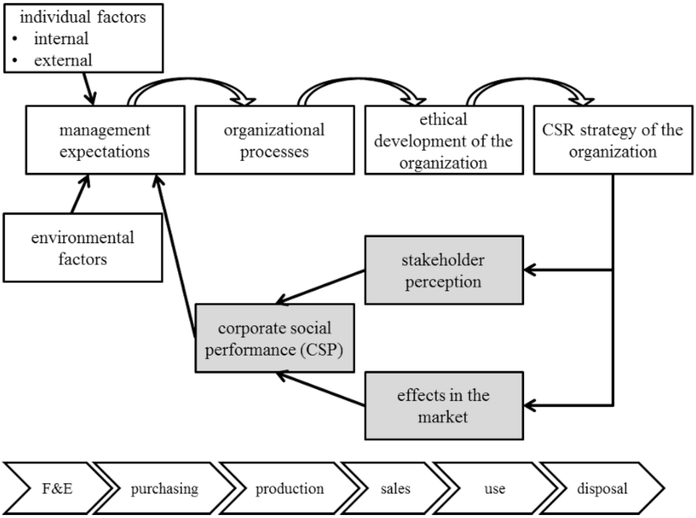


Figure 66: Factors, influencing the CSR strategy along the value chain
Source: by author based on Bruton (2011), Schleer (2014), Schmidpeter (2015b) and Porter (1991)

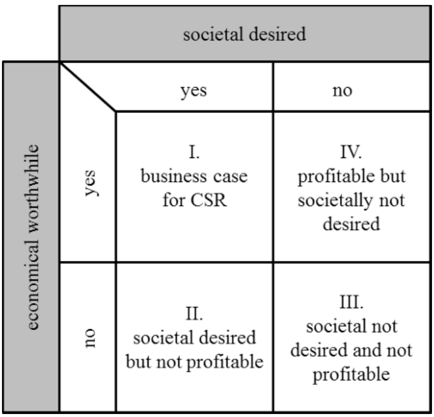


Figure 67: Interaction of social desired and economical reasonable entrepreneurial activities
Source: Schreck (2015)

In the conflict of their definition process of a CSR strategy enterprises need to balance between social desired and economical reasonable entrepreneurial activities and strategies (Figure 67) in the context of the influencing factors mentioned above (Figure 66).

2.3. Critical evaluation of approaches in sustainable social responsibility and energy

CSR instruments and benefits

CSR can be operated using different instruments. In this context, corporate foundations (foundations founded by enterprises), corporate volunteering (enterprises support volunteering activities of the employees) and corporate giving (the enterprises donate of money, goods or services) can be differentiated, all of which being voluntary activities. According to Endste and Wildner (2014) the benefits which can occur for organizations are manifold and touch different areas of the organizations. They call the benefits the five "R of CSR": recruitment, retention, reputation, response and resources. These can be extended by adding the benefits CSR is additionally providing in risk management (Loew et al., 2011).

CSR and recruitment: Divers studies come to the result, that there is a clear connection between the social responsibilities an organization practices and the attractiveness this organization experiences at the labour market (Endste and Wildner, 2014). They found out, that there are even applicants being ready to resign from higher salaries if the organization trustfully can confirm to take social responsibility. However, the economic performance of the organization is with 40% more important to applicants than CSR activities (3%).

CSR and retention: Another important element to applicants is the motivation of the employees to increase retention. The reason for that is the fact that unmotivated employees threaten by their behaviour the competitiveness and performance of the organization (Endste and Wildner, 2014); Lotter and Braun (2014) named this effect the "war of talents". On the other hand motivated employees support the result of the organization besides being more creative, better performing and receiving higher salaries.

There are several options for organizations to practice responsible leadership, such as flexible work time models, work-family-balance models, as well as possibilities for child care. Which measures finally make sense for the organization depends on the individual situation of the enterprises.

CSR and reputation: reputation herein is a combination of different components. In the case of CSR, Endste and Wildner (2014) identified competency and sympathy of the organization as the important elements. The organizations sympathy increases the more CSR activities are performed, on the other hand the competency is increased the less CSR budget is being spent. Consequently, CSR cannot replace the core competency of an organization. If the market is convinced of the competency of an organization, CSR activities positively influence the purchase decision process. Projects supporting the idea of sustainability in Germany for instance could be awarded by the UNESCO as "*UN world decade – education for sustainable development".*

Projects assigned with this logo could largely benefit from reputation and promotion. One example for an UNESCO-affiliated sustainable project is the sustainability initiative "*ACT-ORANGE… save our planet*", initiated and evaluated by the author (subject of chapter 6.1) (Weber, 2015b; 2014b).

CSR and response: as laid out earlier, CSR can support innovation, motivate employees, support the image and so forth. Consequently also shareholders and investors can be interested in CSR activities. In these cases, the organization needs to ensure a smart communication strategy to inform this group on the results and success of the CSR activities; otherwise, their support for costly CSR measures will be stopped quickly (Endste and Wildner, 2014).

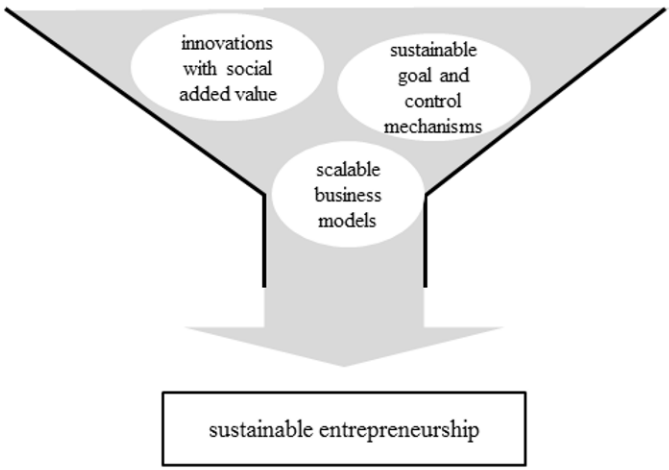


Figure 68: Sustainable entrepreneurship
Source: Schmidpeter (2015b)

According to Schmidpeter (2015) sustainable entrepreneurship is the only meaningful management approach for future successful enterprises. He defines sustainable entrepreneurship as the teamwork between innovation, sustainable control mechanisms and scalable business models, which include besides employees also shareholders and investors (Figure 68) (see also Schaltegger, 2015 and Grieshuber, 2015). In this context please also refer to the open innovation process model and the sustainability sweet spot of an organization (chapter 3).

CSR and resources: finally CSR activities can be funded also by ethical stock and other ethical financial assets. As Endste and Wildner (2014) point out, these option offer two advantages to the investors: gains and social conscience. In order to manoeuvre in the wide field of investments, several rankings and certificates can help the investors to find the right funds match according to their profile. Examples are the Dow Jones Sustainability Index (DJSI) and others which are covered later in this chapter.

CSR and risk management: CSR has besides others also the objective to identify, analyse, evaluate and observe risk of social and ecological aspects and to propose corrective action. The intent thereof is to enable a conscious dealing with and controlling of these risks. In this context CSR-management can serve as sustainability risk management (Loew et al., 2011). As such, CSR management can support:

- **The reduction of strategic risk**: the development of an organizational strategy depends on several factors. Mega trends of sustainability, such as climate change and its consequences or the strategic positioning of certain customer and societal groups, can change the business and risk surroundings of organizations. CSR management helps making aware of those and defining necessary actions.
- **The reduction of investment risk**: CSR management investigates the ecological and social risk of investments (see also ratings and rankings later in this chapter).
- **The reduction of process risk:** the organizational protection of the environment, the adoption of guidelines in purchasing and development to avoid ecological and social risk potentials will reduce process risks. CSR managements systems co-work in this context with environmental management systems, such as EMAS.
- **The reduction of product risk:** it needs to be ensured that products comply with for example energy efficiency standards and ideally over achieve them in order to stay competitive in the market. CSR management supports in this case the implementation of sustainability related specifications are met.
- **The risk awareness of the employees:** anything can be defined by rules and guidelines. In order to ensure, that the risk factor "human" is aware of those and ensures their implementation, the employees need to be sensitized for the context, context and necessity. CSR management helps here to manage the related processes and responsibilities.

In the context of risk CSR management can be understood as a continuous organizational improvement process supporting the reduction of organizational risk. The risk management process as defined in ISO 31000 industry norm (Figure 69) can be useful support of the CSR management process (Dal-Bianco, 2015; Ebner and Goiser, 2015).

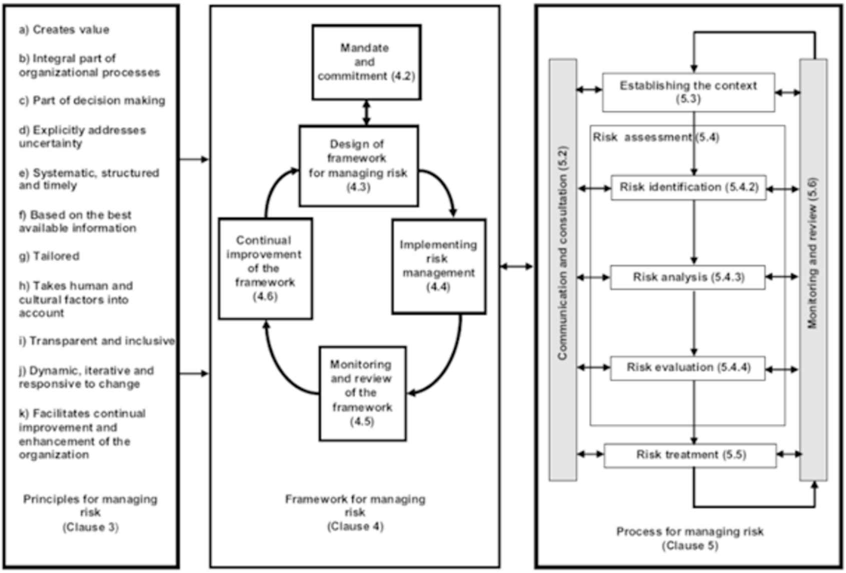


Figure 69: The elements of the risk management process according to ISO 31000
Source: Loew et al. (2011)

CSR guidelines, standards and reporting systems

In literature several CSR guidelines and reporting systems are described (Kuhlen, 2005; Hentze and Thies, 2012; Kohlhof et al., 2006). The reporting systems are a result of the demand for information besides the standard annual financial report. A reporting system ensuring trustworthiness and credibility to employees, customers, partners, etc. increases and improves internal as well as external acceptance of the organizations economic activities. At the end, this will result in trust and finally business success. For an excellent sustainability report several attributes are required (Jasch, 2015; Schleer, 2014; Milke, 2014):

- Trustworthiness and transparency
- Auditable statements – confirmability
- Fundamentality analysis and stakeholder involvement
- Balanced presentation of all relevant sustainability areas

	ISO 26000	EMAS	GRI	UNGC	OECD	SA8000	DNK
characteristics	guiding norm	management standard	guidelines and performance indices	behaviour codex with network and communication platform	behaviour codex with recommendations	standard with requirements for organizations	standard with requirements for organizations and performance indices
origin	international standards organisation	EU regulation	joint initiative: CERES (NGO) and UN environment program	United Nations	OECD	Social Accountability International	Council for Sustainable Development of the German Government
target group	any organization	any organization	any organizations, focusing on enterprises	any organizations, focusing on enterprises	Internationally acting enterprises	all enterprises, independent from size, location or sector	all enterprises, independent from size, location or sector
legal status	voluntary, not certifiable	voluntary, certifiable	voluntary, certifiable	voluntary, not certifiable	international agreement, binding for signing states, not for multinational enterprises	voluntary, certifiable	voluntary, not certifiable
level of details	high: around 600 concrete requirements	high: several management requirements, 9 core indicators with 6 environmental key areas	high: several management recommendations and indicators	low: 10 general principles for orientation	high: 68 concrete recommendations in 10 sectors	high: 9 thematic core areas with 50 concrete recommendations	middle: 20 criteria with performance indicators
thematic focus	organisations leadership, human rights, labour methods, environment, integration of consumers & society, organisational wide integration of sustainability topics	environment, management, legal compliance with environment laws	economic performance, environment, labour methods, human rights, societal questions, product responsibility	human rights, labour norms, environment protection, combating corruption	transparency, humen rights, labour relations, environment, corruption, consumer protection, technology transfer, competition, taxation	child labour, forced labour, labour protection, freedom of assembly, right on salary negotiation, discrimination, disciplinary procedures, labour time, salary, management systems	strategy, process management, environment, society
transparency	principles of transparency, recommendations for internal and external communication	public environmental statement, public register	principles of transparency, qualitative indicators, several application layers (complexity of the report context)	progress notice	complaint system (violations get published), national contact centre	official listing of all certified sites and locations	declaration of conformity

Figure 70: Comparing overview of selected sustainability standards and initiatives
Source: *** BMU (2014a)

- Management systems
- KPIs and related measurable objectives
- Logical connection of the fundamental areas, their KPIs and the objectives

Investors	Enterprises	NGOs
• Benchmark for sustainable funds • Basis for index funds • Orientation for actively managed funds • Basis for structured products • Use for engagement strategies	• Orientation for sustainable leadership • Quality proof for stakeholders • Support in the acquisition of capital from ethical and social oriented investors	• Support in identifying potential partners and sponsors • Instrument in pushing for sustainable and responsible leadership • Orientation for own investments

Figure 71: Options for the use of sustainability indices
Source: by author based on Schäfer (2015)

Sustainability indices have in comparison to other indices a much higher benchmarking function. They serve as comparison tool in sustainable banking sector as well as in the industry to benchmark products, services as well as organizations and can be manifold be used (Figure 71) (Schäfer, 2015).

The German Federal Ministry of Environment developed an overview comparing the main characteristics and factors of a selection of mostly referenced sustainability standards and initiatives (Figure 70).

In the following, the mentioned initiatives, guidelines & standards as well as a selection of management systems related to sustainability and environment marks and labels for product and service evaluation are listed and described:

a) Initiatives, guidelines & standards

United Nations Global Compact (UNGC): is a worldwide pact between enterprises and the United Nations (UN) targeting to manoeuvre globalization to become more social and ecologic. Enterprises signing the contract commit to follow ten principles, such as to respect human rights, to support environmental awareness, to outlaw forced as well as child labour and to fight against corruption (***BMU, 2012c; 2014a). The UN Global Compact Management Model hereby follows a well-defined process, similar to the PDCA-process known from the Energy Management Systems (ISO 50001) (Figure 72).

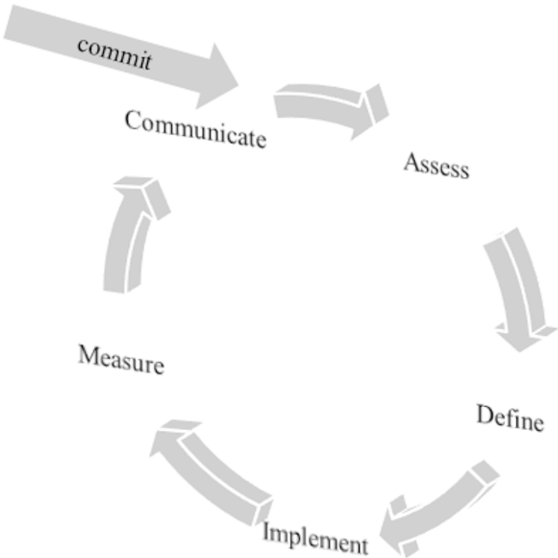


Figure 72: UN Global Compact Management Model
Source: based on Hentze and Thies (2014)

OECD-guidelines for multinational enterprises: worldwide effective code of ethics concerning the responsible behaviour of enterprises. The guidelines describe recommendations from governments for the economies and include topics as work relations, transparency, corruption, consumer protection and environment (Pittner, 2014; Hentze and Thies, 2014).

Global Reporting Initiative (GRI): International network organization which developed guidelines for the creation of sustainability reports. The GRI-standards shall ensure a transparency and comparability of the reports of enterprises different in size and structure. The GRI co-funded from the German Society for International Cooperation, the Australian Government and other governmental and private organizations (Jasch, 2015; Hentze and Thies, 2014; Weber, T, 2014c; Gebauer, 2014; ***BMU, 2014a).

Assurance Standard AA1000: can be used in addition the GRI-standard to verify sustainability reports. Developed by the Institute for Social and Ethical Accountability (ISEA), it targets to increase trust, quality and credibility of sustainability reports. In addition its objective is to assist organizations in better understand their ethical and social services. It is important to hereby involve all stakeholders (Pittner, 2014; Hentze and Thies, 2014).

Frankfurt-Hohenheimer-Leitfaden (FHL): supports the evaluation of the implementation of CSR in enterprises and financial services. It was developed by the universities of Frankfurt and Hohenheim. During the rating process, criteria such as environmental friendliness, social and cultural acceptance are assessed. The objective of the FHL is to provide an instrument to ethical focused investors to identify related enterprises. By its Corporate Responsibility Rating (CRR) it uncovers strengths and weaknesses of organizations in the ecologic, social and cultural fields.

German Sustainability Codex (DNK): is a recommendation of the German Counsel for Sustainable Development and its use id voluntary. The DNK supports the evaluation of the sustainability efforts of enterprises and provides transparency. The DNK was developed based on the aforementioned United Nations Global Compact, the OECD-guidelines and the GRI-standards (Hentze and Thies, 2014; ***BMU, 2014a).

Dow Jones Sustainability Index (DJSI): is a stock index considering besides economic and ecological also social and ethic criteria. The DJSI includes the most sustainable enterprises only (Hentze and Thies, 2012). Factors such as strategy (i.e. long-term economic, social and environmental aspects, while keeping reputation and global competitiveness), customer and product (i.e. long-term customer relationship marketing), financial (i.e. transparent financial accounting), human (i.e. best in class employee satisfaction) and governance & stakeholder (i.e. highest standards of corporate governance) are assessed (Schäfer, 2015; Pittner, 2014; Hentze and Thies, 2014).

IÖW / future ranking: the *German Institute for Ecological Economy Research (IÖW*) and the *German Association Future Sustainability Reports German Enterprises* jointly publish the IÖW/future-ranking since 2005 (Hentze and Thies, 2014).

Corporate Responsibility Index (CRI): created by the German Bertelsmann Foundation in 2011, it analyses the core motivators of entrepreneurial responsibility. Its objective is to support the organizations in the development process of their strategy concepts and the implementation and expansion or corporate responsibilities. Its analysis evaluates and indicated which measures generally are relevant for a successful CR management and which support the CR activities the most. The research is being updated in a biannual modus (***www.cr-index.de). In order to be able to measure progress and success of the sustainability activities, organizations need to define concrete and measurable objectives. Based on those key performance indices (KPI) (for KPIs refer also to chapter 1.1.3) should be developed which can be integrated in the corporate controlling system (Fries et al., 2015; Pittner, 2014).

b) Management systems relating to sustainability

Eco Management and Audit Scheme (EMAS): is a system combining *Environment Management Systems* and *environmental auditing* for organizations intending to improve their environmental performance. These can be enterprises, service providers, administrations and other organizations. Attending certified organizations need to declare its direct and indirect effects on the environment, its environmental performance and objectives. These declarations are assessed by certified experts and need to be update on a yearly basis (Jasch, 2015; Hentze and Thies, 2014; ***BMU, 2014a).

ISO 50001 industry standard - Energy Management Systems (EnMS): usually certified according to ISO 50001, management systems are designed to continuously monitor, control and improve energy efficiency in organizations. Energy management systems can be embedded in existing management systems which eventually already exist in the organizations in the sectors of environment (EMS), quality (QMS), security (SMS), etc.

ISO 26000 industry standard: is a guideline for social responsibility containing examples and best practices for ideal social and ethical behaviour (Schmiedeknecht and Wieland, 2015), and was approved by 99 states back in 2010 (Keller-Kern and Prox, 2014). As it refers to all organizations it represents a voluntary but important step towards a worldwide common understanding to promote social responsibility. It defines several core topics, such as fair business methods, environment and organizational leadership as well as principals such as human rights, ethical behaviour and transparency (Enste and Wildner, 2014; Bruton, 2011) (Figure 73).

According to ISO 26000, organizations are accountable towards these persons and stakeholders, which are concerned by their activities and decisions. Internal strategies, decisions and activities need to be transparently communicated including potential effects to environment and society. This communication however shall not include confidential information which might be protected by law or would eventually harm personal, commercial or safety related data protection rules. The ethical behaviour of the organization shall base on the principles or honesty, neutrality, equal treatment and integrity (Vitt et al., 2011; Hentze and Thies, 2014).

Social Accountability SA8000: is an international standard for the improvement of working conditions by defining minimum criteria on social and work standards. It follows the recommendations of the International Labour Organization (ILO) and the United Nations (UN); the certification voluntary. Enterprises certified by this standard obligate themselves to resign forced labour, to ban child labour, to pay fair salaries and to actively get engaged for job safety and health protection (Jasch, 2015; Hentze and Thies, 2014; ***BMU, 2014a).

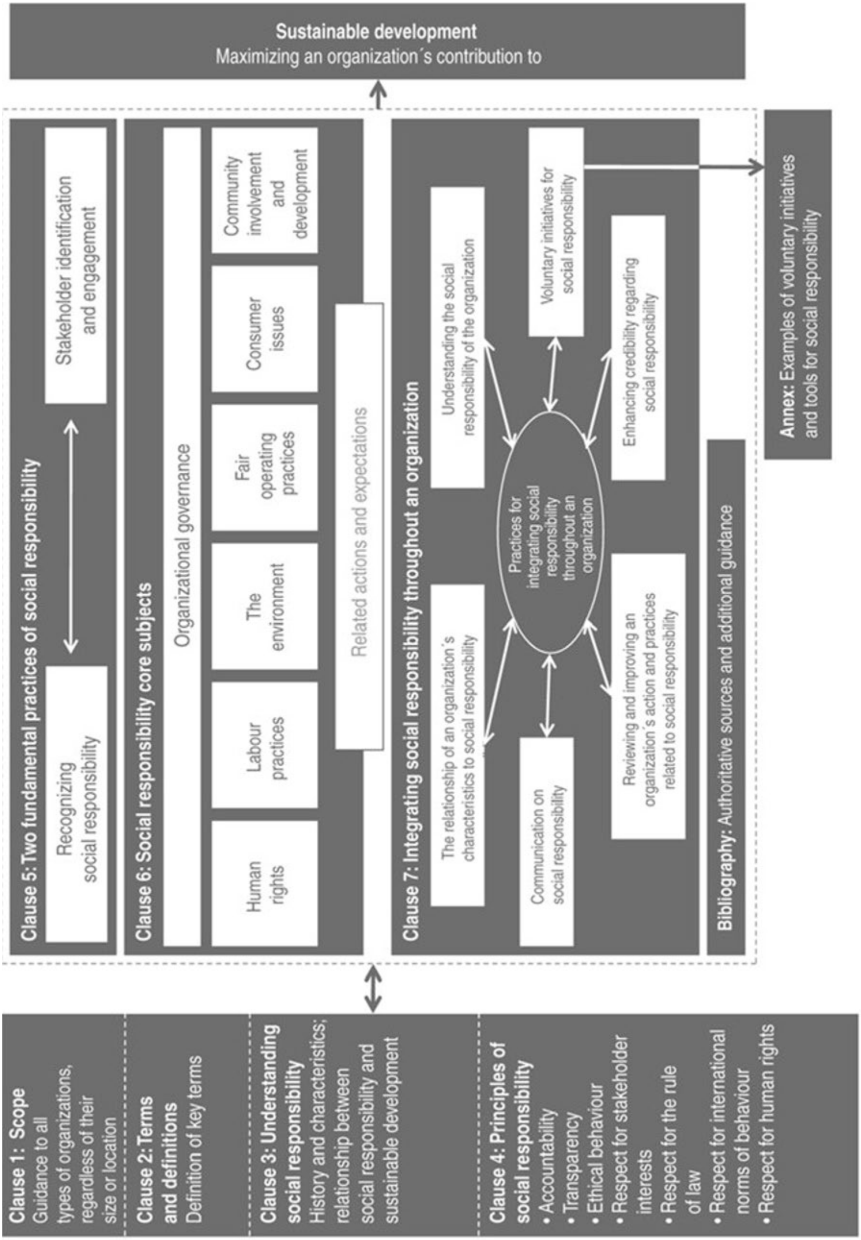


Figure 73: Overview of the content of ISO26000 industry norm
Source: Schmiedeknecht and Wieland (2015)

c) Environment marks and labels for product and service evaluation (exemplary)

During the resent years, many initiatives started communicating information on sustainability to the consumers. As a consequence, there is a huge variety of sea of quality related to sustainability on the market. A good overview can be found at the database ecolabels (www.ecolabels.com), including around 463 labels in 147 countries worldwide; for Europe, more than 130 labels regarding sustainability are known (Hieke et al., 2015).

The blue angel: is a German mark for products and services protecting the environment sponsored by the German Federal Ministry of Environment and the Federal Office for Environment. Every person is allowed to propose products and services for its mark-up. The mark is not a general certificate of compliance but is awarded for specific conditions. Copy paper for example can be awarded with the blue angel as being produced 100% from recycled paper (***BMU, 2014).

Marine Stewardship Council (MSC): is an environmental mark displaying fish from sustainable fishing. MSC is an independent organization operating internationally founded to address the problem of the worldwide overfishing. Jointly with scientists, environment organizations and fishing experts environment standards were developed for the evaluation and signing of fishery companies (***BMU, 2014).

Forest Stewardship Council (FSC): was founded as NGO of public value and acts internationally. In Germany the FSC mark is being promoted by the environment organization WWF (World Wide fund for Nature), Greenpeace as well as representatives from industry and labour unions (Weber, 2014c; ***BMU, 2014).

Fairtrade: is a mark from several initiatives belonging to the umbrella organization Fairtrade International. The Fairtrade initiatives define minimum prices to be paid by the dealer to the producers of goods. Its level is higher as the world market price in order to guarantee a fair and reliable income. In addition, environmental and social standards are being established through long-term relations between producer and retailers (Weber, 2014c).

Summarizing, due to the development in the international context, the topic of responsibility of enterprises requires adjustments for CSR on the national levels. The important guidelines and standards in this field need to be considered in this context (Figure 74).

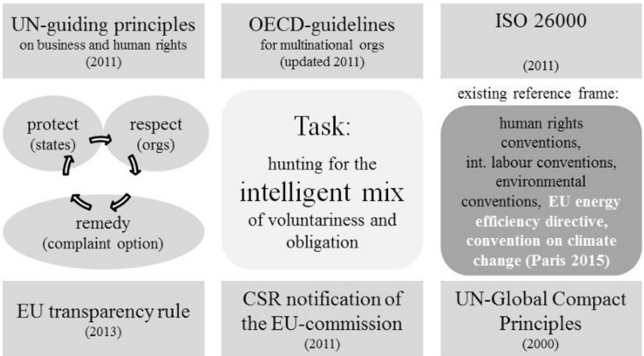


Figure 74: Projections for standards and guidelines in the field of CSR
Source: by author based on Milke (2014)

Phases of a CSR strategy

As mentioned CSR is a process and sustainable organization leadership is being developed and rolled out in several steps, instead of being a static condition. In literature four main phases are mentioned Kuhlen, 2005; Hentze and Thies, 2012):

- **Analysis:** is the inventory taking of the initial starting situation. This phase is being supported by instruments of project management, such as the stakeholder-analysis, the status-quo-analysis and the SWOT-analysis (SWOT = Strengths, Weaknesses, Opportunities, Threats).
- **Planning:** here the CSR objectives are defined and prioritized, stakeholder get prioritized, the CSR concept is being developed, CSR- measures, performance indicators and responsible are assigned.
- **Implementation:** execution of the CSR projects and CSR-controlling
- **Communication:** the fourth phase includes development and implementation of a sustainable reporting as well as the failure models and effect analysis.

The next level of CSR

In order to be successful, CSR needs to become a live philosophy and activity in the organization. In needs to span all sectors and departments of the enterprise and to be carried by all employees with no exception. Hereby in needs to be understood, that CSR is not another kind of marketing strategy or a new sales niche, but a fundamental set of behaviour and questions concerning the corporate culture. CSR-strategies are situative, specific and depend on the respective context; CSR strategies cannot be copied and pasted between enterprises.

Each organization needs to frequently check, verify and adopt its CSR strategy. The CSR-concept needs to be developed and implemented in cooperation with all decision makers and involve the employees which a lengthy process requiring time and resources within the organization and live the concept of Corporate Citizenship (***BMU, 2014a).

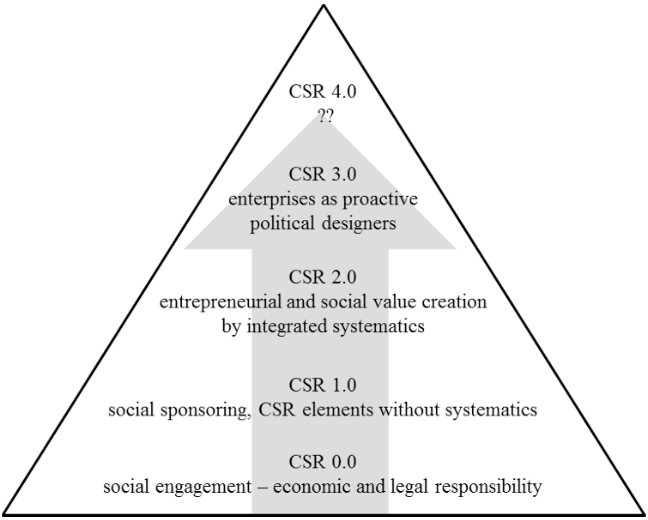


Figure 75: CSR development pyramid
Source: by author based on Schneider (2015)

However, as Schneider (2015) points out based on his intensive literature research, without an internationally standardized understanding of what CSR is, a further development of the concept, implementation as well as monitoring and analysis is hindered and complicated. As a consequence, CSR is in a steady development process (Figure 75).

Based on these findings, and the models of Corporate Citizenship and Corporate Social Innovation (CSI) referred to in chapter 3, the author developed a next generation CSR (chapter 7): the CSR^{plus} model.

3. Today's approaches of innovation in the context of sustainable energy strategies

3.1. Definition of innovation and its relation to energy strategies

The conflicts coming along with social and ecological challenges such as climate change, resource availability, urbanization, lack in confidence in organizations etc. are often perceived as threats by enterprises. Recently however, more and more organizations understand these as chances for innovation, especially as customers and enterprises increasingly base their purchase and investment decisions on sustainability and social responsibility factors. As described earlier, CSR is developing to becoming a trend in the society. As a study unveiled 2010, 93% of the CEOs worldwide understand CSR as the critical future factor for business success which is to be integrated in the internal processes developed towards an innovation competition (Scholl, 2014). Innovation hereby can be defined as improvement, novelty or newness (Lerch, 2015). In the context of innovation, literature (Hockerts and Morsing, 2006) identified two key focus areas addressing the innovation factor: corporate social innovation and eco-innovation, defining CSR as important lever for innovations.

As concluded previously, innovation is a key element for the success of KIBS, but also generally by amending the value-added process through sustainable entrepreneurship (Schaltegger and Hansen, 2013; Schießl, 2015). An important element in the evaluation process of innovation is to measure it using the methodology of KPIs (key performance indicators (Kaschny et al., 2015) which are investigated in chapter 1.1.3. In the case of KIBS being active in the researched field of energy efficiency for instance, innovation concerns the entire organizational behaviour and strategy (Gelbmann et al., 2013). Especially in the era of "industry 4.0" the interaction of new and significant technological innovations such as mobile computing, social media, internet, etc. influences value chain and business models of many organisations (Baum, 2013). According to statistics of the German Federal Ministry of Economics (***BMWi, 2014f) 54% of the German SMEs created between 2008 and 2010 innovations, much better than the European average (34%).

Innovation is widely described in literature; however there is no one generally accepted definition existing so far (Vahs and Brem, 2013; Bauer, 2013; Graf, 2014; Kaudela-Baum, 2014; Krell, 2014; Werther and Jacobs, 2014; Wiesemer, 2014; Blaettel-Mink and Menez, 2015; Eckardt, 2015; Hartweg et al., 2015; Schießl, 2015; Staufer, 2015; Praag and Versloot, 2007). Hereby technical innovations (such as products and processes), business related innovations (such as new business model,

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4_4

new market structure) and organisational innovations (such as new structures, new cultures, new organisational systems) can be differentiated (Bauer, 2013). Weis (2014) defines innovation as the sum of {idea + invention + diffusion}, concluding that an idea only can develop towards an innovation, if it was successfully implemented in the market. The critical element of the innovation is its novelty (Lerch, 2015). Averdung (2014) describes service innovation (as for example KIBS in the field of energy provide) as the effort to create new type of service or the further development of an existing service. Innovation, jointly with corporate venturing and strategic renewal improve the performance of organisations (Kuratko et al., 2015).

3. 1. 1. The innovation process in the energy business for KIBS

Ideally, ground-breaking innovations need to be understood from two angles, the market view and the viewpoint of the enterprise (Table 8).

Table 8 Factors of innovation
Source: Großklaus (2014)

Innovation factors in the view of enterprises	Innovation factors in the view of the market
profit generation	solve customer problems
supporting sales also for other products/services if the enterprize	better comprared to alternative products / services
attract markets with a high growth and demand potential	guarantee an optimal price-value relation
close relation to the customer	offer a high benefit (technical, economical, psychological, ecological)
producable and salable with existing resources	minimum of explanation required
matching / expanding the existing portfolio	long lifetime
strengthen the organisation's image	high quality
improve existing processes by improved technologies	no "me-too" products
create a wide product range using little components	

Here it is important to understand, that both sides cannot be looked at in isolation, but need to be understood as a complex interacting system. With a growing degree of innovation, traditionally also the risk level is increasing as indicated in the light grey arrows in Figure 76. The risk from A to C and A to G are moderately increasing, whereas an innovation into all new markets with an all new technology (arrow A to K) represents also the highest risk level.

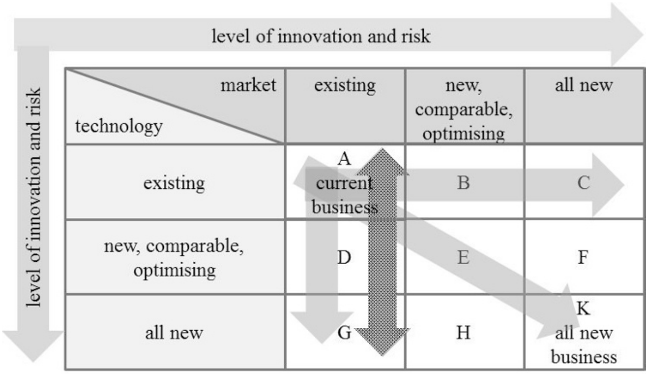


Figure 76: Innovation-risk-matrix
Source: by author based on Großklaus (2014)

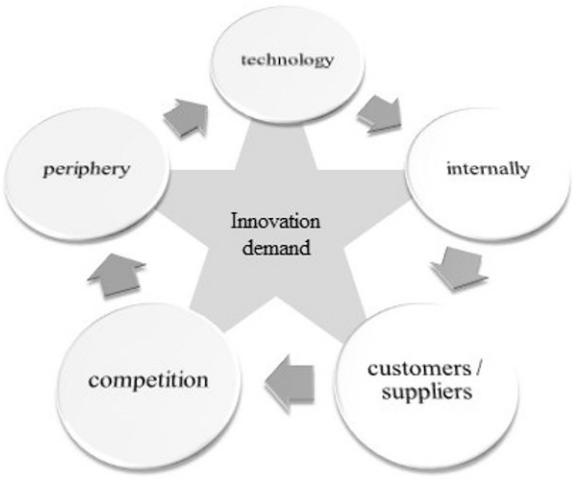


Figure 77: Stimulating factors of the innovation process
Source: author's design

However, Großklaus (2014) did not consider the impact of a new demand in an existing market, indicated in the dark arrow in Figure 76. In this case an innovation meeting new or so far not matched customer requirements in an existing market can be realized at a very low risk level. As a side effect, this "*wow*" or "*I've been waiting* *for this product/service*" in the market and the along going image gain might attract new customers also in other product segments from the competition (Eckardt, 2015).

As shown, the innovation process can be described as a sequence of activities focusing on novelty, newness, and variety. Its inputs are being stimulated and influenced externally as well as internally (Figure 77).

The innovation process hereby needs to follow a clear and economically rateable objective as well as to focus on the market introduction and usage of the innovation (Trout and Wied, 2014). A key element of innovation hereby is the full value chain, containing market expansion, distribution and sales channel, supply process, production, maintenance, and the administrative activities of the organization (Maier et al., 2014; Rothwell, 1992; 1994; Rogers, 1983; Van de Ven, 1986; Bessant, 2005). The determinants of an interactive value chain consist of the four elements service provider, communication, technology and the customer for the service with each of those containing specific factors (Figure 78).

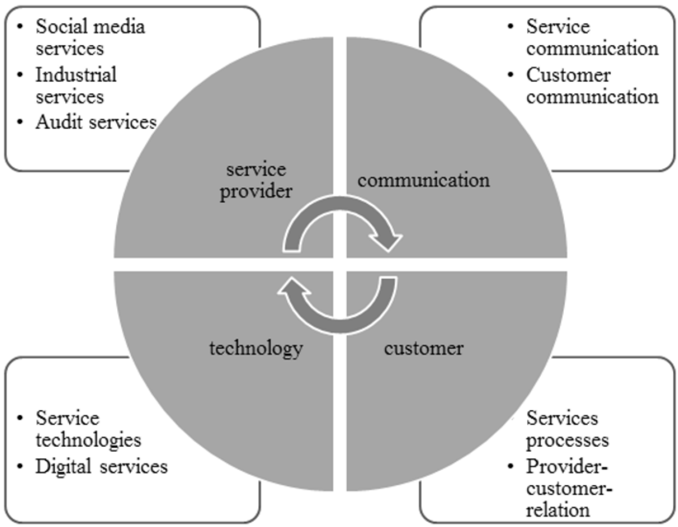


Figure 78: Determinants of interactive value chain of services
Source: by author based on Bruhn and Hadwich (2015)

True innovation requires a frame of free and unconventional thinking – established structures and processes need to be left, a think-tank supporting creativity needs to be available/established (Geschwill, 2015).

In the context of providing services, as KIBS in the area of energy do, Eggert and Fliess (2015) specify the service value chain as the value generated through service activities. In general the service value chain is comparable to the value chain defined for products. The difference between both is described through the direct contact the customer has to the service provider compared to a product producer.

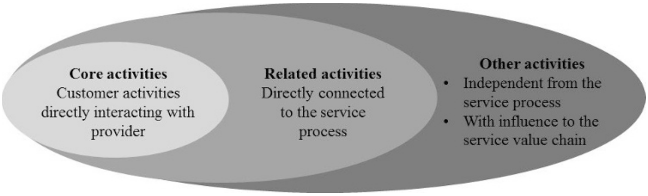


Figure 79: Levels of customer activities and interactions
Source: Eggert and Fliess (2015)

Through this closer relation and contact between customer and service provider (see also Figure 78) the value chain is expressed in a much more direct relation and impact scale. Hereby three levels of interaction between the customer and the service provider with different correlations can be distinguished (Figure 79).

Table 9: Comparison of innovation approaches
Source: by author based on Bullinger (1994)

	General Understanding of Innovation	
Feature	**Type 1**	**Type 2**
Effect	short-term, dramatically	long-term, reliable, undramatically
Speed	big steps	small and big steps
Protagonists	a few elected (management)	each employee
Approach	individual ideas and efforts	team approach, systematic approach
People	specialists	generalists
Information	intern, secret	public, collective
Feedback	limited	intensive

Describing innovation, Bullinger (1994) distinguishes two philosophies as shown in Table 9. In the context of the researched field of energy economics however a mix of both types is reality.

The effects for KIBS in the field of energy audits for example can be short-term and dramatically, in case they focus on the previously described EDL-G (German energy service law) audit business; on the other hand they can be long-term but not dramatically, in case they focus on the standard energy audits. The best effect can be achieved here by combining the opportunities of both EDL-G and standard energy audit businesses.

In terms of the selected approach, team effort as well as individual strategies are possible options for both EDL-G as well as standard energy audits. In both cases the auditors need to be specialist on the other hand however also generalists in order to be able to cover the audit through a systematic and holistic approach.

3. 1. 2. Steps and phases of the innovation process

The innovation process generally follows a "several steps" approach varying from three to seven steps as indicated in Table 10.

Table 10 Stages of the innovation process
Source: Maier et al. (2013)

Stages / *Models* / *Year*	*Stage 1*	*Stage 2*	*Stage 3*	*Stage 4*	*Stage 5*	*Stage 6*	*Stage 7*
Rothwell 1994	Idea generation	Research design and development	Prototype realization	Manufacturing	Marketing and sales	Commercialization	
Van der Vent et al. 1999	Initial period	Development period	Implementation period / finishing				
Nooteboom 2001	New ideas	Consolidation	Generalization	Differentiation	Reciprocation		
Mulgan and Albury 2003	Generating Possibility	Prototypes of promising ideas	Manufacturing and expanding	Analysis			
Verloop 2004	Generating and crystallization of the idea	Developing and demonstrating	Investing and preparing for launch				
Cormican and O Sullivan 2004	The environment analyses and identifying opportunities	Innovation generating and investigating	Planning and sponsor selection	Project prioritization and assign teams	Implement the product implementation plan		
Tidd and Bessant 2005	Searching	Selection	Realization	Execution	Commercialization	Sustaining	Learning and reinnovating
Andrew and Sirkin 2006	Generating the idea	Commercialization	Realization				
Hansen and Birkinshaw 2007	Generating the idea	Idea conversion	Idea diffusion				
Jacobs and Snijder 2008	Variation	Selection (Internal)	Realization	Selection (External) / survival	Multiplication	Learning	

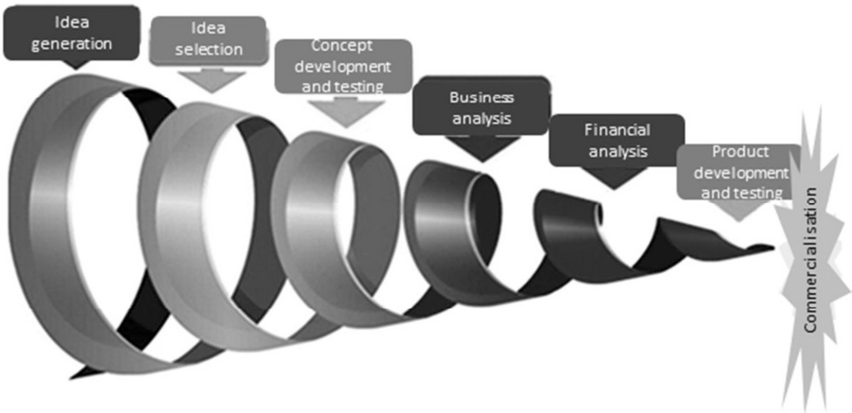


Figure 80: Stages of the innovation process
Source: Maier et al. (2014)

Based on the reviewed the literature and from the experience in several innovation projects a seven step approach is proposed beginning with the idea creation and ending with the execution phase as outlined by Maier et al. (2014), (Figure 80).

Phase 1: Idea generation

As this phase is very important for the success of the innovation process it should follow a stringent set of criteria and objectives and be accompanied by formal idea filtering procedures and systems (Kusiak, 2007). Mostly however, ideas are created randomly.

Phase 2: Idea selection

Less profitable ideas shall be identified and eliminated prior wasting money. In this phase market potential, production capacity and changes of success need to be evaluated. The component matrix is a useful tool during the analysis of innovations (Figure 81). The innovation finally needs to be accepted in the market, or by the inventor.

Phase 3: Concept development and testing

The core competencies of the innovation and its growth potential need to be connected in order to be maximized. A study showed that 28% of the companies reject the innovation idea in case it is not in line with the corporate strategy, and 22% modify policies to benefit from the innovation (Kusiak, 2007).

Phase 4: Business Analysis

In this phase, the organization already has a better understanding of the innovation product and its potential effects on which the market can be evaluated.

Phase 5: Financial Analysis

Based on phase 4 first calculations can be performed such as variable and fixed cost, achievable price and based on those profitability.

Phase 6: Developing and testing of the prototype

This phase is to test the market and collect information regarding a realistic sales price.

Phase 7: Commercialization

Finally the innovation process is ended by the commercialization of the product – the "moment of truth", when the product is being released to the market and its success can be measured (Kusiak, 2007).

3. 1. 3. The innovation analysis and correlations

During the evaluation process, KPIs (refer also to chapter 1.1.3) are helpful elements comparing innovation projects. In this context several kinds of KPIs can be distinguished depending on the focus of the evaluation. This can be in the area of income, earnings, cost and structure (Weis, 2014).

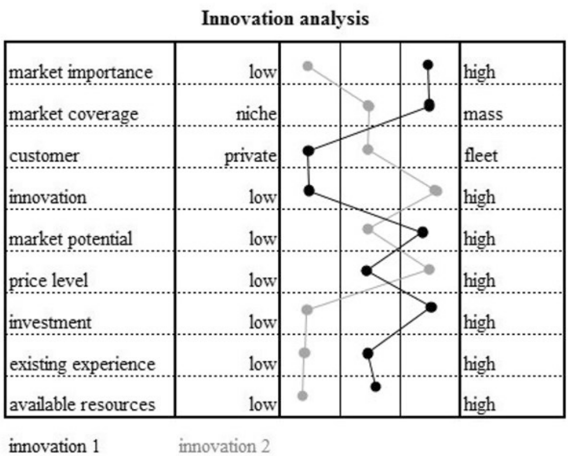


Figure 81: Innovation analysis matrix
Source: by author, exemplarily

In the case of income for instance the overall turnover can be defined as the sum of {turnover innovations + turnover copy products + turnover standard products}. The innovations can be compared by dividing the turnover of the innovations by the overall turnover. This concept can be calculated also for copy and standard products for appropriate comparisons with the situation in the market.

The same concept can be used for earnings as well as cost and can in addition also include the development and other cost for innovation, copy and standard products.

In case of the organizational structure, KPIs for the number of employees per department (sales, development, etc.) and sold units of the products can be established and in some cases also be compared with the data from competitors.

Innovation is not to be understood as an end in itself. Innovations usually a geared by specific organizational objectives which can be economic, social, economic or technical. These specific objectives depend on the general targets of the organization as well as on the general environment, such as legal, competition, market development etc. (Vahs and Brem, 2013). The main objective hereby is to achieve advantages versus the competition and as such in measurable economic success factors. The innovation objectives and their correlations can be visualized in the spiral model (Figure 82), with the spiral symbolizing the phases of the innovation process connecting the influencing elements from outside.

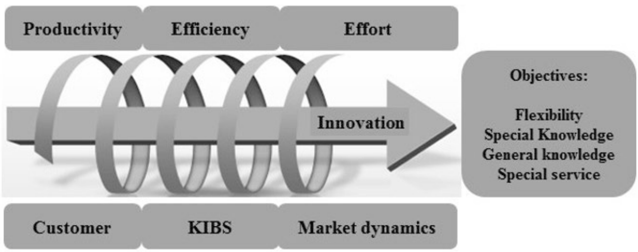


Figure 82: Correlations in the innovation process
Source: by author

The important element hereby is the KIBS itself. Here the innovation idea needs to be created or as signal coming from outside being identified. Throughout the process the market dynamics are changing and frequently need to be adapted in the process without losing track of the customer benefit. The elements productivity, effort and efficiency also correlate with the customer benefit and hence the decision making process of the organization throughout the innovation phases.

During the innovation process the cost element is an important factor which is increasing and more difficult to influence as longer the process lasts (Hoffmann, 2014). Consequently, the innovation process needs to include gate reviews in order to keep track of the progress and cost/value relationship. In case of deviations of the strategic cost/value objective corrective action needs to take place or the process needs to be stopped in order to avoid unnecessary financial threat to the organization (Figure 83).

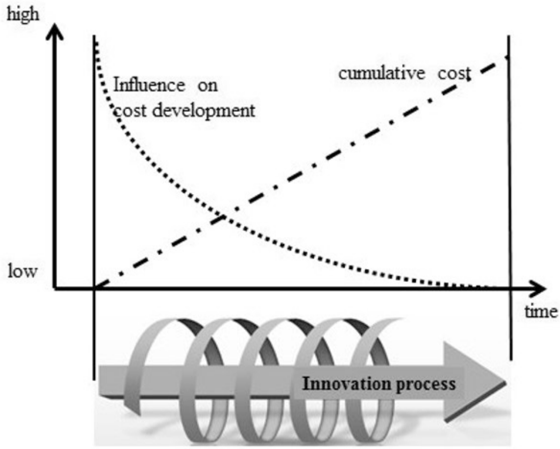


Figure 83: Cost value relationship throughout the innovation process
Source: by author based on Vahs and Brem (2013)

During the innovation process the cost element is an important factor which is increasing and more difficult to influence as longer the process lasts (Hoffmann, 2014).

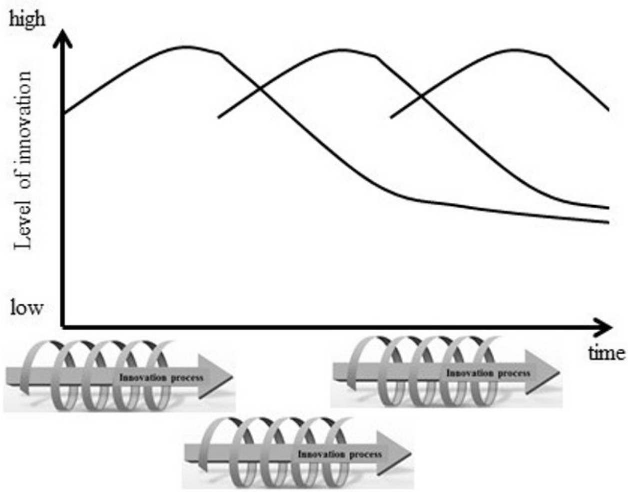


Figure 84: Changing importance of innovations over time
Source: by author

Consequently, the innovation process needs to include gate reviews in order to keep track of the progress and cost/value relationship. In case of deviations of the strategic cost/value objective corrective action needs to take place or the process needs to be stopped in order to avoid unnecessary financial threat to the organization (Figure 83).

The timeline being an important factor during the development process also has a fundamental impact on the significance of the innovation to the customer and with that to the financial relevance to the organization. As explained above, already during the innovation process, the market dynamics result in a changing environment and consequently influence the potential market success of the innovation. As soon as the innovation will be out on the market, this effect will rapidly increase and the importance of the innovation will decrease the longer the industry will mature until another innovation will "take over" (Figure 84). This effect needs to be included and considered in every stage of the innovation process.

3. 1. 4. Different kinds of innovation strategies in the context of energy economics

In literature two kinds of innovation are being distinguished: incremental innovations and radical innovations (Pleschak and Sabisch, 1996; Rothe, 2015; Binder, 2014; Krell, 2014; Schallmo and Brecht, 2014; Kroy, 1995) (Figure 85), with both versions being equally important (Schießl, 2015).

Incremental innovations are described as evolutionary innovations which take place in existing or similar markets and known areas of application. These innovations focus on product or service improvements.

Radical innovations are described as revolutionary innovations with a high level of novelty resulting in complex interdependent changes within the organization. The higher they are technology or market driven, the higher are their chances in the market.

Kroy (1995) describes radical innovations risky but as extraordinary chance for the organization. Successfully implemented in the market, radical innovations assure a monopoly position for a certain time as well as knowledge and experience lead versus the competition (Eckardt, 2015). Hereby it is possible to skim the market with high profits and to benefit from image gains.

The innovation strategy of an organization is a part of its general strategy and of upmost importance for the positioning of the enterprise going forward. In this context, it needs to consider four major areas, namely technology, timing, process and product strategy. These four areas are in constant interdependency, being kicked-off by internal or external impulses (Figure 86). Within the enterprise there are several sub-innovation strategies which can be covering several business divisions or/and several functional areas. The entirety of all innovation strategies hereby is to be seen as part of the corporate innovation strategy.

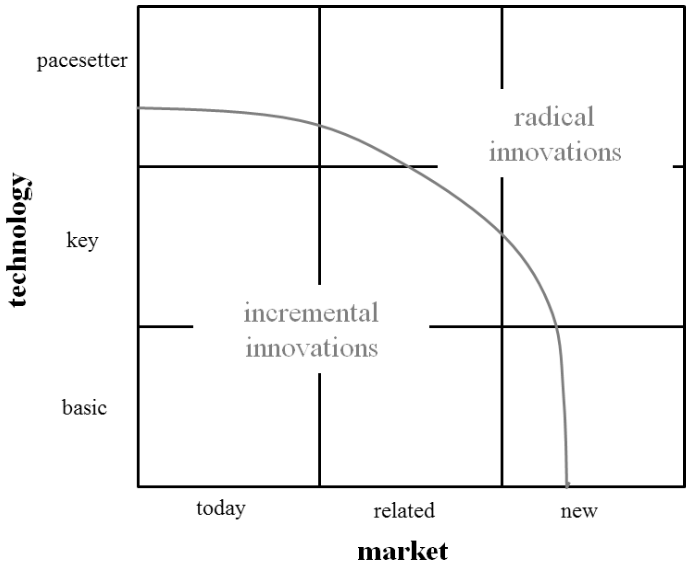


Figure 85: Relation between incremental and radical innovations
Source: Kroy (1995)

Developing the innovation strategy, it is not only important to be familiar with customer requirements, market demand and development and competitor's activities but also to combine existing experience with new information (Jetschny and Franke-Jordan, 2011). During this process, the required information can be sourced externally, developed internally or provided within a cooperating network of partners (Gerybadze, 2004; Hube and Engelhardt, 2014). In the case of innovation-networks, the informal dimension plays a key role. Only if the personal contacts and trustworthy relationships with the network partners exist, the process will be successful. A high level of fluctuation in the network members, especially in global networks hereby is a risk which should not be underestimated (Kaudela-Baum et al., 2014).

A second important dimension in the context of innovation networks is the innovation competency of the network partners (Doepfer, 2014) which ideally should be on a comparable level ("eye-to-eye-level") in order to ensure fairness in the system.

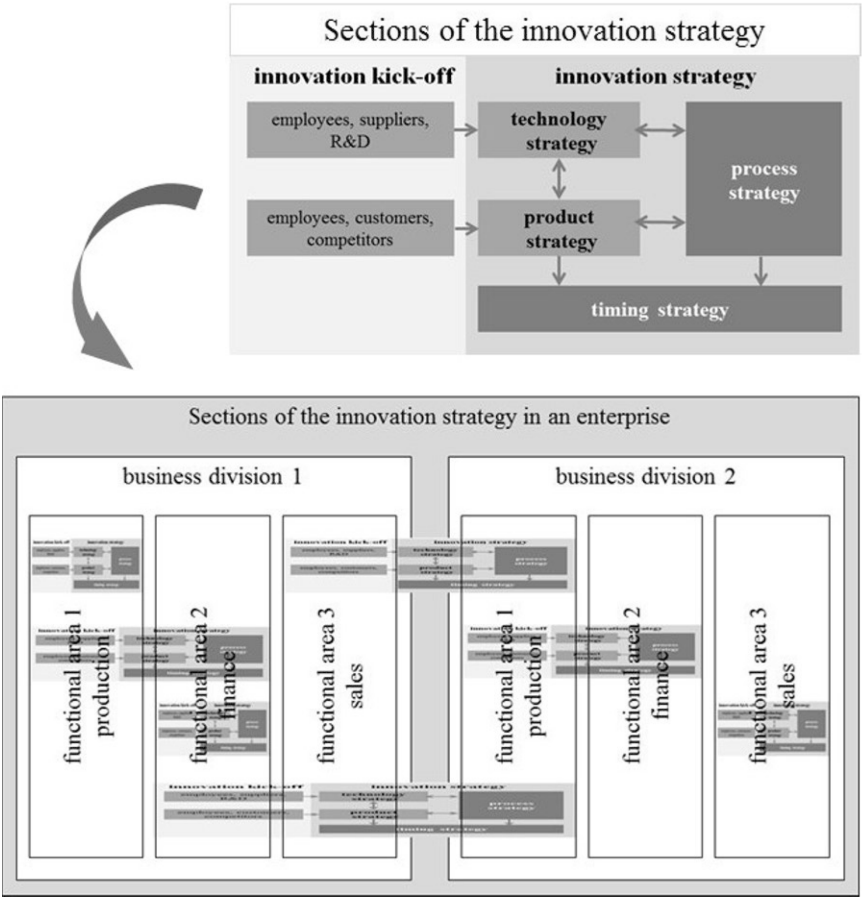


Figure 86: Sections of the innovation strategy
Source: by author based on Macharzina and Wolf (2012) and
Vahs and Schäfer-Kunz (2012)

In case some partners will be identified as weak, the stronger members of the network will either remove them from the group or themselves reduce their input in the network. This will reduce the effectiveness of the network and will on the mid to long-term result in its breakup. In their research project with R&D employees Herstatt and Nedon (2014) confirmed, a working partner relationship and fairness belong to most important factors and prerequisites for network innovation projects.

3.2. The open innovation approach supporting the energy networks

In this context, Chesbrough (2003) developed the model of the "open-innovation-approach" and defines it as follows: "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market" (Chesbrough et al., 2006).

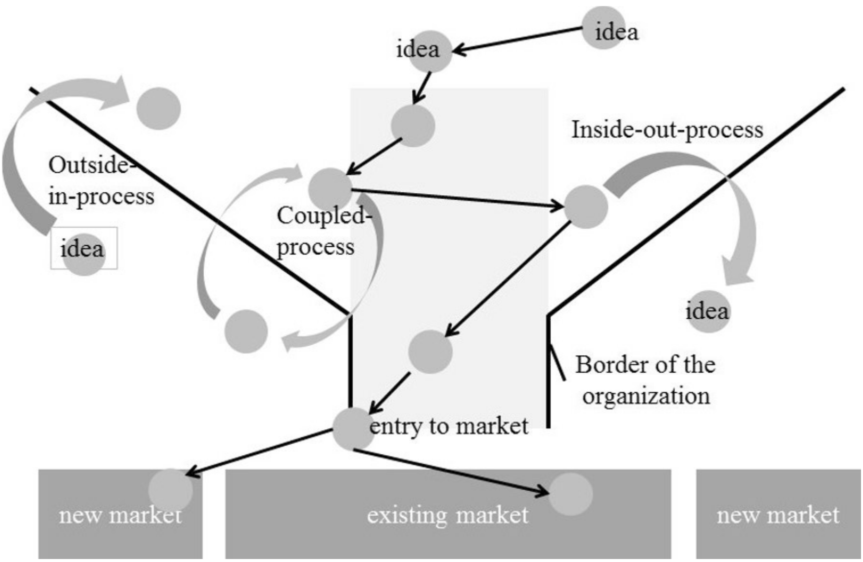


Figure 87: Sub-processes of the open-innovation-approach
Source: by author based on Hartweg et al. (2015)

Accordingly, the open-innovation-approach is an innovation process integrating input from outside with the knowledge available internally to the best possible result (Rothe, 2015; Gassmann and Enkel, 2004; Dahlander and Gann, 2010; Van de Vrade et al., 2009; Hube and Engelhardt, 2014; Kaudela-Baum et al., 2014; Herstatt and Nedon, 2014; Blaettel-Mink and Menez, 2015). The open-innovation-approach assumes, that knowledge is not concentrated in the own organization only, requiring "in-sourcing" of knowledge through co-operation networks (Kunert, 2014). Hereby the own organization needs to identify and decide which of the jointly collected information is of which value and shall be used in the process. It is important to benefit from a successful business model instead of being first in the market.

The open-innovation-approach benefits from a combination of several sub-processes guiding towards the market introduction of the innovative product/service (Figure 87), namely:

- Outside-in process: insourcing of knowledge from process partners
- Inside-out-process: sharing knowledge with the process partners
- Coupled process: combining outside-in and inside-out process

The market leadership will be a result of combining internal and external inputs throughout the innovation process (Chesbrough, 2003). For all benefits of open innovation processes there are also negative elements that need to be considered throughout the process (Figure 88).

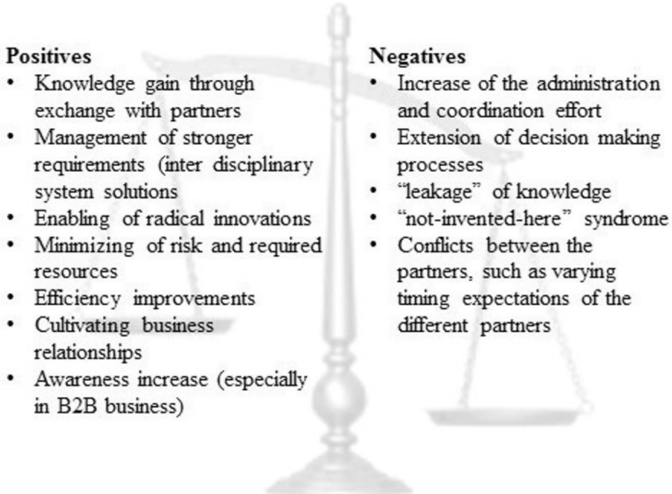


Figure 88: Pros and cons of the open innovation process
Source: by author based on Herstatt and Nedon (2014)

Herstatt and Nedon (2014) confirmed that it can be difficult and time consuming to find the right partners for open innovation networks. At the end, each potential partner of open innovation processes needs to decide himself whether the balance between benefits or the negatives are OK for him. Their research however concluded that for most of the participation enterprises the advantages of open innovation processes dominated.

Potential partners for open innovation networks can vary from public sectors over suppliers, customers to even competitors (Figure 89). During the composition of the network it needs to be ensured, that, depending on the innovation subject, all required competencies (social, technical and functional) are well represented.

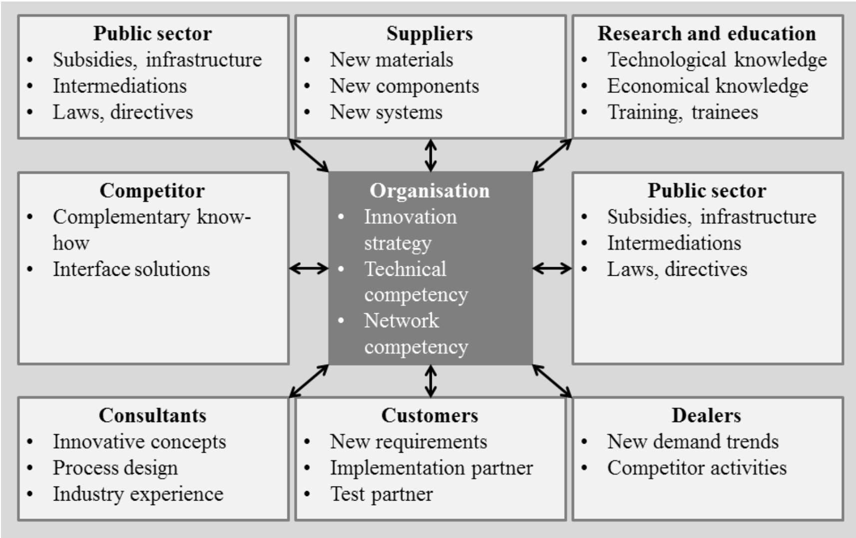


Figure 89: Potential partners of open innovation networks
Source: by author based on Herstatt and Nedon (2014)

Thereby co-operations usually are started with the objective to

- bundle strength,
- balance weaknesses,
- benefit from cost advantages,
- minimize risk and
- benefit from (technological) know-how of the partners.

During this process it is important to distinguish routines, organizational and dynamic capabilities (Heitkamp and Rasmus, 2014). The ability to cooperate consists of three steps:

- searching for partners: with the intend to identify appropriate partners
- process coordination: with the intend to steer and coordinate all activities during the cooperation,
- usage of experience: with the intend to benefit from experiences and learnings made in previous or parallel co-operations.

In literature several models of the open-innovation-approach are being discussed (Table 11). Some of which focus on partner integration others on the pure product development process. In the context of this research looking at KIBS in the field of energy consulting and energy services, the focus was put on the partner integration models; five of the mentioned models will be described in more detail.

Table 11 Open-innovation models
Source: by author

Model	Author
pico-job model	Blohm et al., 2011
webbased customer interviews	Dahan and Hauser, 2002
methodical open product development	Kirschner, 2012
integration of customer feedback	Schulte, 2006
planning of technological product innovations	Brandenburg, 2003
assumed customer requirements	Lorenzi, 2003
preventive quality management methods	Lesmeister, 2001
collective innovation idea evaluation	Schwarz and Hofmann, 2013
partner integration model	Rothe, 2015
Corporate Social Innovation (CSI)	Stark, 2013

The **pico-job model** by Blohm et al. (2011) is based on the concept of small structured tasks offered through agents via the internet. The "customer" handling the tasks is being motivated by offered benefits (monetary or not). In order to ensure a defined quality it is possible to profile the "customer". This model suits a long-term customer relationship, especially in the B2C business. The disadvantage is, that the "customer" contribution is motivated by benefits, hence the truth factor cannot be assured, as the motivation could end-up in participating in as many tasks as possible in order to create a maximum share in benefits. The advantages of partner integration are not fulfilled in this model as well in the next concept of the **web-based customer interview model** designed by Dahan and Hauser (2002). This model contains six methodologies which can be used in the different phases of the innovation process and ensure a fast and low-cost access to customer requirements. The objective here is the direct relation and connection between the customer and the innovation team. This model requires an existing product concept to be evaluated hence it is not suitable for new concepts.

The **methodical open product development model** is also called immersive product improvement (Kirschner, 2012). It offers interested external partners to contribute with comments to existing products and services in the market. Hereby the community has access to all provided inputs and information, which they can comment, evaluate and develop further. The objective is to combine product usage and product development. The **collective innovation idea evaluation model** (Schwarz and Hofmann, 2013) is based on the assumption that the evaluation of innovation ideas is the main driver for the success of the innovation. The collective knowledge of the employees and external partners is being used through an attribute evaluation process. Out of a defined set of attributes, the interviewees as asked to select three of them and assign them to the evaluated innovation in process. Through the defined pool of attributes, a numerical analysis visualized in a matrix will provide a quantifiable prioritized set of internal as well as external feedback.

Rothe (2015) combines in his **partner integration model** the advantages of other models with the focus on maximizing the benefit from external process inputs. This process provides concrete recommendations which are based on the evaluation of open-innovation-methods through process specific and organization / innovation specific assessments, reducing the technical and economic risks to a minimum. Knab et al. (2014) researched cooperative innovation models on the example of the German smart-energy market and could prove that this model is well suited for identifying potential economical and societal benefit, for developing cooperative value chain structures, for planning in complex and uncertain market conditions as well as for preparing the implementation of new business models (see also Bruhn and Hadwich, 2015).

3.3. Trends of corporate social innovation and their correlation with CSR and KIBS in the field of energy

In the context of sustainability in enterprises, through the integration of social topics and external stakeholders, CSR is fastly developing to be an important motor for innovation in literature also being named as Corporate Social Innovation (CSI).

Through CSI the competitiveness is being complemented by another motivator: both partners not only are learning from each other but develop in addition new areas of experience leading towards innovative social, economic and societal ideas (Stark, 2013). This model gets the partner integration model to next step/level, as the partners develop a joint business plan, matching each other's corporate policies as well as objectives. Its four elements are visualized in Figure 90.

The inter-sectorial alliance element in Stark's (Stark, 2013) corporate social innovation model hereby reflects the key section for energy service focused KIBS and practicing a mix of the partner integration model and the open innovation approach mentioned before.

Due to the timely delay of impacts and effects, measuring the effects of social and sustainable innovation is not as easy compared to the traditional variants of product and technological innovations. By reason of the societal trend towards sustainability however organizations are forced to increasingly integrate CSR (Corporate Social Responsibility) in their corporate strategies.

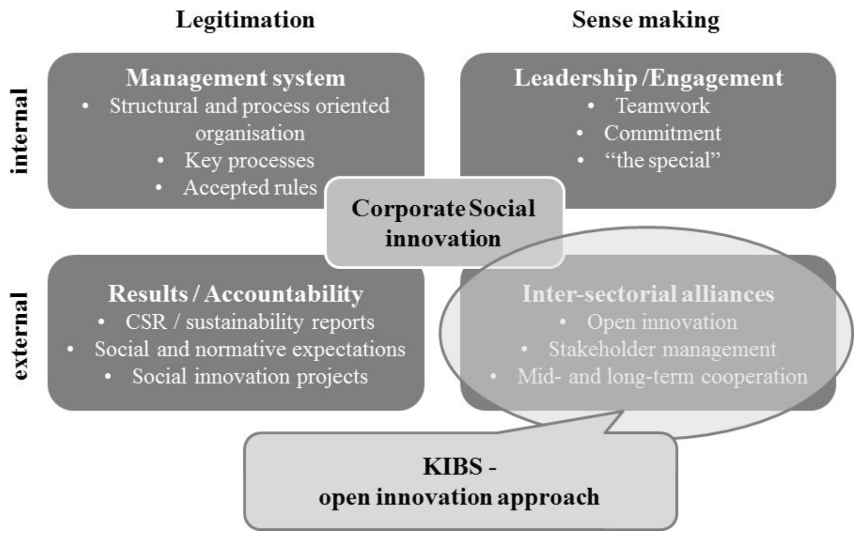


Figure 90: Corporate social innovation and energy service KIBS
Source: by author based on Stark (2013)

By understanding enterprises as part of the society and creating societal value, CSI (Corporate Social Innovation) adds the citizens as organization to the open innovation model, developing CSR to the next dimension of responsible and accountable business management (Figure 91).

As outlined before, innovation is traditionally the key of success for enterprises, in today's development phase represented by social innovation, pushing the innovation process using the open innovation approach towards a trend creating added value for society and economy (Osburg and Schmidpeter, 2013). Innovation and entrepreneurship are especially linked with small businesses, where most of the KIBS focused on energy services operate (Sahut and Peris-Ortitz, 2014). Innovation thereby is not to be understood as a given feature of entrepreneurship; instead both must go parallel in order to allow innovation to develop. Small and medium business entrepreneurs present an important and very special role in the economy.

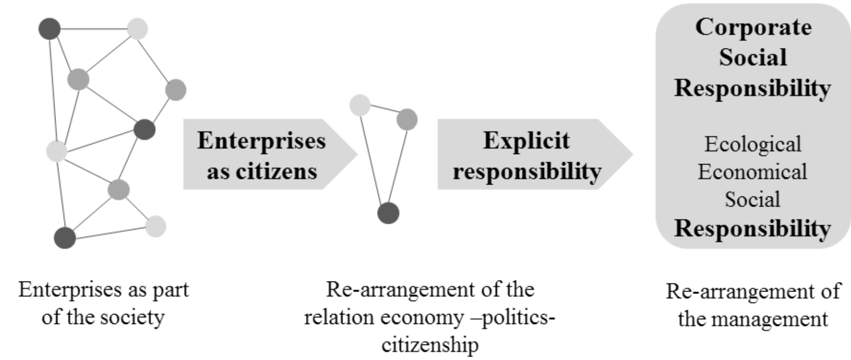


Figure 91: Enterprises in the society
Source: Osburg and Schmidpeter (2013)

Besides creating a relatively high level of employment and productivity increase, they also originate, produce and market high-level innovations; and this more efficiently and spending less R&D than their larger counterparts (Praag and Versloot, 2007); good examples in this context are innovative products increasing the efficiency in wind turbines, such as innovative clutches, slip rings, etc. (Weber, 2015c). The motivation for innovation in the energy sector is higher, the higher the energy price, hence a high energy price can also be interpreted as being good (Nitsch, 2015). Concluding, innovation can find a smart source in its "sustainability sweet spot" (Figure 92).

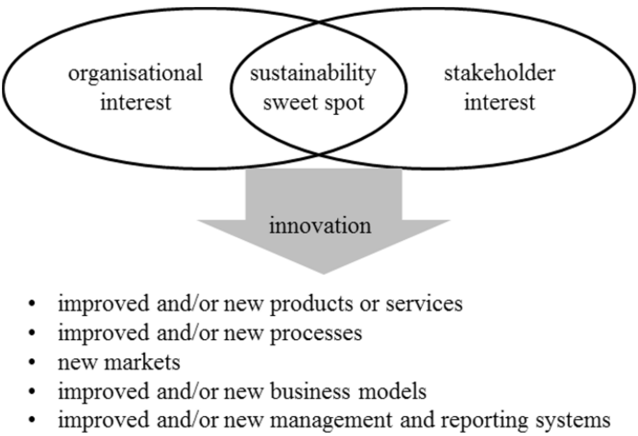


Figure 92: Sustainability sweet spot
Source: Grieshuber (2015)

In this context social questions can be used as learning laboratory in the process of identifying new requirements and to develop based on those solutions for new and/or existing markets. Altenburger (2015) refers to this model as Corporate Social Innovation (CSI).

4. Actual evolution of the energy economics in Germany

4.1. Factors influencing the energy economics surroundings

4. 1. 1. The Europe-2020-Strategy and its relation to sustainable energy strategies

Following the Lisbon strategy, the Council of the European Union approved the Europa 2020 strategy back in June 2010. Aiming at increased growth and employment in Europe, innovation, research and development are important elements. Based on the three priorities of smart, sustainable and inclusive growth, several targets and lead initiatives are designed to support its successful implementation (Figure 93).

	Targets	Flagship initiatives
Smart growth	— Increasing combined public and private investment in R&D to 3 % of GDP — Reducing school drop out rates to less than 10 % and increasing the share of the population aged 30 to 34 having completed tertiary education to at least 40 %	— Innovation Union — Youth on the move — A digital agenda for Europe
Sustainable growth	— Reducing greenhouse gas emissions by at least 20 % compared to 1990 levels — Increasing the share of renewable energy in final energy consumption to 20 % — Moving towards a 20 % increase in energy efficiency	— Resource efficient Europe — An industrial policy for the globalisation era
Inclusive growth	— Increasing the employment rate of the population aged 20 to 64 to at least 75 % — Lifting at least 20 million people out of the risk of poverty and social exclusion	— An agenda for new skills and jobs — European platform against poverty and social exclusion

Figure 93: Europe 2020 strategy's key priorities, headline targets and flagship initiatives
Source: ***eurostat (2015)

The relation of the five defined headline targets is visualized in Figure 94. The solid lines show direct the dotted lines indirect relationships and interaction. The dotted link between the "climate change and energy" and "poverty and social exclusion" objectives was added by the author, energy prices for instance certainly have a direct impact on consumers and as such can result in poverty. "Sustainability, climate change and energy" represent essential element of the European 2020 strategy (highlighted in Figure 94). By 2020, the greenhouse gas emissions are to be reduced by at least 20% compared to the 1990 levels. The share of renewable energy in the final energy consumption is to be increased by 20% and the levels of energy efficiency are to be increased also by 20%.

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4_5

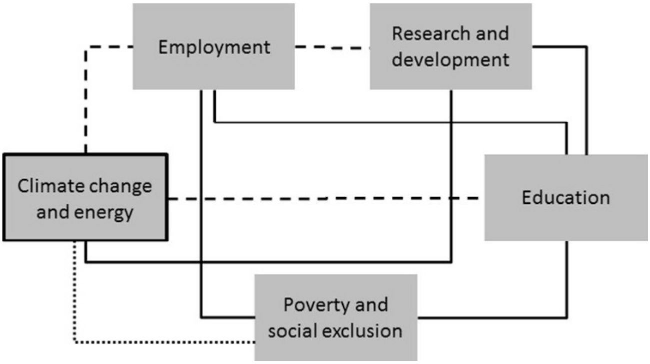


Figure 94: Europe 2020 strategy headline targets and their interlinkages
Source: by author, based on ***eurostat (2015)

These growth targets are to be realised by focusing on developing an innovation and knowledge focused, resource efficient and competitive economy. The challenges in the field of energy in this context are on smart cities and communities, mobility, low carbon energy (renewable energy) as well energy efficiency. The field of energy efficiency addresses five main areas:

- Buildings and consumers (critical elements are here increase of the energy performance of existing buildings, new energy efficient buildings, construction skills, consumer engagement and the “leading by example” function of the public sector)
- Heating and cooling (critical elements here are technology for residential and industrial district heating and the boundaries and against renewable energy solutions)
- Industry and products (critical elements here are innovation through “mass market” as well as in the industry, heat recovery, reluctance to join efficiency networks and clusters)
- Financing sustainable energy /critical elements here are the attractiveness of investments and short ROI requirements, integration of “soft factors” in to business case calculations and implementation of life-cycle-cost calculation)
- Transport and mobility (critical elements here are the implementation and support (infrastructure) of alternate drive systems (i.e. e-mobility), alternate transport systems such as car sharing etc., extension of public “green” transport)

A key element with regard to industry and product is the insurance of the implementation of the EU product and process energy efficiency legislation and defined industry norms.

4. 1. 2. Industry norms in the context of energy efficiency

Energy management and the ISO 50001 industry norm

The industry norm ISO EN DIN 50001 defines energy management services globally. The services in this sector comprise energy management systems for production processes, buildings as well as for combinations of both, software development, evaluation and measuring of energy consumption data, concept development, installation of energy management systems and certifications as well as consulting (Prognos et al., 2013). According to a study the number of 3,240 certified energy management systems was registered by March 2014 in Germany. This reflects around 1% of the registered enterprises registered in Germany at that time (***BMWi, 2014c). The details of the energy management systems are referred to throughout the document.

Energy audits / Energy consulting and the DIN EN 16247 industry norm

There is no central register administering consultation services in Germany. In lieu thereof a variety of databases is on the market for energy consultants and auditors to register. As being independently operated, some of them concentrate on certain sectors such as industry, or buildings, others combine several. Consequently, one searching for a consultant is being challenged during the process of identifying a qualified energy efficiency expert. With the beforehand mentioned implementation of the EU Energy Efficiency Directive, two databases operated by German authorities in charge of managing the energy audit process (BAFA and dena), developed to be the place to go to find a qualified energy expert. Prior being listed in these databases, energy consultants and auditors had to proof qualification and experience following a clear set of requirements. In addition, only these auditors are, according to the EU Energy Efficiency Directive, accredited to apply for governmental subsidies supporting the execution of energy efficiency measures of their customers. On top and under certain conditions, their consultation service is proportionately being subsidized by the government. (***BAFA, 2015e).

During an energy audit, information of the actual energy consumption profile of industry processes, buildings, and/or industry sites is being systematically collected in order to quantify potential energy efficiency measures. In a next step, these need to be evaluated and the results are to be summarized in a specific report (***BMWi, 2014c). Energy audits are also obligatory requirement prior installing certified energy management systems according to the DIN EN ISO 50001 industry norm. Details for energy audits in general are defined in the DIN EN 16247-1 industry norm.

4.2. The chronicle of the German energy transition

The energy economy globally undergoes currently a major change. It started 2011 in Germany with the “Energiewende”, a very complex strategy for a comprehensive energy transition (as the roadmap Figure 95 illustrates) and is meanwhile also on focus in France and the United States of Amerika, with President Obama’s “Clean Power Plan”, announced 1st of August 2015.

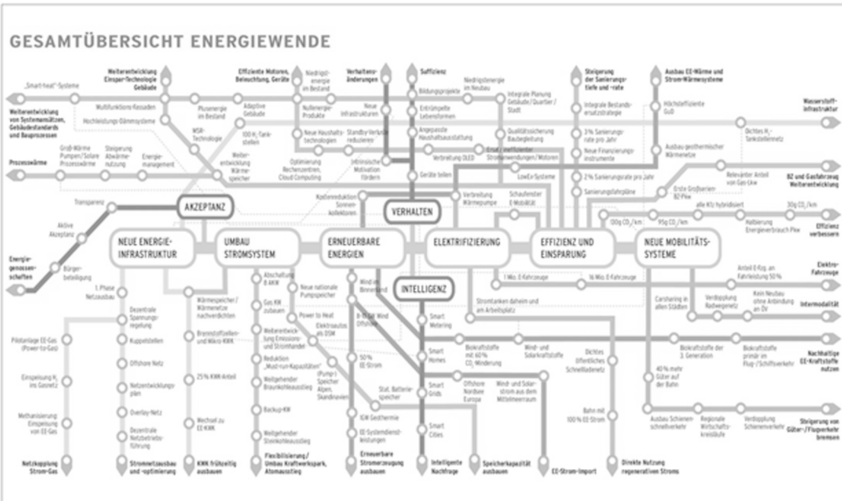


Figure 95: Complexity of the German “Energiewende” roadmap
Note: This is an exemplary schematic illustration by ifeu, Fraunhofer IBP & university of Regensburg - the details are not important here, the charts intention is to illustrate the complexity of the process “German Energiewende”, Source: Niederhausen and Burkert (2014)

In Germany, the call was to leave fossil and nuclear energy supplies and change them into a sustainable, renewable energy production in the sectors heat, mobility and electricity (Weber, 2015). Germany is so far the only nation worldwide walking such a radical path in such a short timeframe. By that, Germany is called the testing laboratory for the reorientation of its entire energy system. The objectives for this energy transition are:

a. climate protection and counter fighting global warming by reducing greenhouse gas emissions. With energy efficiency measures being a vital part of the plan and
b. reduction of the risky nuclear power production (environmental and social sustainability) and
c. use of sustainable energy resources.

The push for energy savings (example: building insulation), improved energy efficiency (example: shifting towards LED lighting) and renewable energies are hereby vital parts of the energy transition; smart meters and smart grids are also crucial elements in order to achieve successful and effective load management.

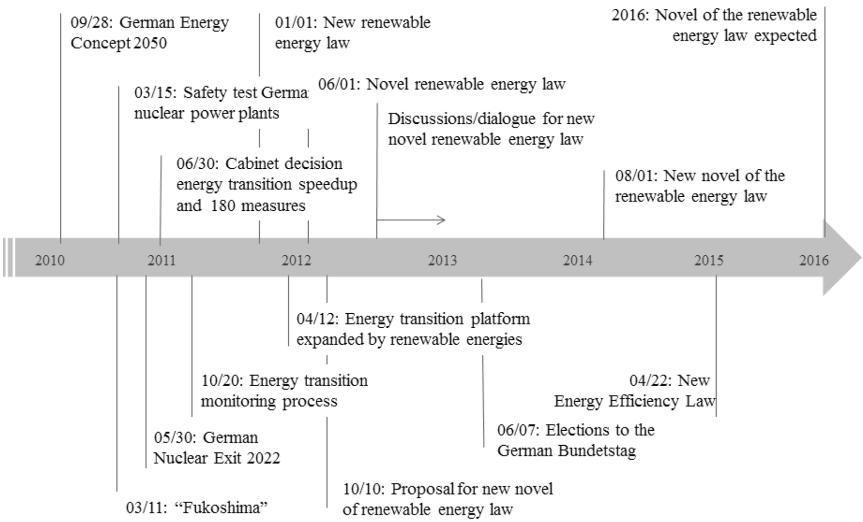


Figure 96: Chronicle of the German "Energiewende"
Source: author's design

The energy transition in Germany started originally long before the nuclear catastrophe in Fukushima (Maubach, 2014). The EU policy for the privatization of the power industry was implemented into the national law already in 1997 (Kemfert, 2013).

After that, several changes such as separation of power production from grid management were implemented. This was already a major paradigm shift of the traditional power supply (Weber et al. 2014).

Following that, the German government decided in 2009 to develop a national energy concept (Sohre, 2014). This plan was put on action one year later (Figure 96), when for the first time, the German government presented a long-term strategy for its energy transition (Weber, 2015).

This plan includes:

a. a) the exit from nuclear energy,
b. b) expansion of the renewable energies and
c. c) most important measures for the increase in energy efficiency and the reduction of the emissions of greenhouse gas.

The directions called out by the German government were based on several studies and scenarios, carried out by several nameable scientific institutes such as Prognos AG, gws, ewi, the Institute for ecology and others. In combination, these explain and state the context of a successful execution of an energy transition in Germany. Most of those were commissioned by the ministries of finance (BMF), economy and energy (BMWi) and environment (BMU) (Solorio et al., 2014) (Figure 97).

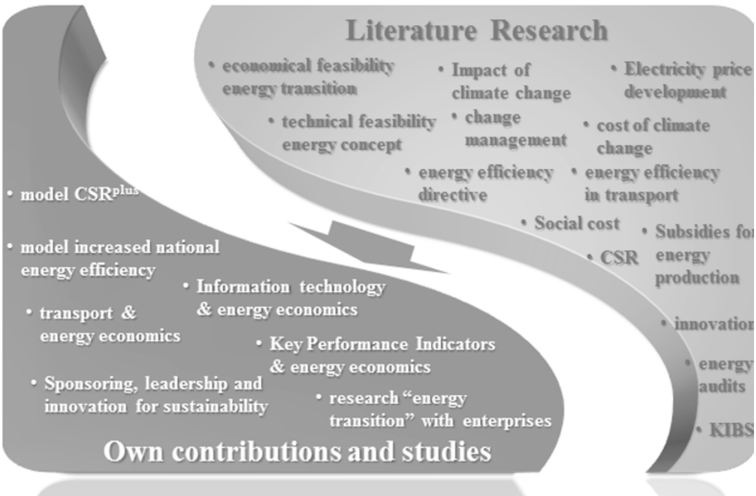


Figure 97: Literature research and own contributions
Source: by author

These studies acknowledge the feasibility of the energy concept of the German government (*** Prognos et al., 2010) confirming that based on the current technical knowledge a switch away from nuclear and coal dominated energy supply to a production of primary energy through renewable resources by 2050 is technically doable (Wosnitza and Hilgers, 2012).

Compared to other energy sourcing strategies, the studies also confirm this process to also be beneficial to the national economy (Weber, 2015), with a maximum effect to be achieved if the "energy transition" and measures for the protection of the environment would be performed simultaneously (*** BMU, 2013).

The economic as well the technological feasibility of the objectives defined in the energy concept were also confirmed by additional studies from different sponsors. Some of which confirmed the feasibility of switching to 100% renewable energy production (the Federal Office of Environment, the German DLR, and the Governmental Expert Commission Environment SRU).[3]

After the Fukushima incident in March 2011, the German government had all German nuclear plants undergo a stress test. Two months later, in May of the same year, the shutdown of the nuclear power plants until 2022 and the systematically development of the renewable energies were announced by the government (Bardt and Kemperman, 2013). In the context of this development, the public became strongly sensitized for sustainable energy production which increased the expectations from the end-consumers towards the energy suppliers and sustainability in general (Wallikewitz and Schymczyk, 2015; Schleer, 2014).

The advanced pull-out from nuclear power was researched in detail, supplementary pushed after the reactor disaster of Fukushima. Securing grid stability and electricity supply at a high quality level were the most important elements investigated, besides greenhouse gas development, electricity costs and projected electricity imports (BET, Ökoinstitut e. V., ZNES, Greenpeace, R2B Energy Consulting)[4].

All these studies confirmed that the replacement of nuclear power supply in Germany can be rapidly compensated by the capacities of existing and planned fossil and renewable energy power plants together. Of course there would be challenges following such a path, these however could be addressed through grid expansion and modernization of the grid infrastructure (Weber, 2015).

Since then, the renewable energy law underwent several changes concerning the support for renewable energy plants (see also Marin, 2013). During the following years, the feed-in-tariff system underwent several minor changes coming along with a debate on high electricity prices. The EEG 2.0 (major change to the renewable energy law in Germany) was debated heavily and after a few modifications passed parliament approval on August 1st, 2014 (***BMWi, 2014a; 2014b).

---

[3] *** Ökoinstitut e. V. & Prognos, 2009; *** SRU, 2011; *** DLR, Fraunhofer IWES, IfnE, 2010; *** Umweltbundesamt, 2010; *** Bundesregierung, 2010; *** SRU, 2013; *** ZNES, 2011;

[4] *** BET, 2010; *** ZNES, 2011; *** Greenpeace, 2011; *** R2B, 2011; *** Ökoinstitut e. V., 2010

4.3. The impacts of the changes in energy strategies to the German business sectors

Throughout the early years of the changes in the German energy economic system, the German labour market for green technology employed already 1.4 mil people in 2011 with renewable energies and energy efficiency as the main drivers and rising stars in the job market (Figure 98), a booster for an economic growth and employment not only for the energy sector (***BMU, 2012a; Blazejczak et al., (2010).

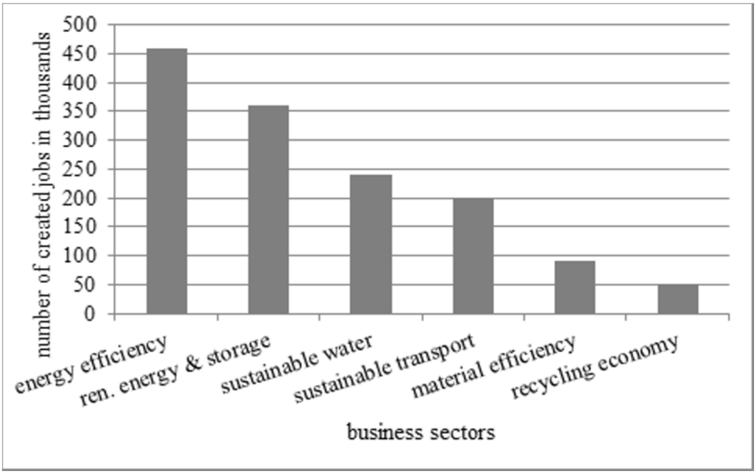


Figure 98: Job creation in the German green tech sector 2011
Source: Wiehl (2014)

Since 2013 company insolvencies and increasing unemployment resulted from the political decisions during the outer years (***BMU, 2013; Bardt and Kempermann, 2013). The high electricity price in combination with falling feed-in-tariffs caused a major competitiveness issues for the German renewable energy sector (Weber et al., 2014). With the given uncertain und unstable political framework, investors and banks were reluctant to provide necessary funds for new projects, hence the market slowed down almost to zero, as study confirmed (***IZA, 2013). However, a recent study by the DIW (German Institute for Economic Research) confirmed, that the chances of success especially for knowledge intensive business services, as many can be found in the energy efficiency sector, are improving (Figure 99) (***DIW, 2015; ***BMU, 2015).

Respective laws pushing for energy efficiency activities were also installed. For enterprises considering applying for refunds on electricity and energy taxes, since 2013, energy management systems became mandatory. This concept was intensified as of 2015 by the obligation to perform true energy savings by the participating companies.

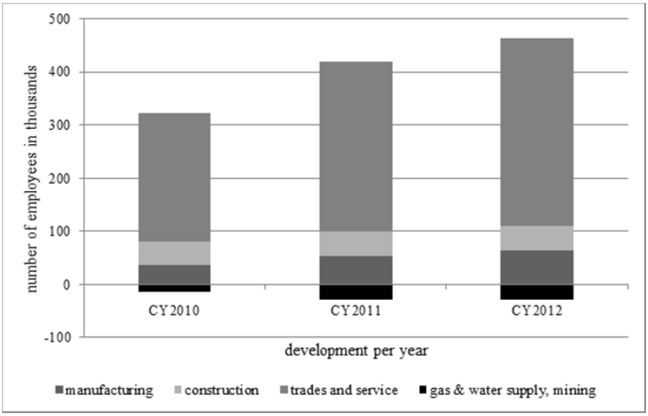


Figure 99: Energy efficiency measures: impacts on employment in Germany
Source: *** BMU (2015)

While larger companies usually have the capacities, means and financial reserves to take such changes one way or the other, small and medium sized enterprises (SMEs) are struggling to handle such changes in their running cost. Also exceptions to energy taxes are often enough applied to large companies, so SMEs usually cannot benefit from (Weber, 2015).

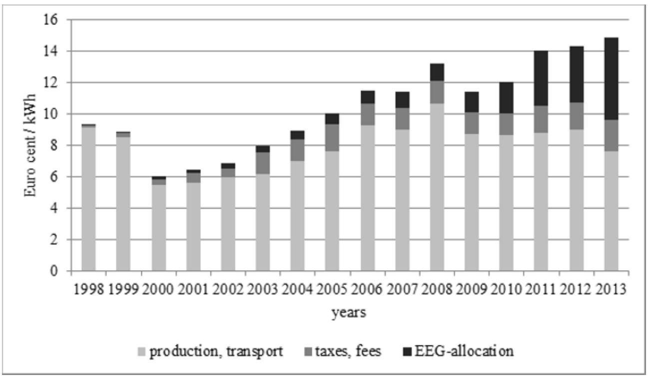


Figure 100: Development of the average electricity price for the German industry
Source: by author, based on data from *** bdew (2013)

The development of the averaged electricity price for the German industry is described in Figure 100. There, the top section of the bars in indicate the share of the EEG-allocation[5] in the electricity price. After 2013, the increasing trend of the EEG-allocation continued (Bardt and Chrischilles, 2014). Besides the EEG-Allocation, there are several other fees which howver have smaller share in the price structure, such as licence fee, KWK-G[6] and the §19-allocation[7] (***IHK, 2014; Scheffler, 2014; Müller et al., 2013)

One key element for enterprises to be competitive is price competitivness on one hand of their produced products or offered sevices, on the other hand of the purchased products and goods. The latter ones are influenced by transport cost, production cost, distribution cost, labour cost as well as energy cost (whereas transport, production and distribution cost also depend on energy cost). In case the competitiveness cannot be assured on the long-term, the business will have to be terminated (Bureau et al., 2013).

The price and EEG-allocation discussion usually is missing a complete inclusion of historical and current subsidies. While renewable energies are being blamed for being the origin of the high electricity prices (a fact also confirmed in Spain by Costa-Campi and Trujillo-Baute, 2015), as their development is being subsidized through the feed-in tariff-system, the public discussion tend to forget, that coal and nuclear power were subsidized during their development also (Bardt and Kempermann, 2013). However, their subsidies were coverd invisibly to the consumers via “normal” taxes, whereas for the coverage of the renewables subsidies, a specific fee was invented, visible to every person as part of their monthly electricity bill (***FÖS, 2013; 2015). As shown in Figure 101, the development of coal and nuclear power in Germany was by far more subsidized, than any other energy production technology. In addition, there is another factor often forgot which needs to be added to the discussion covering future subsidies: not included here are the costs for neither dismounting the fossil and nuclear power plants nor the final storage of the nuclear fuel elements – these will heat up the price and subsidy discussion in the close future (Brunnengräber et al., 2014). Any renewable power plant in Germany however by law has to include any dismounting cost in the original business case already.

[5] EEG-allocation: with the introduction of renewable energies in Germany, the EEG (law for renewable energies) defined the feed-in tariffs. The EEG-allocation was introduced in order to finance the feed-in-tariff system.

[6] KWK-G = subsidy for combined power and heat production

[7] §19-allocation = subsidy for energy intensive enterprises to compensate for the grid access fee

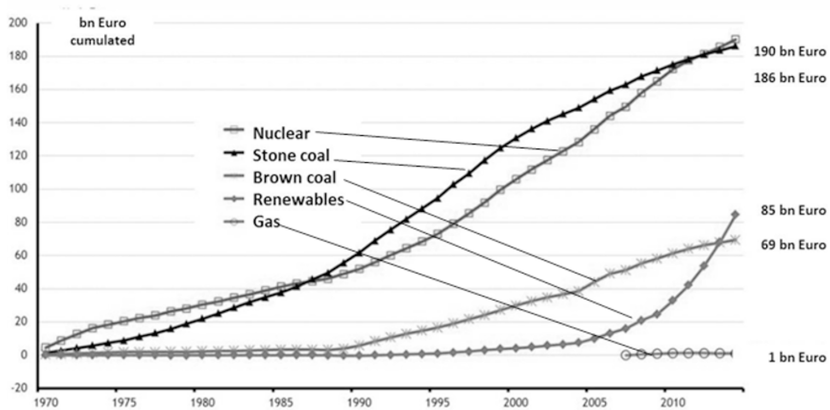


Figure 101: Cumulated governmental subsidies for the electricity sector 1970-2014 in bn Euro
Source: *** FÖS (2015)

Whilst the German industry was faced with electricity prices at an uncompetitive high level (Sundt and Rehdanz, 2015), their competitors in bordering countries such as France and the UK could benefit from a much lower price level, realized mainly through subsidized nuclear power (Bureau, et al., 2013; Weber et al., 2014).

This debate of energy price levels however should be seen in the right context (Bureau, et al., 2013). Energy prices are composed of several components. On one hand there are fixed and direct cost resulting from the production process. In addition we find add-on-cost, such grid usage cost, general taxes, VAT (Value Added Tax), and various additional fees and allocations (***BMWi, 2013; Küchler, 2013). Artificially controlled and regulated electricity prices are representing a wrong image of the real cost situation though (Bardt and Chrischilles, 2014). As a consequence, business decisions, based on wrong real assumptions, cause trouble, once the framework is being changed. In addition, regulated price levels will be guiding to inefficient energy sourcing decisions as well false decisions related to whether or not perform any energy efficiency measures (Weber et al., 2014).

These energy price level for the German industry was strongly debated in the context of uncompetitivness in comparison with the energy price levels within Europe. A comparison of the electrity tax level which was undertaken by the BDI (German association of the industry) in 2011 (***BDI & VCI, 2011) proofs a substantial disadvantage in electricity tax for German enterprises within the European context (Mare et al., 2013). As a result and to avoid overstressing German companies, the Federal Government in Germany approved exceptions from the EEG-allocation for those companies proofing a large electricity consumption and facing international competition, in the 1st half of 2015, more than 2,000 applications were registered (Table 12).

Table 12 Applications in 2015 for exceptions from the EEG-allocation in Germany
Source: *** BAFA (2015)

Germany	2014	2015 (by July 2nd)
Applications	2,461	2,268
thereof producing industry	2,331	2,138
thereof rail transport	130	130
Requested points of consumption	3,404	3,09
Requested amount of current [GWh]	116,47	117,011

Companies and public consumers which were not benefitting from this regulatory however had to compensate the financial value of these exceptions. After the European Commission opened a case against the German government the guidelines had to be slightly adjusted (Weber, 2015).

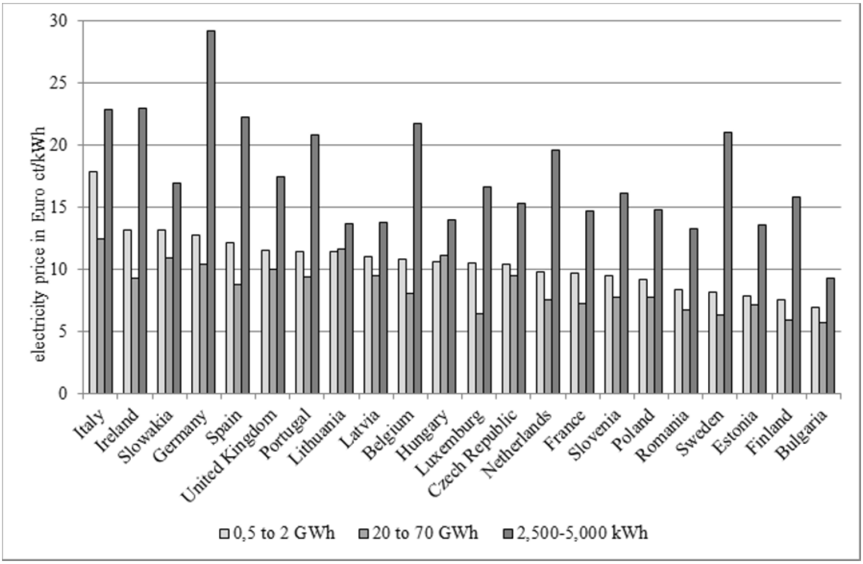


Figure 102: Electricity prices in Europe by consumption clusters 2013
Germany and Romania highlighted
Source: by author based on data from *** AHK Germany-Romania (2013)

Enterprises in Germany are impacted by changes due to the energy transition some time already. These changes are to some extend caused by adaptations of the energy system to the increasing share of volatile energy sources such as wind and solar power. As laid out earlier these impacts are mainly due to increasing energy prices. The main drivers in that context are increased taxes and additional fees (Bardt and Kempermann, 2013; Bardt and Chrischilles, 2014). Besides these direct effects also indirect effects by the changes in the energy economics can be identified. As the German industry is characterized by a wide structure and intensive supply relations, a high level of work sharing is possible.

by author design based on data from *** statista (2012) and *** bdew (2013)

The price discussion on the other hand often leaves an important element un-addressed: the motivation function high prices can have for a trend-change towards reduced electricity consumption and an increased push for energy efficiency measures (***FÖS, 2013).

Comparing electricity prices, large, middle and low consumption are to be distinguished. In Germany and Romania for example, for low consumers (left bars in Figure 102) the electricity prices in Germany 2013 were more than double (220%) of the Romanian level. This is to a large extent a consequence to the exception regulations from the EEG-allocation for large consumers in Germany described earlier with consumers, not benefiting from an exception, counterbalancing the resulting financial gap (Bardt and Kempermann, 2013). For the large and middle consumers, price discrepancies are not such drastically. However, German companies still face a more than 50% higher electricity price compared with Romania (Weber, 2015).

In the context of production cost for electricity, renewable energies in Germany benefit from an obvious cost advantage versus the fossil power plants (***Fraunhofer ISE, 2013). However, caused by the merit-order –effect, this lower cost benefit is resulting in a higher end price for electricity to the consumer (***ewi, 2012), (***FÖS, 2013).

The gas sector faces a similar situation as the electricity price levels, with the German industry facing price standards double as high as for example the Romanian industry (Weber, 2015). This effect is illustrated by the horizontal line in Figure 103.

Such work sharing concepts are realized by enterprises on one hand focus on their core business and intensively involve Knowledge Intensive Business Services (KIBS) for special activities in their value chain on the other hand, especially for energy intensive enterprises. Consequently there exist very intensive relations between enterprises and the KIBS. Detailed information on KIBS can be found in chapter 1.3 of this document. Especially energy intensive enterprises are in that context crucial for the competiveness and the success for their KIBS partners. This competitiveness is to a good portion driven by the capacity for innovation of KIBS (refer also to chapter 3.3 of this document). As Bardt and Kempermann (2013) found out, that around 70% of the specialized companies rates the capacity of innovation of their partner companies as very important.

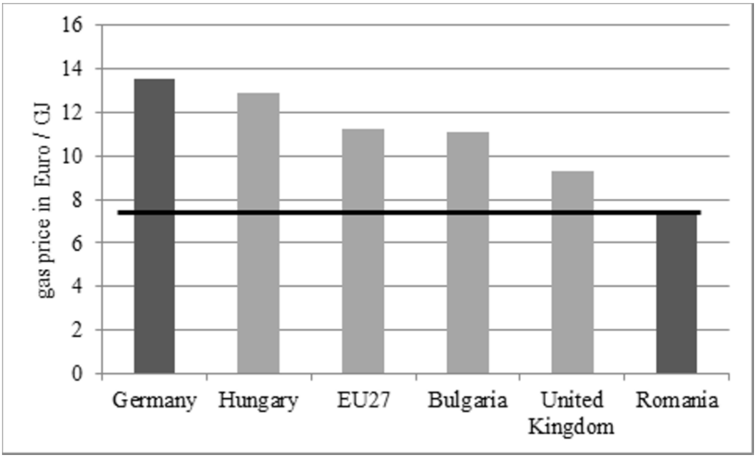


Figure 103: Gas prices in selected European countries
2013 (w/o VAT), highlighted for Germany and Romania
Source: by author based on data from *** AHK Germany-Romania (2013)

In a market with changing energy prices, the shift away from the traditional nuclear and fossil production towards a decentralized production of renewable energies, the mentioned price discussion is in particular important for energy producers. In this context it is important to understand, that in Germany private persons are the main drivers of the decentralized power production, mainly through installation of photovoltaic systems on the roofs of their own houses or through shareholdings in larger photovoltaic power plants and wind farms, being realized through cooperatives. This is mainly due to the inaction of the big power producers mainly neglecting the trend development towards “green” energies during the recent years. Nowadays however a trend-shift can be observed with large power producers changing their portfolio from meanwhile unprofitable fossil and nuclear towards a renewable power production. In consequence, as a recent study revealed, this is one consequence of the negative trend in the profit of the traditional energy production is of huge concern of the energy producing industry (***ewi, 2014a; ***FÖS, 2015a).

Of bigger concern however is the aforementioned political uncertainty withdrawing the planning base for future business decisions and investments (Figure 104), especially as the fossil and nuclear energy producing industry due their high investments for new power plants, require a stabile framework (***acatech, 2012). Recent press reports describe the efforts of the large power producers in Germany in separating their nuclear and coal business (Wüpper, 2016).

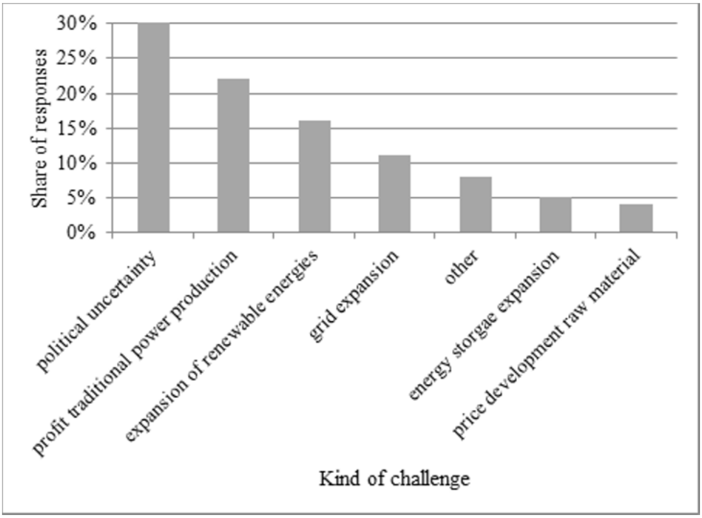


Figure 104: Challenges for power producers in Germany
Source: *** ewi (2014a)

During the process of reducing CO_2-emissions, reduced energy consumption through increased awareness and sensitivity in the use of energy which can be realized by employee training is one option. Another option in this context is the installation of energy efficiency measures, energy audits and energy management systems (Weber et al., 2014). Those are especially important in the context of the Germany energy transition, the "Energiewende" (Ziesing, 2014).

According to a study from McKinsey, since the year 2000, CO_2-emissions and primary energy consumption in Germany increased, whereas the electricity consumption could not be reduced enough. Only six out of the fifteen researched indicators are rated realistic (***McKinsey, 2014):

- Development of the photovoltaic grid
- Reduction of the blackouts per year
- Securing the power reserves
- Grid development
- Preservation and development of employment in the renewable energy industry

- Preservation and development of employment in the energy intensive industry
- The remaining indicators however are “behind target” of which:
- CO_2-reduction
- Reduction of primary energy consumption
- Reduction of electricity consumption
- Development of wind off-shore
- Reduction of the EEG-allocation
- Stability/reduction in electricity prices (households and industry)
- Reduction in necessary interferences for grid stability

Once updating their study in March 2015, McKinsey found out, that in general there is slightly a positive trend, however, a change in trend is not visible yet (***McKinsey, 2015).

The requirements for reduction of the CO_2-emissions in the energy economics will not be possible by energy efficiency measures alone. The use of energy efficient technologies can help to reduce the emissions of technological processes. The objective is only reachable with a parallel transition of the energy system towards renewable energy sources (Rest, 2011).

4.4. Gaps to be filled through additional research for sustainable energy strategies

Changes in the energy economics come along with pros and cons. Consequently there is a high level of uncertainty in the industry, mainly driven by the increasing trends for energy prices. There are new business opportunities which promise options for growth. The group which is foreseen to benefit the most of these is the knowledge intensive business services (KIBS). On the other hand, there is a high level of risk, mainly for the energy intensive enterprises. As both are steadily tied to each other, risk also occurs for the entire market by potential migration of energy intensive enterprises to low energy price countries, as their innovation potentials would then also be gone.

The increasing level of Europeanisation of the energy and electricity politics is another crucial element in this context. The promotion of renewable energies as one core element of the energy transition can only be successful, if being jointly managed with the use of energy efficiency potentials. In that context, it needs to be mentioned that energy efficiency potentials not only focus on electricity but also on the even bigger heat market.

Nevertheless with the ongoing changes in the energy systems, there is a strong demand for further study on this subject. In that context, the responsible department at the German Ministry for economy and energy started a large field research contacting all energy auditors in Germany for respective feedback on the audits performed so far. Questions asking for feedback on the willingness of the enterprises to cooperate up to topics regarding the time frame required for one audit and financials. The results can be expected towards the end of 2016. On the other hand further research is required in order to better understand the energy systems, their changes and effects to enterprises in the European context.

5. Study on the opinions of enterprises regarding the evolution of the energy sector

5.1. General context of the research

Reading through and analysing all the studies and researches performed so far, there was no investigation regarding the correlation between changes in the energy system and its impact on the industry that could be identified. Filling this gap, starting 2013 through 2015 annual field surveys were conducted with the support of the Association of the German Chambers of Commerce and Industry – DIHK[8]. The field surveys were executed using questionnaires with specific questions related to the ongoing changes in the energy economics and the resulting effects to the enterprises. More than 2,100 answered questionnaires were received and analysed for each year (Table 13).

Table 13 Questionnaires overview
Source: by author

country		Germany			Romania
year		2013	2014	2015	2013
sample size [n]		2,394	2,193	2,174	103
shares		100%	100%	100%	100%
	industry	40%	42%	42%	64%
	construction	4%	4%	4%	8%
	service	17%	16%	15%	18%
	trade	39%	38%	39%	10%

In a next step, the data analysed in 2013 and 2014 was compared in order to identify potential trend developments. Selected elements and key findings from 2013/2104 were evaluated also in 2015. In addition in 2015 also new questions were

[8] DIHK: Deutscher Industrie- und Handelskammertag (DIHK, 2014), represents a total of eighty Chambers of Commerce and Industry in Germany and covers hereby for more than three million entrepreneurs in companies of all sizes in Germany.

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4_6

added in order to reflect the actual political and economic situation. The surveys were conducted in June of each year in Germany (Weber, 2015). A second field survey was performed in 2013 with the support of the German-Romanian Chamber of Commerce and Industry (CCI), Bucharest, contacting Romanian enterprises. The objective was to collect data, comparable to the set of data received from the enterprises in Germany.

This data was to be evaluated and compared in order to find out whether enterprises in Romania and Germany assess changes to the energy system / energy economics differently. For that reason, this questionnaire contained the same questions as being used in the German survey. Due to the lower number of member companies of the CCI in Romania, 103 usable questionnaires were received.

In a next step, the feedback from the German and the Romanian enterprises were compared (Table 13). The comparison of the feedback of Romanian and German enterprises was especially interesting, as the companies in both countries face different business environment & frames. In addition both countries have to manage different challenges of their energy systems.

Nonetheless, both countries are member states of the European Union and therefore underlie the same legislation background.

5.2. Objectives and research methodology

The literature offers a variety of techniques for the data evaluation[9], distinguishing qualitative or quantitative research elements. For the presented research the quantitative methodology (Koch, 2012) was used, analysing the collected data using the methodology of the one dimensional frequency scale. The objective was to identify the focus areas, the enterprises identified as important elements coping with the changes in the energy economics (Table 14; Weber, 2015).

The feedbacks received through the questionnaires were evaluated and rated on a four point Likert Scale (Christof et al., 1999) ranging from don't know (1) to increased (4) (Weber, 2015). The determined frequencies usually are visualized through bar diagrams, frequency polygons, pillar diagrams or circle diagrams (Herrmann et al., 2000).

[9]Koch, 2012; Herrmann et al., 2000; Olbrich et al., 2012; Christof et al., 1999; Grunwald et al., 2012; Altobelli at al., 2011; Homburg et al., 2009; Wöhe, 1986; Kotler, 1982

Table 14 Overview descriptive analysis methods
Source: by author based on Christof and Pepels (1999) and Herrmann and Homburg (2000)

	uni-variate data analysis	bi-varaite data analysis	multi-varaite data analysis
frequency analysis	- localisation parameter - dispersion parameter - form parameter - concentration parameter		
dependency analysis		- contingency analysis - regression analysis	- varaiance analysis - discriminant analysis - contrast group analysis - conjoint measurement
correlation analysis		- correlation analysis - coefficient of determin	- factor analysis - cluster analysis - multidimensional analysis - causal analysis

For this research the relative frequencies [p_i] of the selected elements and their related subcategories were calculated on basis of the absolute frequencies [n_i] and the sample size [n]. This calculation was performed following the context of

$$\mathbf{p_i = n_i / n}$$

and transferred into visual bar diagrams for interpretation (Weber et al., 2015a).

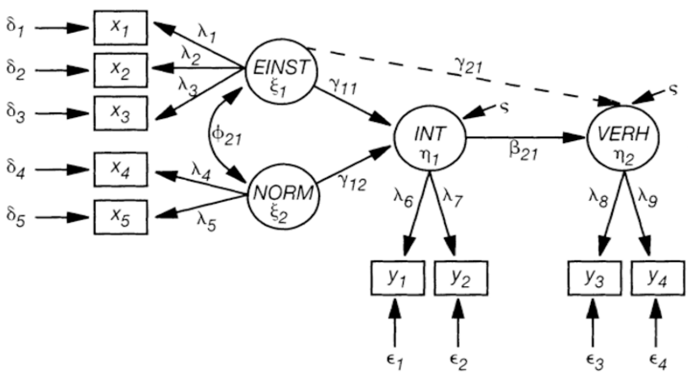


Figure 105: Example of a causal model graph
Source: *** Gabler (2014)

In a next step, correlations were analysed, in order to identify correlations of the single elements researched in the questionnaires. These were proofed using causal relations and verifications (Weber, 2015). Causal models represent the correlation respectively the assumptions of cause-and-effect chains. Usually they are illustrated using graphs visualizing the causal as outlined in Figure 105.

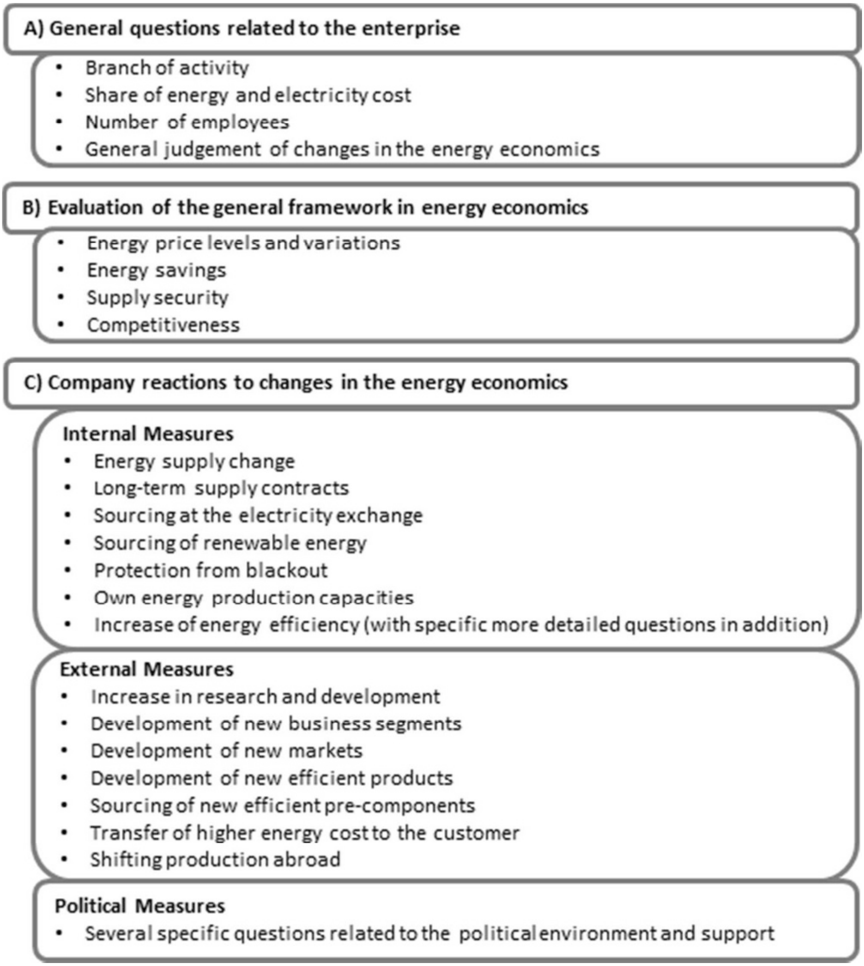


Figure 106: Logic of the questionnaires
Source: by author

The logic of the questionnaires

For both countries and all evaluated years, the questionnaires used were structured according to the same, comparable, principle logic. The (A)-section of the questionnaires asked for general data of the enterprises, hence clusters on branch, size etc. could be developed. The (B)-section was designed to have the interviewees assess selected items on the general framework of the energy economics affecting their business and competitiveness.

Finally section (C) was designed in order to investigate in measures and activities, the enterprises are planning or using in order to counteract the changes coming from a changing energy economics environment. Several of these elements (marked with * in Figure 106) were further detailed in sub sections. In addition, the questionnaires asked to vote on the appreciation of selected political measures (Weber, 2015; Weber et al., 2014; 2014a; 2015).

For 2014 and 2015 new questions were added in order to reflect the constantly changing political, legal and economic framework of the energy system in Germany. Those questions, i.e. related to energy audits (sector: energy efficiency) were separately analysed and evaluated.

The research instrument's background

The data collected was analysed and evaluated in three blocks:

- German and Romanian enterprises in 2013
- Trend investigation of selected sections in German enterprises 2013 -2015
- Correlations between the selected sections within Germany as well as between the two investigated countries

The data was analysed using constantly the same clustering model, exemplarily explained below using block "German enterprises 2013 versus 2014" (Figure 107): (Weber, 2015)

- 2013 companies in general;
- 2013 companies clustered according to their size;
- 2013 companies clustered according to their branch;
- 2014 companies in general;
- 2014 companies clustered according to their size;
- 2014 companies clustered according to their branch;
- Comparison between 2013 & 2014 companies in general;
- Comparison between 2013 & 2014 companies clustered according their size;
- Comparison between 2013 & 2014 companies clustered according to their branch.

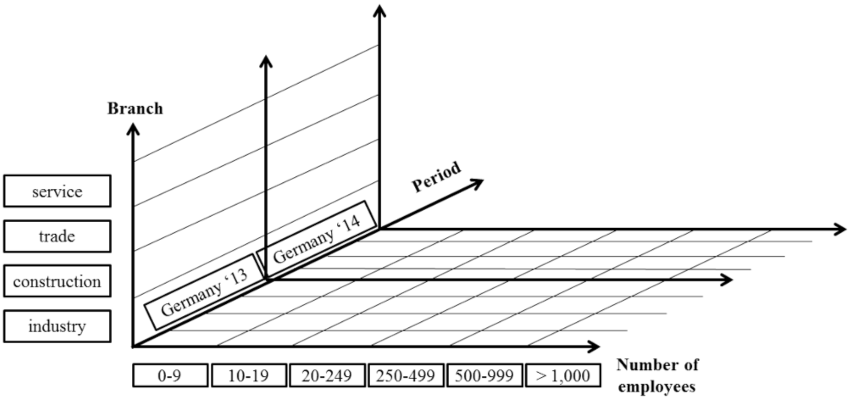


Figure 107: Three-dimensional clustering methodology
Source: by author based on his research

For the analysis of the remaining blocks, following adaptations were introduced in order to reflect the changes focus of the evaluation group:

- Block "German and Romanian enterprises in 2013"
  - The z-axle (period) was replaced by country
  - Item "Germany "14" was replaced by Romania
- Block "Trend investigation of selected sections in German enterprises 2013, 2014 and 2015"
  - Item "Germany "15" was added to the z-axle (period)

5.3. Research results of opinions of selected German enterprises regarding the evolution of the energy sector

All in all, three waves of questionnaires were performed with German enterprises in the years 2013, 2014 and 2015. The data collection and analysis followed the same principles as in the previous waves in order to ensure data comparability (Figure 108). Based on the analysis of three consecutive years with similar sample sizes (2013: n=2,394 / 2014: n = 2,193 / 2015: n= 2,174) first indications for potential trends could eventually be visible.

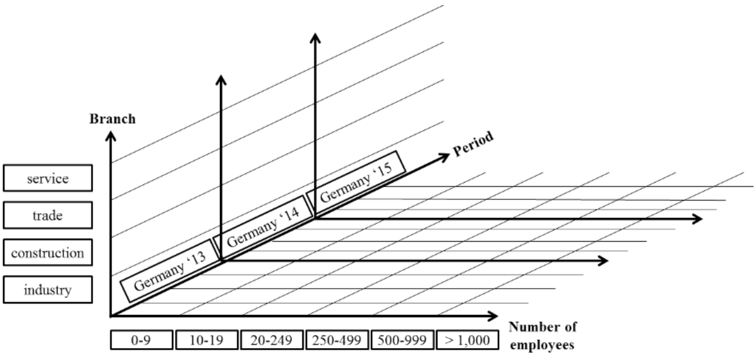


Figure 108: Three-dimensional clustering methodology
Source: by author based on his research

5. 3. 1. General data

A first analysis of the questionnaires referred to the share of branches of the responding enterprises in the researched years (Figure 109). In all three years of the project, the industry and service sectors dominated with around 40% each the numbers returned questionnaires, followed by trade with around 15% and construction with around a 4% share. There were no significant changes between the years found. The minor increase at the industry sector was reflected in a loss of the trade sector.

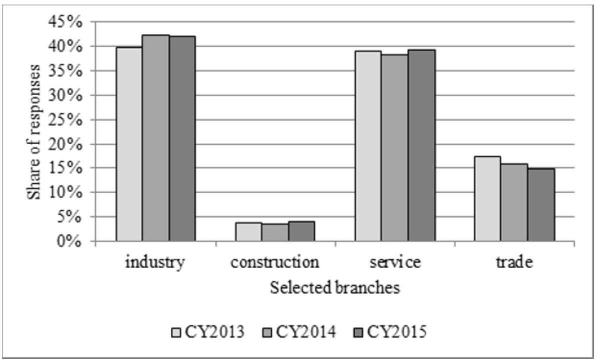


Figure 109: Membership of the respondent enterprises in Germany to selected branches
Source: by author based on his research

In terms of company sizes, in all three years, enterprises with 20-249 employees dominated with around 45% the scene. Adding the smaller company sizes the

SME sector shows an average of around 70% of the participating companies (Figure 110).

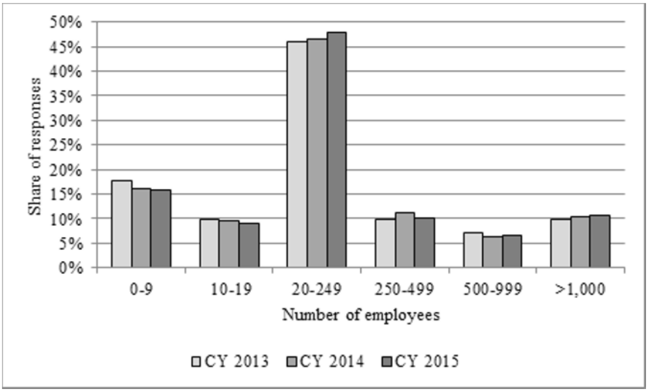


Figure 110: Share of the respondent enterprises in Germany according to the number of employees
Source: by author based on his research

5. 3. 2. Impacts of energy price factors and challenges in the field of energy to the enterprises

The share of the energy cost on the overall turnover (Figure 111) was almost equally spread in the given ranges (0-2%, 2-4%, 4-14%), whereas the group of >14% was only around one third compared to the other 3 groups.

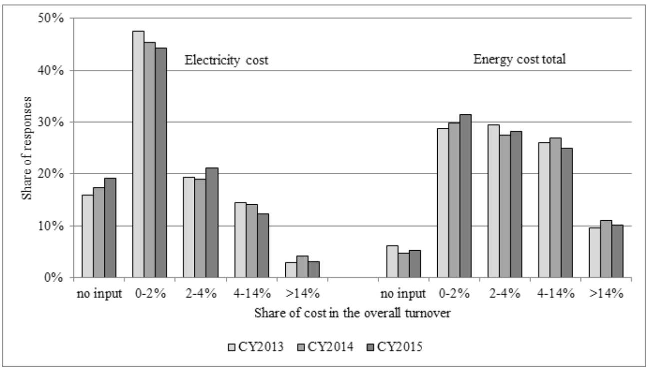


Figure 111: Share of energy costs in general, as well as the electricity costs in the overall turnover of the respondent enterprises
Source: by author based on his research

There was no significant difference between the evaluated years that could not be identified (Weber, 2015).

Whereas the share of electricity cost on the overall turnover however shows a strong focus around 46% in the 0-2% range, the shares of the remaining groups were mainly in the same range between 14% and 19% (Figure 111). Also here no significant changes during the evaluated years could be found, with the exception of a slight increase on the importance of the electricity cost from 2014 to 2015.

In order to go further into detail, the importance of the development of the following factors during the last twelve months was analysed:

- The financial amount of electricity prices;
- The financial amount of energy prices;
- The variation of the energy prices;
- The energy savings;
- Interruptions in the electricity supply;
- Interruptions in the gas supply;
- Concrete problems with the supply security;
- The amount of financial impact in case of production disturbance.

Completing the analysis, the interviewees were asked to judge the consequences of changes in the energy system and economics to the competitiveness of their enterprises (Weber, 2015).

The importance of the financial amount of electricity and energy prices

From 2013 to 2014 the importance of the electricity price reduced slightly.

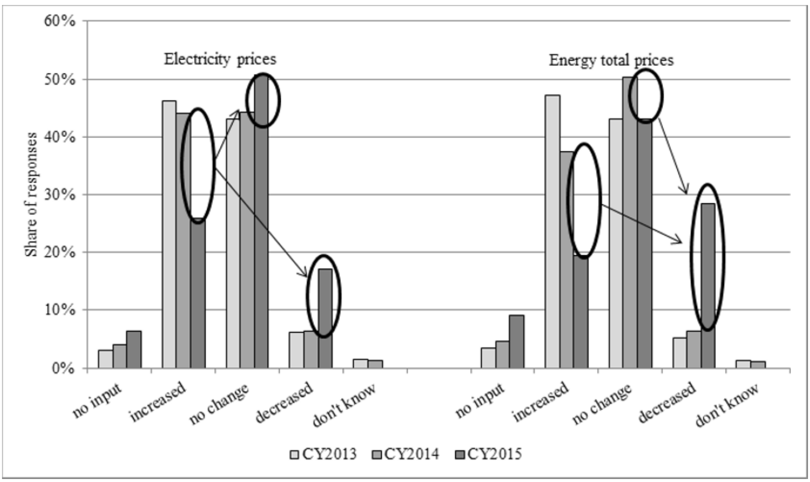


Figure 112: The importance of the electricity and total energy prices for the respondent enterprises
Source: by author based on his research

From 2014 to 2015 however a string shift towards an "unchanged" and "decreased" importance could be observed.

In the case of the overall energy price levels (electricity and gas combined), this trend was even stronger (Figure 112). Analysing the details, the observed effects showed to be almost similar in the evaluated branches; there was also no difference comparing the enterprises by the number of employees. However, the amount of energy prices still is a very important factor for German enterprises (Weber, 2015).

The importance of the variation of energy prices to enterprises

The importance of variations in the energy prices increased from 2013 to 2014, which was a consequence of strongly increasing energy prices during that period along with a strong public debate on further increases to be expected. In addition the level of uncertainness increased significantly from 2.4% (2013) to 10.7% in 2014. This is resulting from the low level of planning security and high level of political uncertainty before the German elections in fall 2014 (Weber, 2015).

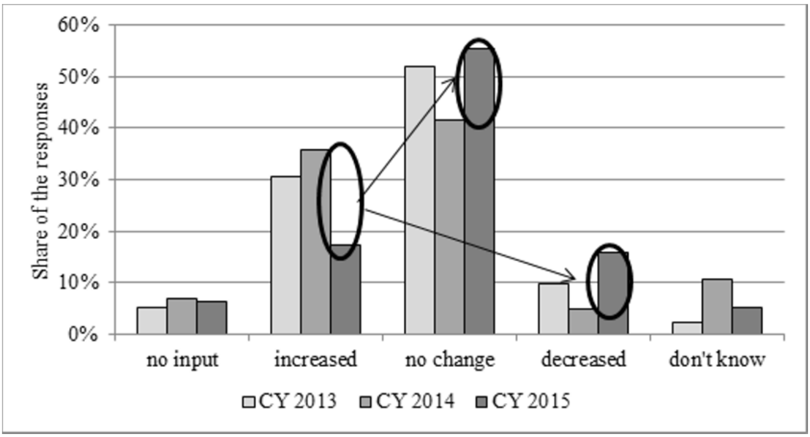


Figure 113: Trends of the importance of variations in energy prizes 2013-2015
Source: by author based on his research

From 2014 to 2015 this share was cut by around 50%, resulting also from the fact the price increase discussions levelled-out somewhat. Some of the "changers" rated this element now unchanged or rated its importance decreased (Figure 113). This phenomenon can be explained by the fact the enterprises already were sensitized and "used to" increasing energy prizes hence correlation strategies were already in place.

The importance of energy savings to enterprises

This interpretation regarding variations in energy prizes is being supported by the changes reported for the importance of energy savings. The importance of energy savings decreased from 2014 to 2015 by about the same level as the rating of the importance of the variations of energy prizes, which was also here covered by increased values in “no change” and “decreased” importance (Figure 114).

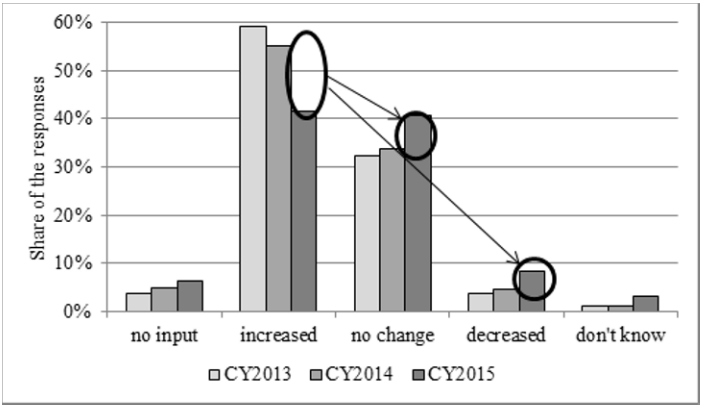


Figure 114: Trends of the importance of energy savings 2013-2015
Source: by author based on his research

From 2013 to 2014 the trend developed towards a decrease, which could be explained as one effect of an already executed high level of energy efficiency measures from the prior years and also driven by the energy efficiency regulations.

Already prior to 2013, enterprises using energy management systems and certified according to DIN EN ISO 50001 industry norm are entitled for back payments of energy and electricity tax from the government, if energy efficiency measures were executed (Weber, 2015).

However, with an around 85% average over the 3 year period it can be said, that energy savings have a very high importance to the entrepreneurs in Germany.

The importance of interruptions in electricity and gas supply to enterprises

Interruptions of the electricity supply were rated mostly “no change during the last 12 months” in both years, showing a slight trend towards a decreased importance from 2013 towards 2015 indicated by the arrows in Figure 115.

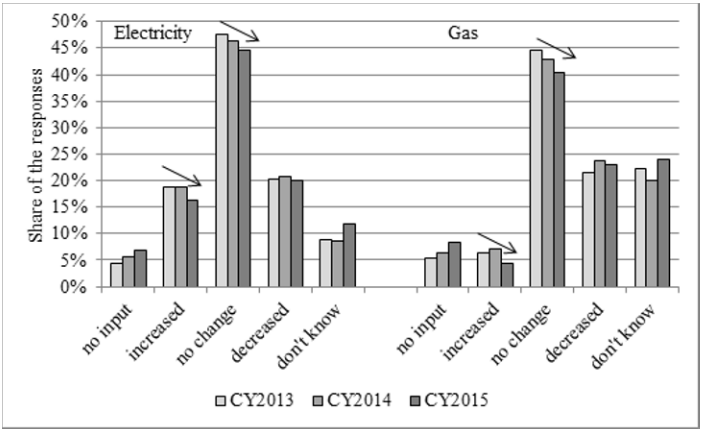


Figure 115: Trends of the importance of interruptions in electricity and gas supply for the enterprises
Source: by author based on his research

In the case of electricity however, the importance of supply interruptions were rated slightly higher than interruptions in the gas supply. This might be resulting from the fact, that the changes in the German energy system mainly concern electricity, whereas the gas supply is mainly untouched so far (Weber, 2015).

Concrete problems with the supply security and the resulting financial loss

In all three years, the respondents reported with around 60% a very strong level of "no concrete problems" with the supply security independent from the branch or size of the company (Figure 116).

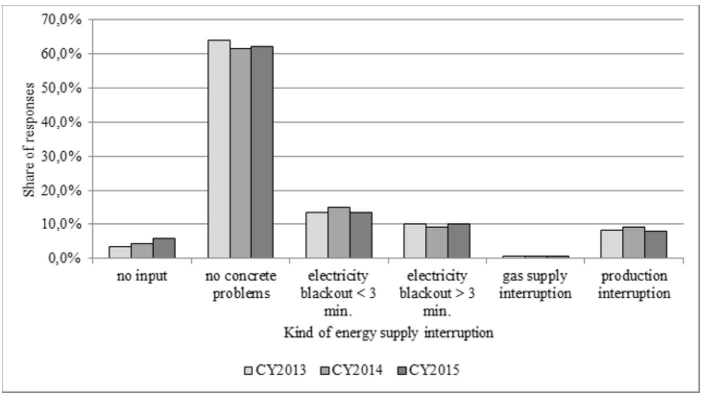


Figure 116: Concrete problems with the supply security in the surveyed enterprises
Source: by author based on his research

Whereas the number of "electricity blackouts longer than three minute" slightly decreased in 2014 and came back to the 2013 level in 2015, a minimal higher number of "electricity blackouts shorter than three minutes" was reported in 2013, increasing in 2014 and coming back to the 2013 levels again by 2015 (Weber, 2015).

The quantity of production interruptions increased somewhat from 8.3% (2013) to 9.1% in 2014 and came back to the 2013 levels in 2015. This might be an effect following the fore mentioned changing numbers of electricity blackouts.

In all three years, a constant negligible level of interruptions was shown in the gas supply (Figure 116).

5. 3. 3. Effects to the enterprises' energy efficiency activities and business development

The importance of R&D, new business and new market development to enterprises

The next factors which were investigated related to the importance of the factors "Research and Development (R&D)", new business development and new market development.

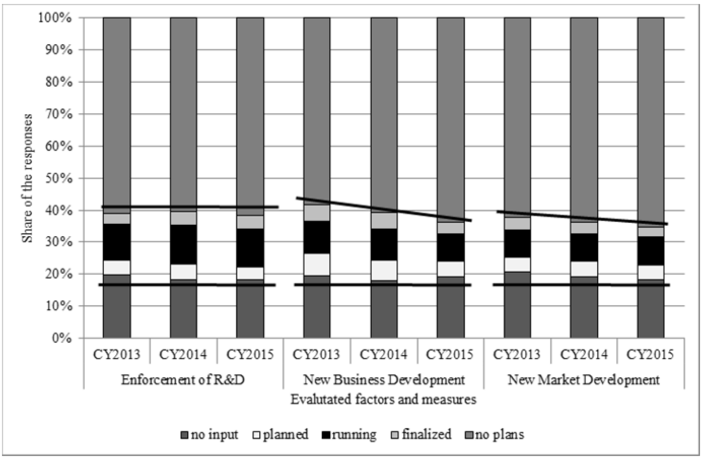


Figure 117: The importance of R&D, new business and new market development
Source: by author based on his research

Comparing those, the levels of importance ranged around 20% summing up planned, running and finalized measures. In the case of the latter ones, a slight decreasing trend from 2013 to 2015 could be observed as indicated by the black lined marks in Figure 117.

The importance of energy efficient services/products and sourcing energy efficient pre-products to enterprises

Comparing the importance of the factors "focus on energy efficient services & products" and "sourcing of energy efficient pre-products" showed also constantly stabile level throughout all three investigated year, here at around 30% indicated by the lines in Figure 118.

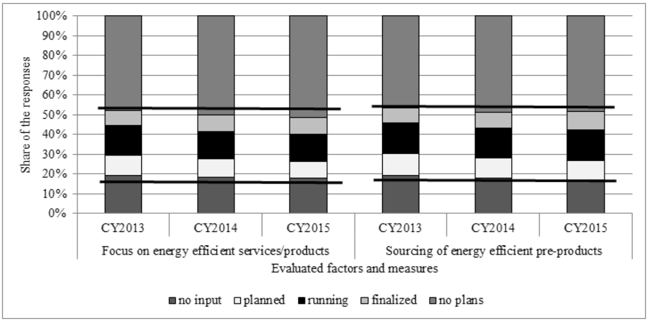


Figure 118: The importance of energy efficient services/products and sourcing energy efficient pre-products Source: by author based on his research

The importance of shifting energy cost to customers and production abroad to enterprises

The importance of "shifting of energy cost to the customer" however was with around 45% in 2013 much higher rated that the factors investigated beforehand.

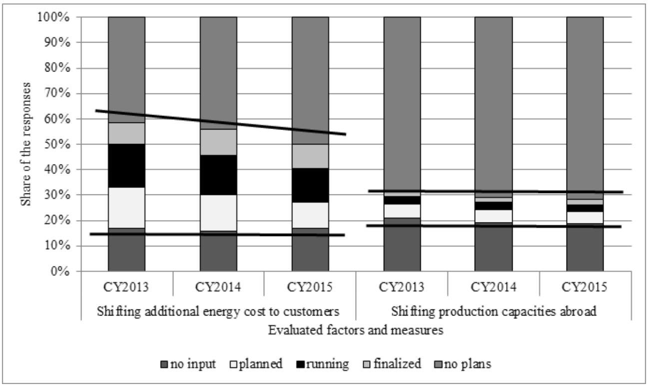


Figure 119: The importance of shifting energy cost to customers and production abroad
Source: by author based on his research

The trend to 2015 is declining by about 10%, as visualized in Figure 119. The importance of “shifting production capacities to abroad” was with around 10% not as significant. A slight reduction could here be observed from 2013 towards 2015 (Figure 119).

The importance of sourcing energy at the energy exchange, of supplier change and of long-term supply contracts to enterprises

Around 50% the interviewees reported an “energy supplier change” to be a valid internal option to react to the changes in the energy economics. The second option “shifting towards long-term energy supply contracts” was rated the same way.

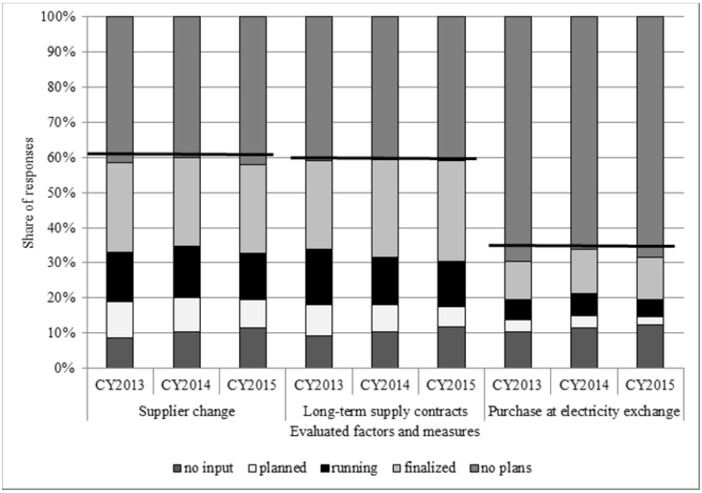


Figure 120: Rating of supplier change, long-term supply contracts, purchasing at electricity exchange
Source: by author based on his research

As seen before within the “supplier change” section, no noteworthy changes could be observed from 2013 to 2015, as indicated by the lines in Figure 120.

Differently, the third option “purchasing at the electricity exchange” shows with around 20% (combining planned, running and finalized measures) a much lower level of importance to the enterprises. The second difference to the other two measures is the level of “no plans” which is with around 70% much bigger than the observed 40% in the other cases (Figure 120). Consequently purchasing electricity at the stock exchange is not a favoured measure for the enterprises. Trend wise, as before, no drastically change from 2013 to 2015 could be observed. The trend of consistency observed at the fore mentioned measures cloud also here be confirmed.

Looking deeper into the feedbacks by the size of the enterprises (

Table 15) it can generally be observed that smaller companies are much more reluctant to “purchase at the electricity exchange” compared with large enterprises, of which around 40-60% consider purchasing electricity at the electricity exchange a valid option. This effect is explainable, as sourcing at the electricity exchange goes along with certain requirements that need to be met (for example: a minimum unit of trading volume is required) jointly with an administration effort that needs to be handled. Smaller companies usually do not have an electricity consumption which would justify the administrative and financial effort, nor could they cope with the administrative requirements (Weber et al., 2015a). The trend from 2013 to 2015, indicated with the up- or downswing arrows in Table 15 does not show any major changes, except for enterprises with 500-999 employees which indicated an importance increase by almost 11% from 2014 to 2015.

Table 15 Share of companies with "no plans" to purchase from electricity exchange
Source: by author based on his research, ref. to Weber at al. (2015a)

Number of employees	0-9	10-19	20-249	250-499	500-999	>1,000
Calendar year 2013	83.0%	83.8%	72.4%	59.1%	51.5%	41.1%
Calendar Year 2014	84.7%	76.4%	67.3%	61.5%	48.6%	39.3%
Calendar Year 2015	81.4%	78.7%	71.7%	62.0%	59.3%	39.1%
Delta (2014./.2013)	1.7% ↘	-7.3% ↗	-5.1% ↗	2.5% ↗	-2.9% ↗	-1.7% ↘
Delta (2015./.2014)	-3.3%	2.3%	4.4%	0.5%	10.7%	-0.2%

Explanation: ↘ : reduced numer of "no plans" ↗ : increased number od "no plans"

The importance of sourcing renewable energy and setting up capacities to enterprises

“Sourcing of renewable energy” is for around 30% of the enterprises a measure either “planned”, “running” or already “implemented”. A notable difference between the three years analysed could not be identified. Only minor changes could be observed, which were mainly caused by project status changing from “running” to “implemented”,. This in addition caused a reduction of the number of “planned” projects slightly (Weber et al., 2015a).

For several respondents investing in the “installation of power production capacities” is a valid measure in their endeavours to reduce their dependency from energy imports. Comparing the two right sections in Figure 121 indicated that “renewable power sources” with around 30% hereby double share for “fossil sources and technologies”. As observed beforehand, no notable changes between the three observed years could be identified (Weber et al., 2015a).

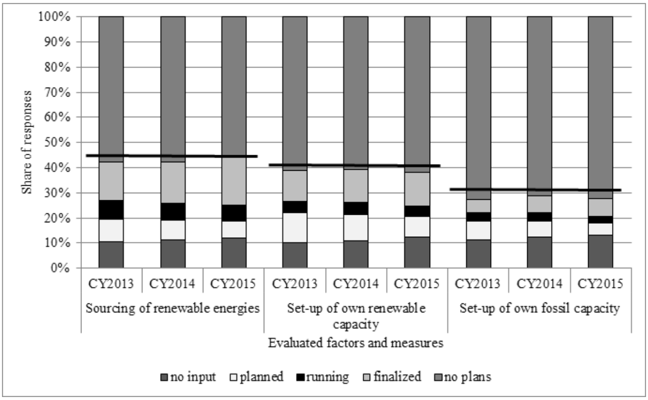


Figure 121: Rating of Sourcing of renewable energies, set-up of own renewable & fossil production capacity
Source: by author based on his research

The importance of blackouts and energy efficiency to enterprises

Blackouts seem not to be an issue for the respondent enterprises. With a consistent level of around 40% in all three investigated years. Hereby the shares of "planned", "running" or "implemented" activities also are stabile (Figure 122) (Weber et al., 2015a).

This goes along with the feedback regarding the importance of "interruptions in the electricity supply" in German enterprises which was rated around 18% in 2013 with a slightly decreasing trend towards 2015.

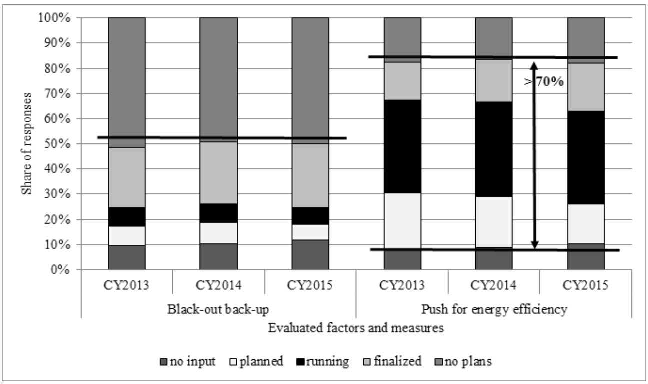


Figure 122: Rating of blackout back-up & push for energy efficiency
Source: by author based on his research

Whereas the area “black-out backup” had a with 50% a relatively high level of “no plans”, measures for “*energy efficiency*” seem with around 70% to obtain a much higher and unchanged popularity as indicated with the arrow in Figure 122. Most of the measures still are in the execution phase (“running”), with the share of implemented measures (“finalized”) being slowly increasing.

The importance of specific measures in terms of energy efficiency to enterprises

As seen before, measures in energy efficiency experience with 70% the highest levels of importance from all evaluated measures and activities in enterprise’s strategies to counteract changes in the energy economic system. The consistent decrease of planned measures over the three years is resulting from the fact that measures in about the same amounts changed status from planned to be implemented (Figure 122).

Focusing now in more detail on energy efficiency measures and activities, the respondents were now asked to rate the individual energy efficiency activities being on focus (Weber et al., 2015a).

Consequently, the interviewees were asked to comment the following options:

- Employee information / awareness raising / training
- Investments into new efficiency technologies
- Efficiency measures in service processes and / or buildings
- Introduction of an energy management system (EnMS)
- Load management
- Involvement of external service providers
- Participation in networks / energy efficiency round tables
- Newly added as of 2014: implementation of energy audits

The interesting question was now to find out which measures and activities the enterprises reported to be mostly used. As Figure 123 indicates, the importance of several measures did not really change since 2013. As such the employee training is with around 20% still the mostly mentioned activity. With 15% on place two, the implementation of new energy efficient technologies is also almost unchanged. Load management, external consultants and the engagement in energy efficiency networks also have not changed in significance.

Changes however can be recognized in the sections of process improvements, energy management systems and energy audits. As most process improvements were implemented in the outer years already, a natural drop by 7% from 2014 and 2015 is explainable. Also the increase in energy management systems from 2014 to 2015 is logic in the consequence of the transformation of the EU energy efficiency directive in to national law in April 2015, forcing enterprises to either perform an energy audit or alternatively install an energy or environment management system. In the case of the energy audits (on the questionnaires as of 2014), a reduction by almost 2% was discovered. With the earlier explanation of the energy efficiency law, a drop in this sector seems not logical at first.

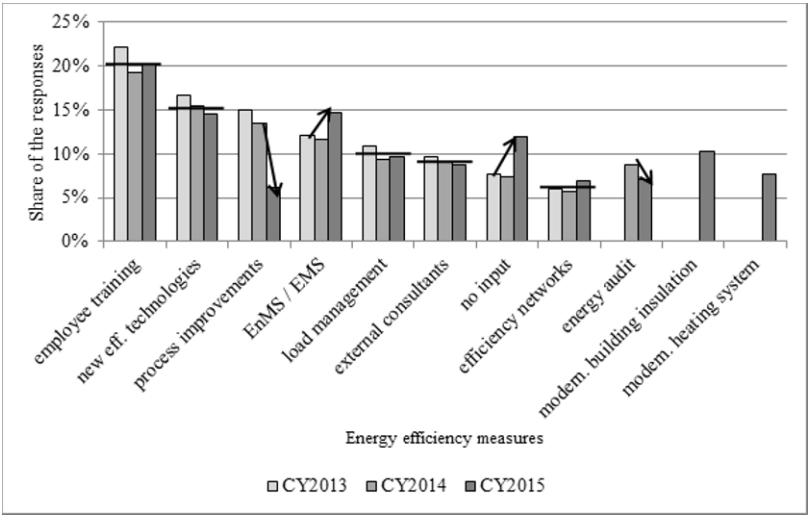


Figure 123: Trends of selected energy efficiency measures 2013-2015
Source: by author based on his research

However, as mentioned earlier, the majority of enterprises resending the questionnaires are SMEs. For SMEs the energy audits are not mandated by law but voluntarily. Knowing that, this reduction is explainable by a lower motivation of SMEs to perform energy audits, even they are subsidized. This reduction was realized also by the authorities by analysing the number of applications for energy audit subsidies (*** BAFA, 2016).

In addition, the interviewees were asked during 2013 and 2014 to specify the amount of "investments into new efficiency technologies" using given ranges of (Figure 124) (in 2015 this question as was replaced by asking on the expected savings potential on energy consumption during the next five years (Figure 127)):

- up to 10,000 Euro
- 10,000 to 50,000 Euro
- 50,000 to 100,000 Euro
- 100,000 Euro and above

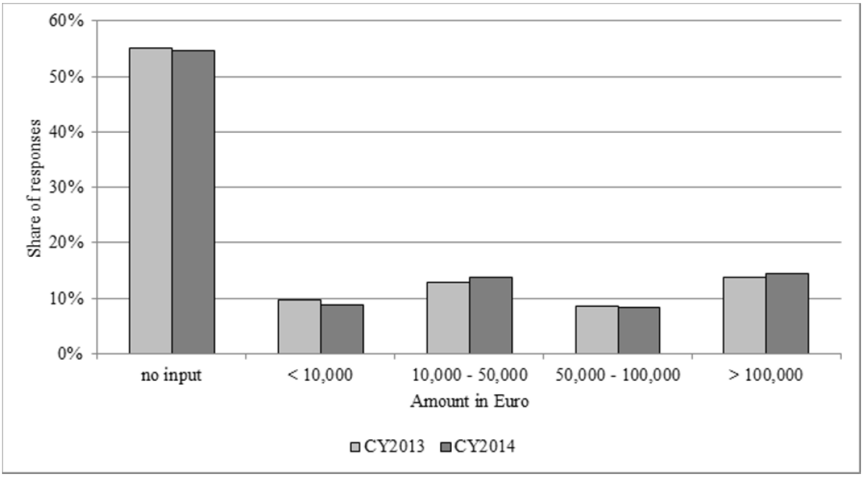


Figure 124: Amount level in case of investment into new efficiency technologies
Source: by author based on his research, ref. to Weber et al. (2015a)

Expectedly, as financials mostly being perceived as a confidential item, the feedback rate of “no input” at around 55% is compared to the other feedbacks relatively high. Such a high level of uncertainty does not allow for conclusions without risking potential misinterpretation. However, looking at the data received, the changes comparing the years 2013 and 2014 are following the trend experienced with the other questions so far: only minor changes (Weber et al., 2015a).

5. 3. 4. Enterprises’ general judgement of changing energy economics

General judgement of the energy transition

Generally the entrepreneurs judged the changes in the energy economics in Germany in 2015 more positive compared to 2014 and 2013. This effect is explainable by the fact that the transition is known meanwhile for some time and the entrepreneurs got “used” to it, it was not anymore the unknown with all its uncertainties. However, even there was shift from negative to neutral perception, the negative sector still is with 21% double as large as the positive sector in 2015 (Figure 125).

This still dominating uncertainty finds its explanation in the answers to the question which political measures the entrepreneurs would recommend for a more secure, more fundable and more environment focused energy transition. Lacking political coordination of the different activities (circle in Figure 126) turns out to be one of the mostly named measures of the entrepreneurial wish list, right after grid expansion and requests to reduce taxes and fees on the energy prices.

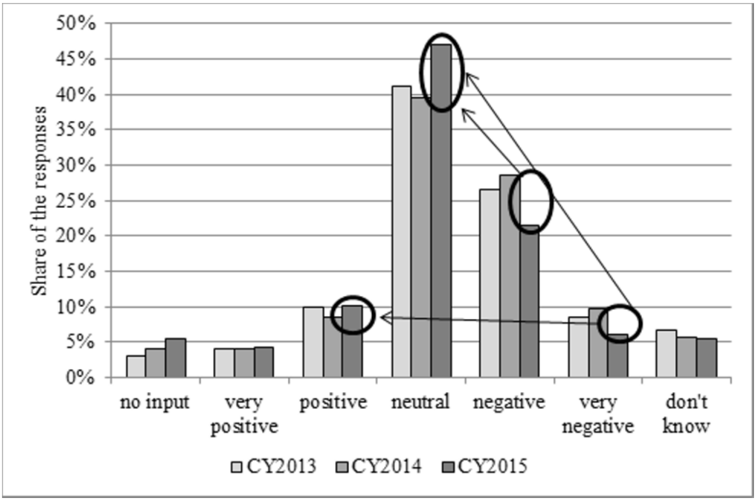


Figure 125: Trend of the general judgement of the German energy transition 2013-2015
Source: by author based on his research

In general there is a trend of increase from 2014 to 2015 in almost all the measures listed. This fact can be interpreted, that around three years after the federal elections the German entrepreneurs missed in 2014, especially in 2015 the expected corrective actions in these fields, wherefore they expressed their disenchantment with politics, their dissatisfaction with the way politics is managing the energy transition in Germany.

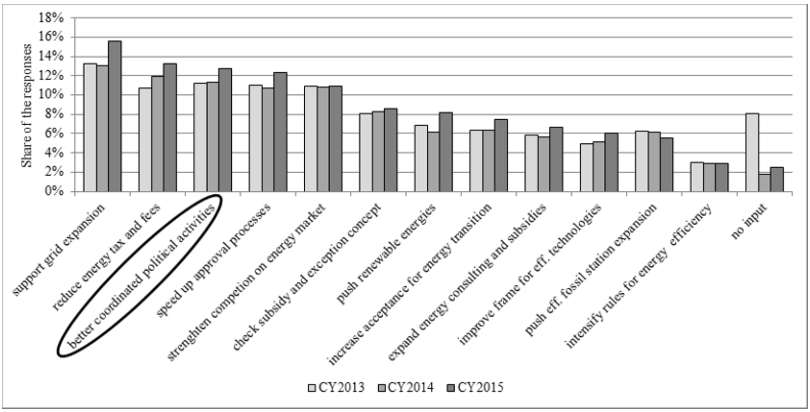


Figure 126: Trend of political measures to improve the energy transition in Germany "wish-listed" by entrepreneurs in Germany 2013-2015
Source: by author based on his research

Savings potential on energy consumption

Asked about the savings potential on energy consumption, the majority (28%) specified a level of “2-5%” of their energy consumption (Figure 127), followed by the levels of “0-2%” and “5-10%”.

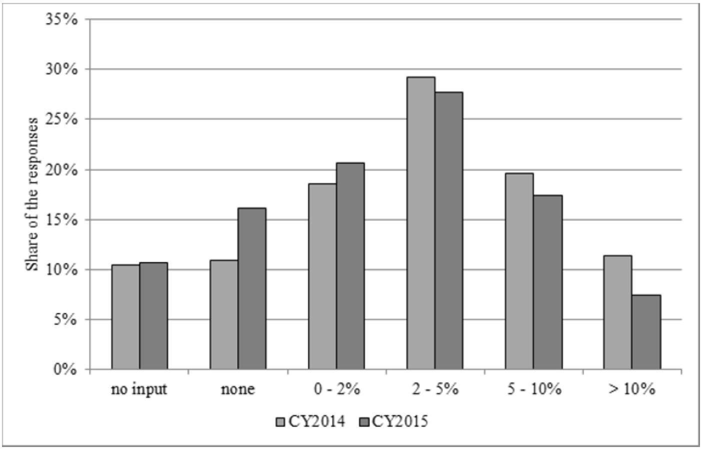


Figure 127: Savings potential on energy consumption during the next five years
Source: by author based on his research

The high level of “no savings expected results from the fact that many efficiency measures were already implemented compared to 2014. However, the majority of the German entrepreneurs (> 25%) still believe in a significant level of potential for energy savings (> 5%) even after implementing several efficiency measures (>7% of the interviewees even see a remaining potential for energy savings of >10% of their energy consumption).

Willingness to pay extra for certified green power

In order to investigate the “green factor”, a specific question was added to the questionnaires as of 2014. Being asked, how much extra they would be willing to pay for certified green regional/German power, the majority of the interviewees (60%) responded almost equally in both years with “none” (Figure 128). With 17% in 2015, the second largest group indicated a willingness to pay an extra of 2%. A surprising 2.5% of the interviewees indicated to be ready to pay an extra of more than 10% for certified green power.

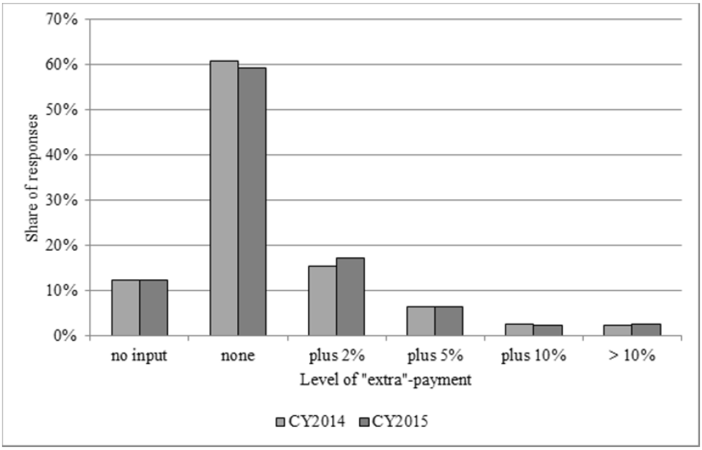


Figure 128: Willingness to pay extra for certified green regional/German power
Source: by author based on his research

5.4. Research results of opinions of selected Romanian enterprises regarding the evolution of the energy sector

For 2013, parallel to the research in Germany (GER), a second wave was performed in Romanian (RO) enterprises. The data collected through 2013 was analysed using the following methodology and clusters (Figure 129):

- German companies in general;
- German companies clustered according to their size;
- German companies clustered by branch;
- Romanian companies in general;
- Romanian companies clustered by size;
- Romanian companies clustered by branch;
- Comparison between German & Romanian companies in general;
- Comparison between German & Romanian companies clustered by size;
- Comparison between German & Romanian companies clustered by branch.

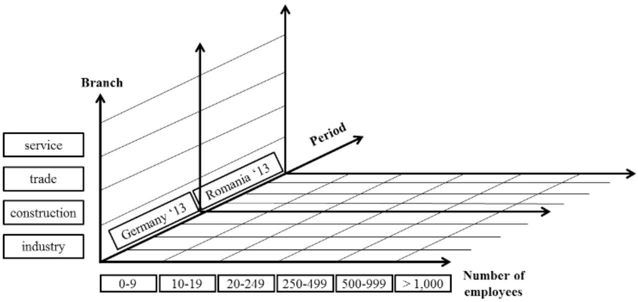


Figure 129: Three-dimensional clustering methodology
Source: by author based on his research

5. 4. 1. General data

A first analysis of the questionnaires referred to the mixture of branches of the participating companies in both countries (Figure 130), which are industry, construction, trade and service.

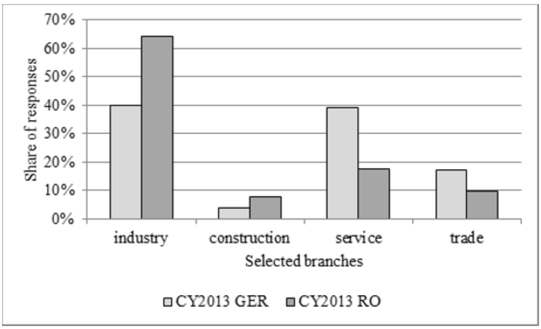


Figure 130: Membership of the respondent enterprises in Germany and Romania to selected branches
Source: by author based on his research

In Romania the company branch mix shows a strong share of industry (64.1%), followed by service (17.9%). In Germany, industry and service where also the branches represented the most, however here having almost equal shares (39.8% Industry and 39.1% Service) without a clear focus on one of the branches.

Generally it could be observed that the level of “no received input” from the Romanian companies was for all questions higher as the German inputs, in average 19.5% for Germany and 32% in the case of Romania. The only exception could be identified for new business development activities. The German feedback rate was here with 19.5% exactly average; however, only 8% of the Romanian respondents did not provide feedback, which is exceptionally low.

Also part of the first analysis was the share of the number of employees of the companies. As Figure 131 illustrates, SMEs in Germany are represented by 73.5% of the participating companies, with a size of 20-249 employees with a share of 45.9% being the strongest group. In Romania, with 28.2% the majority of the responding companies employees more than 1,000 people, followed by the SMEs with 37.9%.

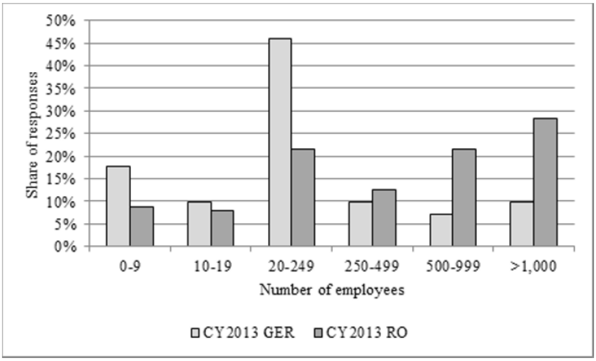


Figure 131: Share of the respondent enterprises in Germany and Romania according to the number of employees
Source: by author based on his research

5. 4. 2. Impacts of energy price factors and challenges in the field of energy to the enterprises

Whereas the share of the energy cost on the overall turnover (Figure 132) was equally spread in the given ranges (0-2%, 2-4%, 4-14%), Romanian enterprises had with a 24.3% share also a strong representation in the cluster of more than 14% resulting mainly from the industry and service sectors.

The share of electricity cost on the overall turnover show for the German companies a strong focus in the 0-2% range (47.6%), whereas in Romania the ranges of 0-2% (35.9%) and 4 - 14% (28.2%) are dominating (Figure 132).

From the findings made so far a first statement can be drawn: companies in Romania have a higher share of energy as well as electricity cost on their overall turnover compared to German companies.

In order to further investigate the background of this statement, the importance of the development of the following factors during the last twelve months was analysed:

- The amount of electricity prices;
- The amount of energy prices;
- The variation of the energy prices;
- The energy savings;
- Interruptions in the electricity supply;
- Interruptions in the gas supply;
- Concrete problems with the supply security;
- The amount of financial impact in case of production disturbance.

In order to complete the analysis, the companies were asked to judge the impact of the changes in the energy system and economics on their competitiveness.

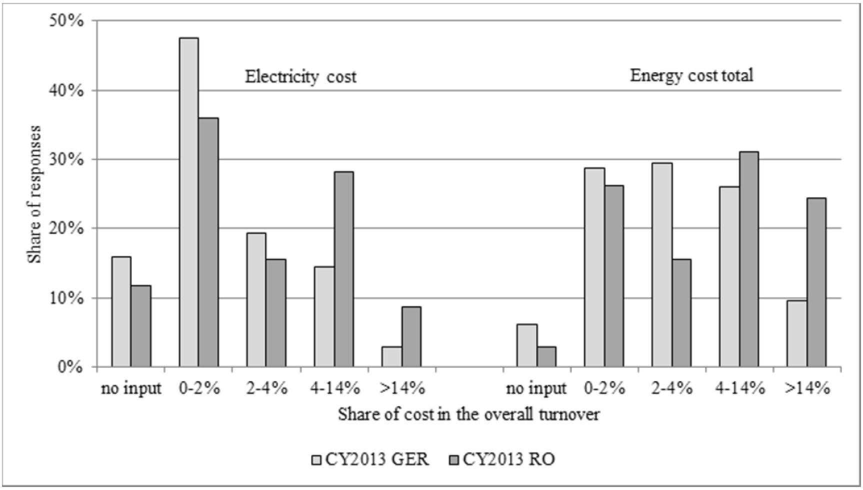


Figure 132: Share of energy costs in general, as well as the electricity costs in the overall turnover of the respondent enterprises
Source: by author based on his research

The importance of the financial amount of electricity and energy prices

In both countries the importance of the electricity price increased, in Germany more as in Romania, which can be explained through the earlier explored higher level of energy prices in Germany (Figure 133). This trend was discovered independently from the branch or number of employees of the companies. For the energy total prices (electricity and gas) this trend was in both countries slightly stronger developed as for the electricity prices only (see right section of Figure 133).

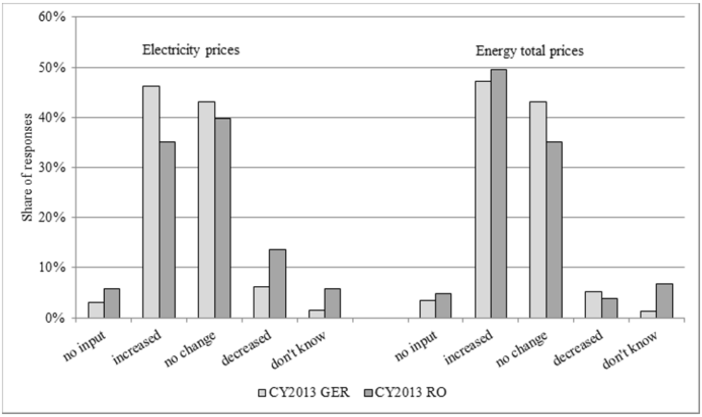


Figure 133: The importance of the electricity and total energy prices for the respondent enterprises in Germany and Romania
Source: by author based on his research

The importance of variations of energy prices to enterprises

The next evaluated item was the importance of the variation of energy prices.

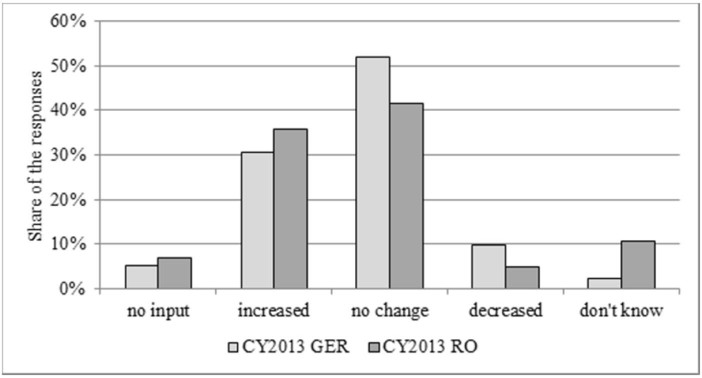


Figure 134: The importance of the variation of energy prices to the respondent enterprises in Germany and Romania
Source: by author based on his research

This factor basically reflects the development of the importance of the amounts of electricity and energy prices (Figure 134). This was to be expected due to the steadily increasing energy prices in both countries for electricity and gas.

The importance of energy savings to enterprises

During the last twelve months, the energy savings turned out to be more important in Germany (almost 60%) than in Romania (35.9%) (Figure 135). This also can be explained by the lower level of energy prices in Romania - lower energy prices reduce the importance of energy savings and efficiency measures.

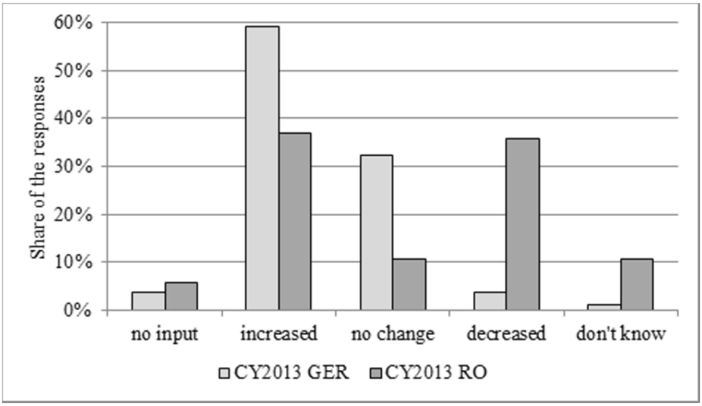


Figure 135: The importance of energy savings for the enterprises in Germany and Romania
Source: by author based on his research

In Germany's case, this trend is similar throughout the branches and is increasingly important for companies the more people they employ.

For Romania, energy savings are more important in branches such as industry, trade and service rather than construction, the size of the company does not play a significant role.

Comparing the companies with energy and electricity cost larger than 14% in the overall turnover, energy savings are more important in Germany than in Romania. One reason for the German motivation for energy efficiency measures is the energy efficiency regulation. Companies having implemented an energy management system according to ISO EN DIN 50001 are entitled for back payments of energy and electricity tax from the government, if energy efficiency measures were installed. In addition, the levels of energy prices are lower in Romania, which underlines a lower level of motivation for energy savings.

The importance of interruptions in electricity and gas supply to enterprises

Changes in the development of interruptions of the electricity supply were rated mostly "no change during the last 12 months" in both countries, with German enterprises rating 47.7% versus Romanian with 38.8%. For interruptions in the gas supply, more or less the same trend could be explored in both countries (Figure 136).

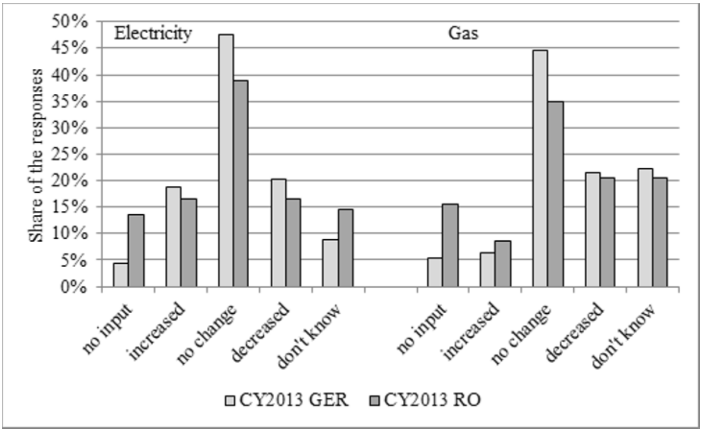


Figure 136: The importance of interruptions in electricity and gas supply for the respondent enterprises in Germany and Romania
Source: by author based on his research

Concrete problems with the supply security and the resulting financial loss

Independent from the branch or size of the company, the German respondents reported to have on average 76.5% no concrete problems with the energy supply security. However, in average 9.9% of the companies reported an interruption in the production process, most significantly in the industry with 17.9% (Figure 137).

In Romania, only 47.6% of the companies were without concrete problems. 35% electricity blackouts over three minutes were reported and in 27.2% of all cases, the production was disrupted. Comparing the four branches, the industry was the one affected the most with 37.5% of blackouts over three minutes and 29.7% of production interruptions.

These results drive to the assumption, that the electricity system in Germany is more stable comparing to the Romanian system.

Asked about the financial impact of the production interruptions, the majority of the companies did not make any statement; either, as the data was not available, or for competitiveness reasons.

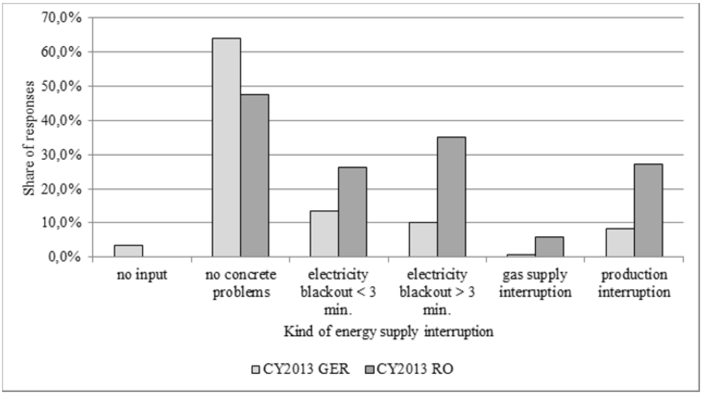


Figure 137: Concrete problems with the supply security in the surveyed enterprises in Germany and Romania
Source: by author based on his research

However, the reluctance to provide these data was 90.6% higher in Germany compared to 61.2% in Romania. Analysing the data gathered from the survey, the majority of companies reported a financial loss of up to 10,000 Euro (5.6% Germany, 20.4% Romania), followed by a loss between 10,000 and 100,000 Euro (3.3% Germany; 14.6% Romania).

However, due to the high rate of abstinence in providing an answer, this can only be an indication without a conclusion being possible.

5. 4. 3. Effects to the enterprises' energy efficiency activities and business development

The importance of R&D, new business & new market development to enterprises

R&D is with 29% a much more crucial element for Romanian enterprises than for German companies with 19% (Figure 138). The share of running and even installed measures with around 15% for R&D equals in both countries. In the case of new market development (average 13%) and new business development (average 16%) running and executed activities are also at comparable ratios for both countries. In all three cases, the Romanian enterprises reported a much higher rate of planned activities (9% – 12%) compared to the German companies (Weber et al., 2014a).

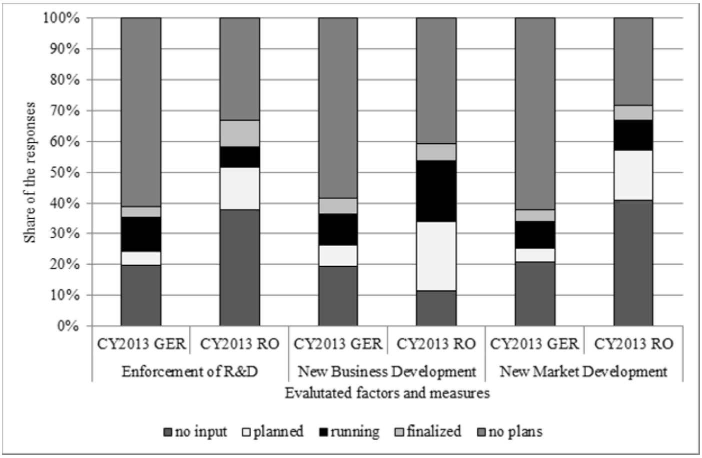


Figure 138: Measures on R&D, new business and market development
Source: by author based on his research

The importance of energy efficient services/products and sourcing energy efficient pre-products to enterprises

In case of energy efficient services/products and sourcing energy efficient pre-products (Figure 139), the respondents in both countries reported similar rates of planned, running and finalized activities (around 34%).

The only exception indicated the Romanian enterprises, which reported with 28% a comparatively high level of planned activities in the section of energy efficient services/products, getting this element to a share of 62% of activities, which nearly doubles the ratios in Germany (33%) (Weber et al., 2014a).

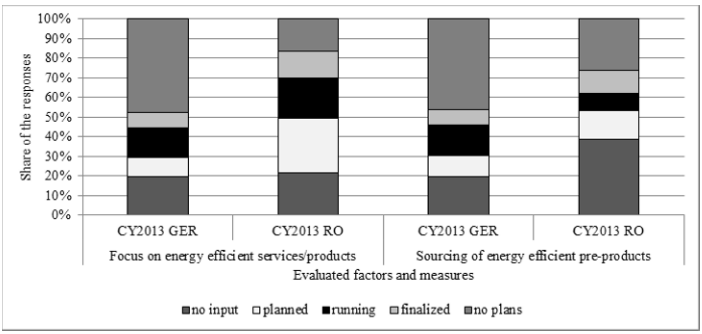


Figure 139: Measures on energy efficient services/products and sourcing of energy efficient pre-products
Source: by author based on his research

The importance of shifting energy cost to customers and production abroad to enterprises

With a 42 % ratio in Germany and 44% in Romania, the interviewees in both countries reported nearly equal levels of activities in shifting additional energy cost to customers, resulting in a more expensive, uncompetitive services/product (Figure 140). While this process is almost finished in Romania, the majority of activities in Germany were shown in an earlier stage - either planned or being in the execution phase.

Not an option for enterprises in both countries is to shift production abroad; a change coming along with a large and complex effort. On one hand, employees need to be either transferred to the new production location (and this not an option for many employees); on the other hand local laws need to be fulfilled and the process itself needs to be financially covered. In addition, production changes mostly end up with image issues of the enterprise, as employment is being reduced in the “old” place, in some cases the old production facility was built with the support of subsidies and other contributions, which mostly need to be returned. All in all, a production shift can end up in a major financial investment/adventure and no-one can assure that energy prices (and other conditions) at the new location will not change over time at levels changing the calculated business case negatively (Weber et al., 2014a).

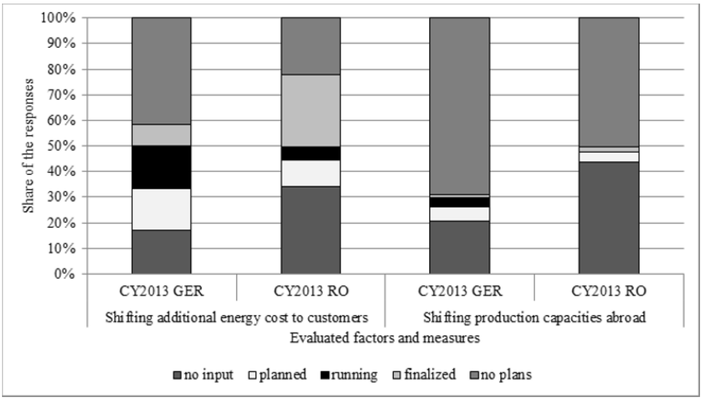


Figure 140: Activities shifting energy cost to customers and production abroad
Source: by author based on his research

The levels of no input and no plans for production location shifts, 90% (Germany) and 94% (Romania), are for both countries at very high levels (Figure 140). Clustering planned/running/finalized activities, the planned measures are in Germany and Romania dominating (54% Germany and 67% Romania). Romanian companies did not show any running activities and report a higher level of finalized measures being compared to the German companies (Weber et al., 2014a).

The importance of sourcing at energy exchange, supplier change, long-term contracts to enterprises

As Figure 141 lies out, around half the respondents reported a “change of their energy supplier” to be a valid option for an internally consequence in facing the changes in the energy economics (Germany 50%, Romania 53%). Comparing the two countries, the level of already finalized activities is in Romania 8% higher compared to Germany, whereas the level of planned and already running activities is slightly higher in Germany.

A similar feedback could be observed for the “shift toward long-term supply contracts”, which guarantee price stability for longer period of time. In the environment of constantly raising electricity prices this is a valid option to be selected.

“Purchasing at the electricity exchange” is for enterprises in both countries not a favourite option; only 32% of the German respondents and 24% of the Romanians reported activities in this area. However, analysing the data by company sizes (number of employees) this sourcing electricity via the electricity exchange becomes more interesting to larger companies (500 plus employees), with a stronger focus in Germany versus Romania. This is a logical trend, as sourcing at the electricity exchange goes along with an administration effort that needs to be handled and also is linked to a large demand for electricity in order to pay out. Smaller companies usually cannot cope with these requirements, nor do they have an electricity consumption which would justify the effort.

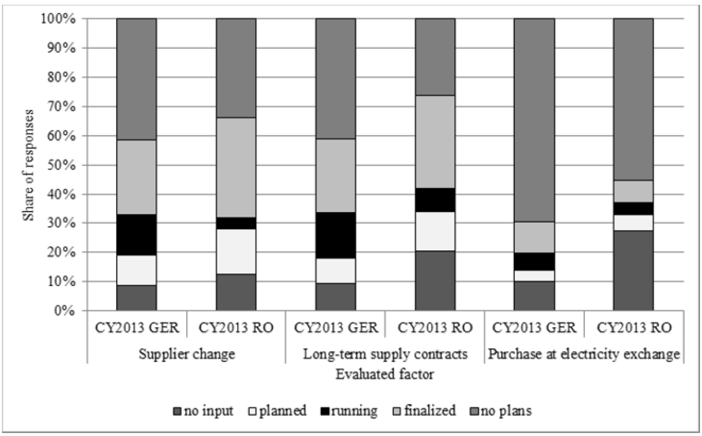


Figure 141: Rating of activities on internal action and activities on electricity supply
Source: by author based on his research

The importance of sourcing renewable energy and setting up own capacities to enterprises

In terms of principle energy sourcing, the respondents were asked to rate “renewable energy sources” as well as “fossil power production”. With a rate of 32% in Germany and 24% in the case of Romania (the two left bars in Figure 142) a trend towards sourcing electricity through renewable energy sources cannot be observed. Being asked about activities to set-up own production capacities using renewable energies, with 29% in Germany and 24% in Romania, a similar trend could be observed (middle two bars in Figure 142). Setting-up own production capacities based on fossil energy sources on the other hand is only an option for 16% of the respondents in Germany and 19% in Romania. In general, renewable energy sources enjoy a slightly higher preference for the German respondents compared to Romania.

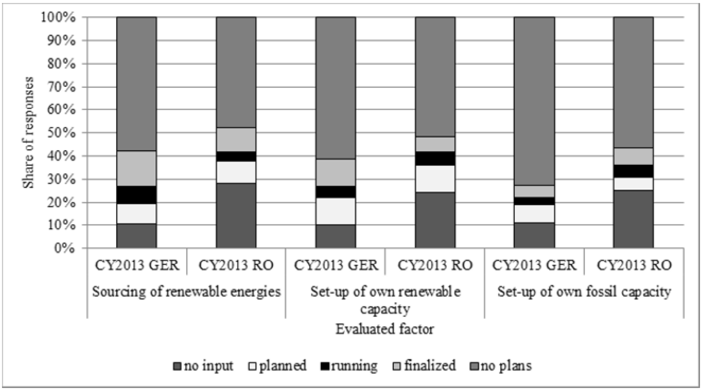


Figure 142: Rating of activities on internal action and activities by energy source
Source: by author based on his research

The importance of blackouts and energy efficiency to enterprises

Blackouts seem to be more on an issue in Romania rather than in Germany. 50% of the Romanian respondents reported activities to prevent from black-outs to be important elements to face the ongoing changes in the energy economics of their country (two left bars in Figure 143). Most of these (70%) are already finalized, 30% are either planned or already running initiatives. In Germany around 40% of the participating enterprises rate black-out protection activities as important elements in the context of energy economics, with the ratio of finalized activities versus planned /running measures being similar to Romania. This comparison confirms the respondent’s feedback regarding interruptions in the electricity supply; in Germany 77% of the respondents reported no problems with supply security, in the case of Romania, only 48% were reported. In a power supply system with a higher rate of supply interruptions, companies are more motivated to prepare for black-out situations compared to s more secure system.

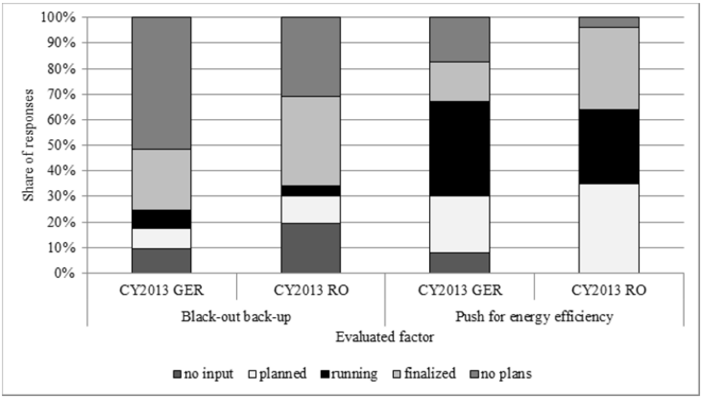


Figure 143: Rating of activities to prevent from black-out and to push for energy efficiency
Source: by author based on his research

Whereas the measures analysed so far did show a comparable level rate of "no input / no plans", measures for energy efficiency were rated differently in both countries (two right columns in Figure 143). For 74% of the German respondents, energy efficiency measures are an important activity to face the ongoing changes in the energy economics; in Romania this rate was even 96%. The relative high rates of inputs provided in both countries indicate that energy efficiency is an important topic that the interviewed enterprises have on their agendas already. Whereas 15% of the respondents in Germany reported already finalized activities (Romania 32%), the share of planned or running activities represents in both markets still the majority (Germany 59%, Romania 64%).

The importance of specific measures in terms of energy efficiency to enterprises

In case energy efficiency measures and activities were rated to be pushed, the respondents were also asked to rate the individual energy efficiency activities being on focus. The choices provided were:

- Introduction of an energy management system (EnMS)
- Employee information / awareness raising / training
- Efficiency measures in service processes and / or buildings
- Involvement of external service providers
- Participation in networks / energy efficiency round tables
- Load management
- Investments into new efficiency technologies

Also here, the Romanian respondents all reported feedback, whereas 22% of the German companies did not provide feedback to the questions; in this section multiple choices were possible. As can be seen in Figure 144, the Romanian companies rate almost all activities with higher shares as the German enterprises. Only in the case of" networking/ efficiency round tables" and regarding "investment into new efficiency technologies" German respondents provided higher rates.

Similar important in both countries are "employee information & training", "investment into new efficiency technologies" and "load management" activities in that order.

"Efficiency in service processes / buildings" was rated the most important initiative in Romania (72%), followed by "employee information / training" (68%) and the "introduction of energy management systems" (52.2%).

In Germany "employee information / training" was rated being most important (61%), followed by "investment into new efficiency technology" (46%) and "efficiency in service processes / buildings" (42%).

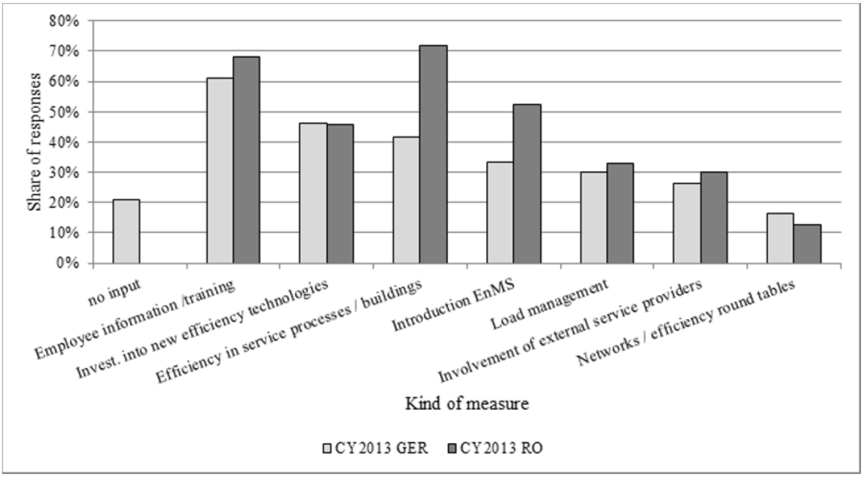


Figure 144: Energy efficiency activities on focus
Source: by author based on his research

In case of "investments into new efficiency technologies", the investment amount was to be specified within given ranges of (Figure 145):

- up to 10,000 Euro
- 10,000 to 50,000 Euro
- 50,000 to 100,000 Euro
- 100,000 Euro and above

The level of “no input” given by the German respondents again is with 55% at the high end. However, also the Romanian respondents were more reluctant than before to provide data (30% “no input”). This can be explained by the sensitivity of financial data which often is handled as a company secret.

The data received indicates that the share of investments in the range of “>100,000 Euro” is in the case of the Romanian enterprises (37%) by a factor of around 2.5 times higher compared to the German companies (14%). The differences for investments smaller than 100,000 Euro are more moderate. However, the high level of “no input provided” does not allow conclusions but would drive to potential misinterpretation.

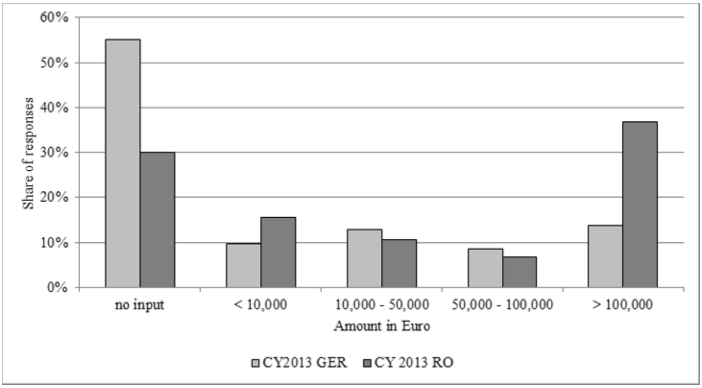


Figure 145: Amount level in case of investment into new efficiency technologies
Source: by author based on his research

5. 4. 4. Enterprises’ general judgement of changing energy economics

General judgment of the changes in the energy economics during the last 12 months by the enterprises

Asked for a general statement regarding the changes in the energy economics on the competitiveness of the companies during the last twelve months, the German interviewees provided mainly a neutral (41.2%) to negative (26.6%) rating, with the industry branch pushing the average trend towards negative (34.7%). Comparing the enterprises by number of employees, the German interviewees did not report a significant impact (Figure 146).

A negative judgment was with 42.7% apparently more significant in Romania, being mainly influenced by the branches industry (46.9%) and service (50%) (Figure

146). The enterprises with a higher number of employees were 50% more negative than the others (Weber et al., 2016a).

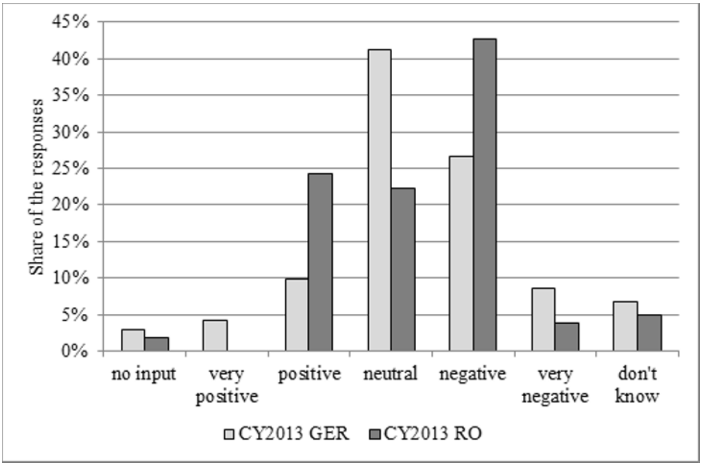


Figure 146: Trend of the general judgement of changes in the energy economics
Source: by author based on his research

As the changes in the energy system in Germany are ongoing already for a longer period of time as well as publicly discussed, the German enterprises were in a position to adjust to the changing energy prices and economic system changes for longer compared to the Romanian companies. As a result, they system changes are rated already with a higher level of "normality" in Germany compared to Romania. Even the feedback receives indicates a less extreme judgment of the energy transition, but still trending negatively (Weber et al., 2016a).

5.5. Correlations of selected measures to changes in energy strategies

Analysing the data, several general effects and relations could be observed, independent form the country or year analysed. Those are summarized and visualized in Figure 147:

- Once changing the energy price levels, two trends can be identified: increase or decrease.
  - A price increase (decrease) will negatively (positively) impact the share of the energy cost on the overall turnover of the enterprise.

- Increasing (decreasing) prices will increase (decrease) the importance of fluctuating energy prices.
- Energy savings become more (less) important in case the energy prices increase (decrease).

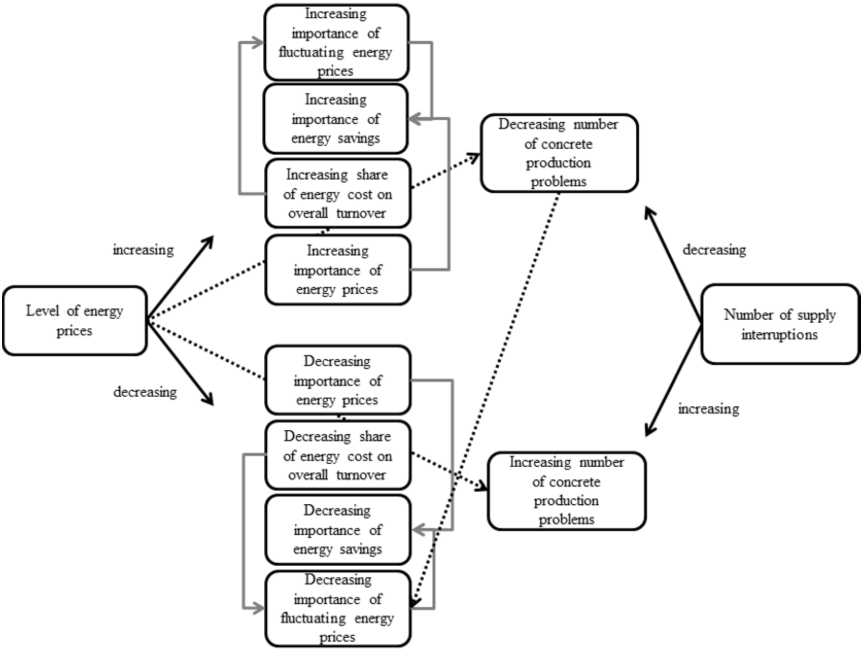


Figure 147: Effects of the changes in the energy economy to various factors - path diagram
Source: by author based on his research, ref. to Weber (2015)

- There are also correlations between the factors shown in column two of Figure 147*:*
  - An increased (decreased) importance of energy prices will increase (decrease) the importance of energy savings.
  - An increase (decrease) in the share of energy cost on the overall turnover will increase (decrease) the importance of fluctuating energy prices.
- The number of supply interruptions is not directly correlated with the factors in the second column in Figure 147. However, with a decreasing (increasing) number of supply interruptions a direct correlation with

decreasing (increasing) number of concrete production problems could be identified.

- A third identified group of correlation was illustrated through the dotted lined arrows in Figure 147; however, a direct connection between the two factors cannot be verified 100%.
- Questions which could not be answered using the collected data are open for additional research:
  - Is there a direct correlation between energy price level and the number of supply interruptions?
  - Allow higher energy prices for the allocation of budget to maintain the energy supply system in such a good condition, that umber of energy supply interruptions is decreasing?
  - Will a more stable energy supply system allow for a more balanced energy price level, and so for a decreasing fluctuation of energy price?

The analysis performed in this document revealed that the enterprises in Germany are confronted with the highest energy price levels in Europe; this trend is not expected to end shortly. Not surprisingly, height and volatility of the energy prices throughout the study were rated as important factors in the context of changes in the energy economics. The energy price was on one hand perceived as challenge to stay competitive, however on the hand and by that an important driver for the decision for energy efficiency measures. This result was seen in a smaller study of the DENEFF (*** DENEFF, 2015a). Also double confirmed by the DENEFF study was the increasingly high demand for a clear governmental energy policy in order to allow for planning security and long-term planning processes.

During the three years research period (2013-2015) the importance of energy efficiency measures decreased slightly which can be explained that several measures were implemented and running in the meantime. However, energy efficiency remains at a very high level of importance. As such energy efficiency and coming along energy savings were given a higher level of attention and investigated in a deeper level of detail.

- ! $ $ L $
$ $! ;
- ! L
! $ $!
$! ; $:
$ 3= 8 : %5 4 P 8
! Q $ 3=)/ 9 ; !
$,2)=)27N C 2#0 %5 4 7 ! $
$! ! 7 ! ;
! # < > 8D , $
* 0 ,C ; %5 (0) %5 (; $ $ $
$ $ P 1$# Q ,% 0 $ P 6 0
7 8 " 0 8 #$%!Q;
3 @ 3 ; ; = O
$ $: $ $ $ $ 8
$
! $ $ $
; $ $ $; $ 8
; ! ; $!
! ! ! ! $
$ $! ! $ $
$! $ $ $
$ $! $ 8
, $ (0 J $ $!
$ $
$ $; $ $ $ 8
! !
$! $ $ $ $ 8
! : $; 8 $
7 ! ; ! $ $
$ $! ! $ $: 8

#ponsoring H an effective met"od for supporting sustainability initiatives I
; : L 1 :
! * $! , $; ; 0
! , ! ; 60

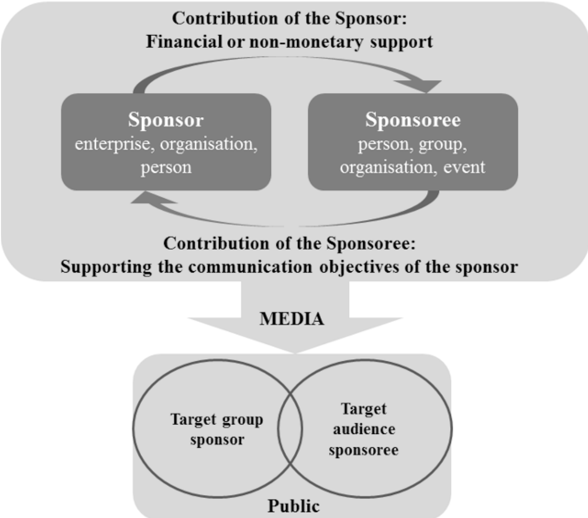
6 9 !
/ l $. $; @ ; ,%5 50 C ,%5 (0

Characteristic	Support			
	Patronage	Donation	Sponsoring	Crowd-Funding
Kind of Sponsor	· Private persons · Foundations	· Private persons · Enterprises	· Private persons · Enterprises · Foundations (seldom)	· Private persons · Enterprises
Motivation to support	· Only support	· Support motivation dominating · Eventually tax benefits	· Support · Communication objectives	· Support · Return
Cooperation with the sponsoree	· Partly	· No	· Through sponsorships	· Seldom
Media effect	· No	· Rare	· Yes	· No
Use in the field of environment	· Often	· Dominant	· Rarely	· Very seldom

$ $ L , 0 $
; $! $ 8
: $; ; : * L $!
$ $! $! $
$! ! ! $ L $:
,> ! ; %55&0 $
!
$ $ L ! $
$ $ * ;

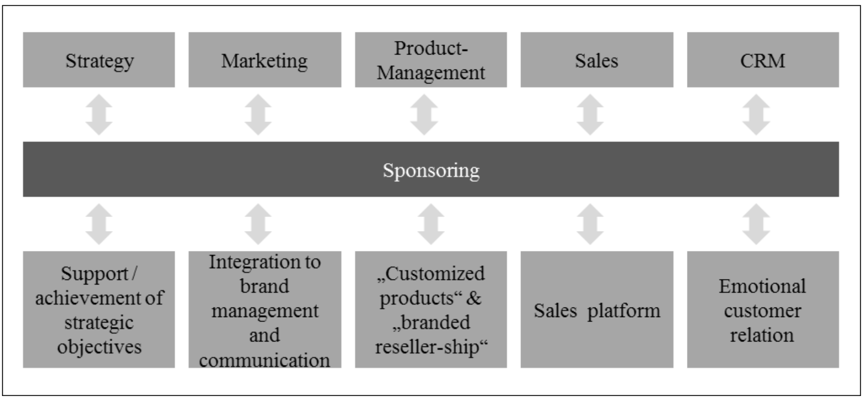
$ 8
; $; 8 $; ; 8 ; ;
, 60
$ $; ! 8
! ! ! $ $
$ $ < $ * $ $
; ; !! <
C $ K ,%5560; # < ,%5560 ,%55(0 / !! < ;
! < $
; ; ! ; ; ! $ < 8
: ,> ! ; %55&W / ; %5 'W # < ; %5560 $ 8
* ; ! ! ! ! ; $
$: ,C . ; %5 50 * !
; 8$ 8 ; ; ; ! ,/ $;

%5 50 / $ $ < *
$,> ! ; &+&0 $ *
4+



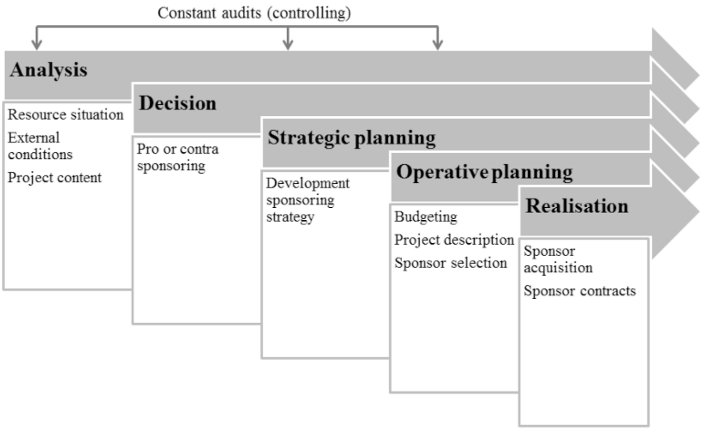
4+I $
/ I $ > ! , &+&0 C , &&(0

! $ @ 8! * $!8
! ; $ $! ! ! !
" ! ,7 /$! ; &+ 0



4&I ! !
/ I $ @B 8/ $! / ,%5560

$ * ; 8
! ! ! , 4&0 $ $! $ $ $
! , $! 0 < $! P 8
Q ! ,C ; %5 (0 $! $!
$ $! * $;
! ! $ $,C ; &&(W) ; %55(0



(5I /
/ I $ - , &&+0 / ,%5 '0

$!
, (50 $ $ $; $
$ $: J $ 8
$! $
! $ 8 ! 8 ! $
,C ; %5 40

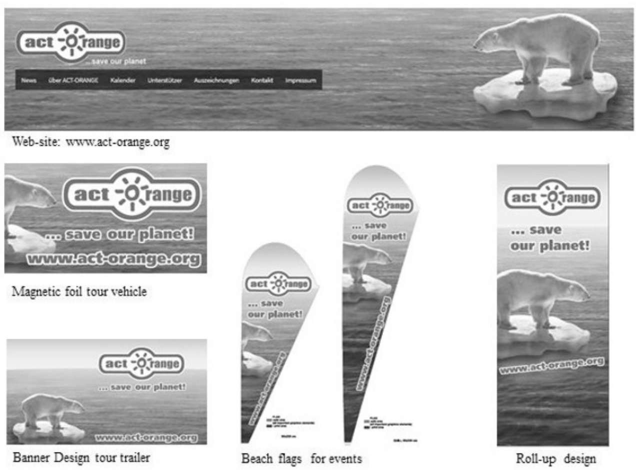
6 % 9 : $! $

! ; ! $; ! ; 8
$ 8 $ 2
$! ! 8
$ $! $ $: ; $ 8
7 ! 2 ! $! ; !
$ $ $
$ $! $!

! $; $
$; ; $ $; $
8 ; C ,%5 4 0 8
$, $ 0
$; , 0 ! ! :
$ $,. 0
; $; $,.0;
$ $ $:
,.0; , 0 ,.0 ! 8
; ,.0
, 0 1 , 0 $ $ $ $
,.0W , 0 ! $ 8
$ I ,.0 $ $ 8
, 0 , 0 !
$ $! ! $ L 8
, 0 ! : $ $ 8
$ *

(et**"**odology

$! ! P Q P Q !8
! $! J " $ *
$!! ,/ $; %5 (0

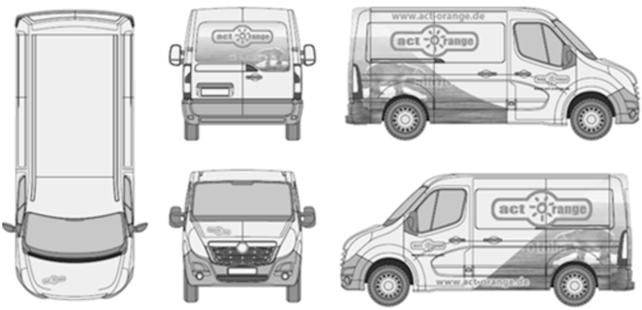


(I 1 8 8 !
/ I $; C ,%5 4 0

. $; $! $ $ $;
l $ $ 8
$ $ L ; ! $
$
$ L !
! ! 8 ; ; 8
; 19/ ! , 8 8 0 !
! , (0

(%l 8/$ $
/ l $; C ,%5 4 0

/ 8/$ $ $ $ C
$ L ! $! 8
! $ 19/ ! ; $! ! $
L , (%0



('l $
/ l $; C ,%5 4 0

$ L $ $; $ $
! $,
! 9 7 $ $ 0 $ $
! $ * ! $, ('0

(4I > ! $ $ 3=)/ 9
,/ I $; 8 0

/ $ $ $ 3=)/ 9 P3=
: J ! Q $ 3=)/ 9
, (40 !!
$; $!! $
$! ; ! $ $!8
! ! $! 8
$
3 $ L $ $ * ;
$
$
$ $ I

. P Q $ $!
$ $ $: $
$! < $, 0 &'
,.0 &5 $ I

a. **5**roup ***A! '** %personal contact**)**+

$ $ $; ! $! 8
! $ $
$! L $
; 8 8 ! F
$

$ $ $ $ $! ! !
! $

b. **5**roup ***4! H** %blind contact**)+**

$ $! ! $ $ 8!
$! ! $:
$ $ $! $ $! ! 8
! ; ; $
; ; !
, +0 . $; * $ $! ! $ 8
L ! $ $
$: $ $ $! $ 8
$ $ 9 $ $ $
$ $ $ $ $, 0 : $ 8
$ $ $ $ 8

6 ' 2 $ $

$ $! : I

- $ 19/ ! ! ; ! !
  ! $! $
- 1 ; ! ; ! ; 8 $
  ; $: ;
  ; $ L
- '5Z ,%& 0 **( ) 9** **.**
  $ $, 0
- ! $ **(:) 9-** **.** $ Z ,
  &50 $ $, +0

$ L $ $ $, 0 P 8
Q $ $ $ $,C ; %5 4 0
3 * $,.0 P P ! <
; $ $ $: $ 8
* ; $! $ $!

! $
$ 7 !

, 0 U U
/ I $ $ $; C ,%5 (0

Branch	number of responses	thereof		
		positive	negative	observe*
automotive	7	1	4	2
elektro-bike	5	1	2	2
renewable energy	33	9	6	18
foundations	14	4	2	8
church	4	0	4	0
associations	10	3	4	3
communication	4	0	3	1
universities	4	2	0	2
clubs	4	4	0	0
other	8	5	2	1
total	**93**	**29**	**27**	**37**

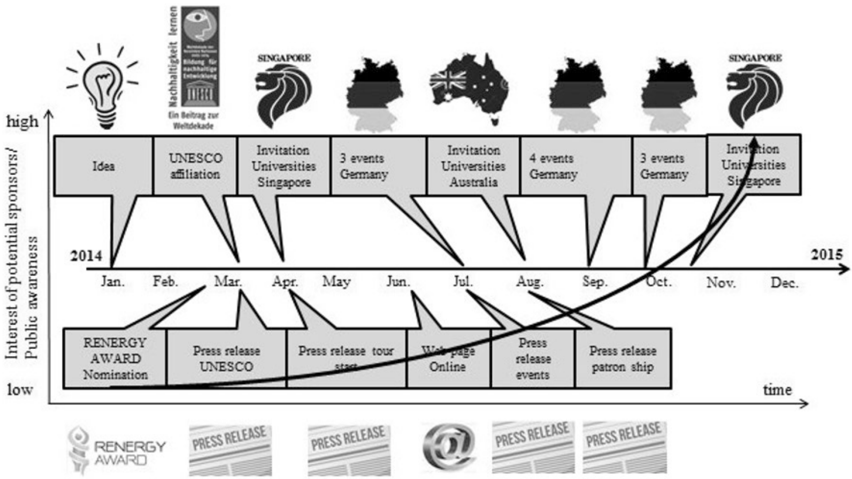
,V H ! P Q ; $ $! $
$! $ $; ! 0

+ ,.0 U U
/ I $ $ $; C ,%5 (0

Branch	number of responses	thereof		
		positive	negative	observe
associations (sympathising)	7	1	4	2
total	**93**	**29**	**27**	**37**

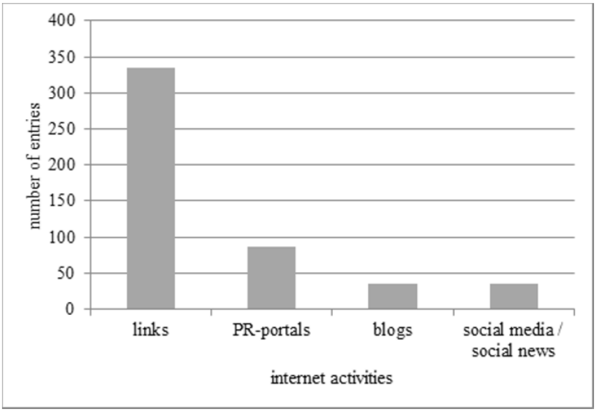
$ $, 0 $ 8
! $; ! $;
$ $ $! L $
$ $ $
> ; $! $;
$! $
: ! @ ! ! ; $
; $ $!
! ; $ $ 8 $; $
! ! $
3=8 8 : $ 3=)/ 9 **9*** **+** ; **,**

- . $ $
, ((0
$!! $ 8
$ $ $ $ $; $
! 1 ; $
! : ;



((I # ! $!
/ I $ $ $

(6 < * ! $! 8
$ 8 $ $
; ! $ $! 128 ; ! M ;
$ $
1 ,120 $ " $!
! $! $ $!
! $; $
$ $! ; $;
; *$,C ; %5 4 0 @ ! 8
! ; ; $ $ $ 8
; $ $ $ $! $! $



(6I #

/ I $ $ $; C ,%5 4 0

$ $ $ $ $ $!
< $ $ $; ! !
! $! $!
! $ $ $

&e2t steps

$ $ $ $; ! %5 (
P Q $ $:
$ %5 6; ! $ $
L ; - $; $ $
$) / $
8 $ $ 8
: $ $ P 8 Q $ $

A.1. #tudy on t"e role of .nowledge Intensive 4usiness #ervices in t"e conte2t of c"anging energy economics in 5ermany

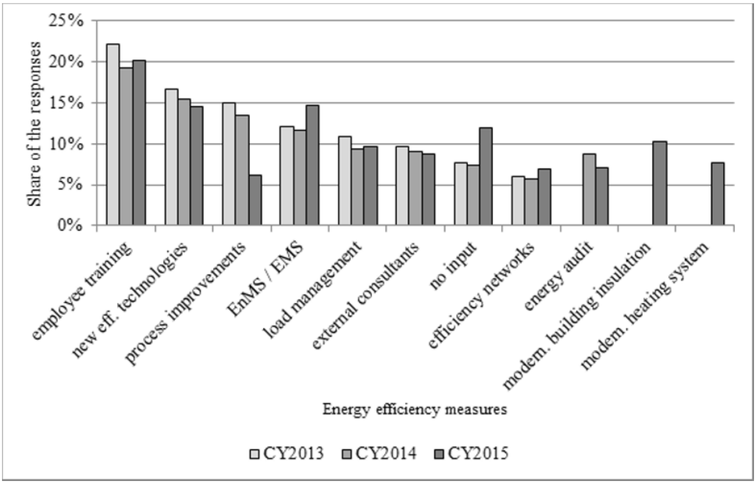
6 % 7 * $ $

; $ - .
/ ,- ./0 $ $!
$ 9 $ $ $ $; $ $ 8

; $! ! L $ $ $ $
* - ./ ! ! 8
$! $ $ (

6 % %9 : $! $

$: $ $ * $ - ./ $ *
$ $! 7 ! $ $ 8
L $! $ $ * $ 8
! ! W
$! $ $ L 8 $
,- ./0



(I)) / 7 !
/ I $ $ $; C ,%5 (0

$! ! $)# 87 7 ! %5 (:
! $ $! $ $
! (; %5 ($! ! ; ! !
! $ L ; $! - ./
$ * ! : ! $ $ 8
! $ $ $! $ $ ($!
$ C ,%5 (0 C ,%5 (0; $ $ $
L $! %5 ' $ $ %5 (,%5 'I H%;'&4 F %5 4I H %; &' F
%5 (I H %; 40 7 ! , (0 $!

$! ! ! !
! $
2 $! $ $ 8 8
7 ! ; $ %5 4 L)
$ $ $!
$! 5Z $ $ $ * ; $! !
! ! 8
,C ; %5 4 W / %5 40

(et**"**odology

$ $; $! $ L $ $ $ 8
(' - ./ * 8
$ $ $ $ - ./ * 8
* L ! $ $ $ 7 !
! ! $,C ; %5 60I
! * 7 !)) / !! %5 (
;
.)*$ - ./ $ %5 (;
@ ! $ 7 !) = ;
# 8$! $

A. **5**erman **$**nergy **$**fficiency **#**ummit **1;**1@I $ 8
! ; $ $ $ $ $! $ 8
$! ! ! $
$ * % 1 $
$)# 87 7 !

4. Frankfurt **$**nergy **$**fficiency ConferenceI # $ 4(*$ 8
$ $
# $;
$; ! ! ; 8
$ < $ %5 *
$
$

C. **5**erman **$**nergy Auditor **&**etwork AssociationI $ $
55 ! ! 45 $ $, $
0 $! D %5 (

D. #eminars : in'"ouse training participantsl (6 ! $
< M 8$!

<ypot"eses

$ L $ $
$ $,C ; %5 60l
2 ! $ $ 7 ! $ $!
< - ./
% $ $ # ! (; %5 (; $!
$! !

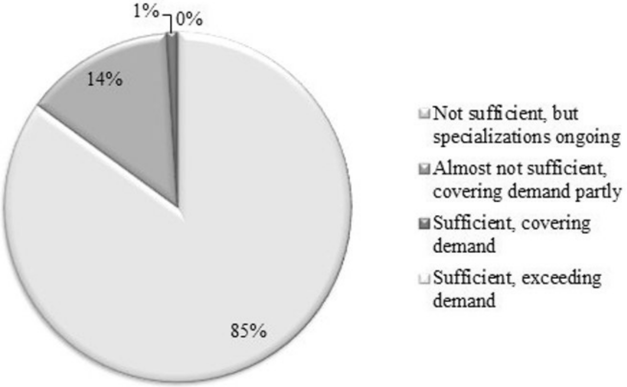
' # $! ! ; - ./
! ! $ $
! L $!
4 ! ! - ./
$ $;
$; $!
$! 8 8 $,VVV 7 ; %5 40
$ $ $! , 0
$ - ./ , 0 ,C ; %5 60

6 % ' 2 $ $ - ./ $ * $ 8
! 7 !

Question 1: Are there enough specialists to cover the increased demand for KIBS energy audits?

/esult 1l C $ $)# 87 ! ! %5 (! $
$ * # ! (; %5 (; !
,- ./0 $! ; $ $
! ! - ./

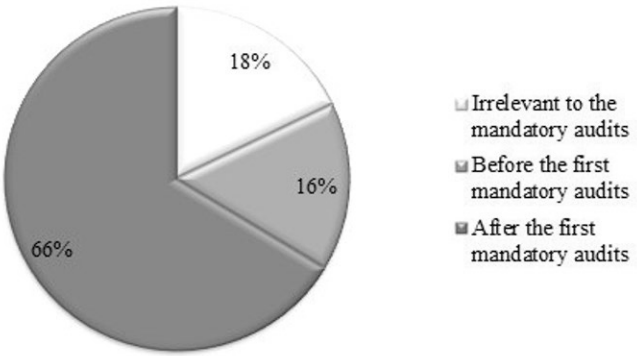
/esult **1**l - ./ $
L * ! %5 ( ) ! $ 8
* $ L $



(+I < $! - ./
/ I $ $ $; C ,%5 60

C $ $ $ $! - ./ ! $; $ $ 8
$

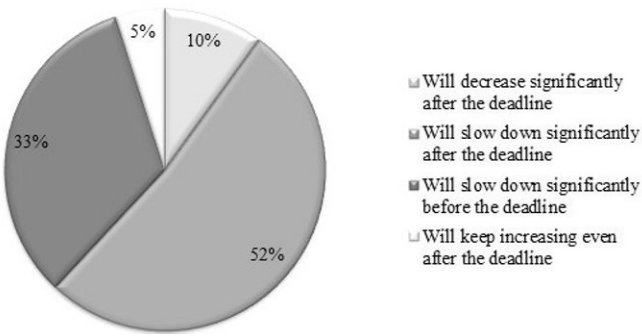
Question 2: When will the demand for monitoring and metering services increase significantly?



(&I ! $! ! !
/ I $ $ $; C ,%5 60
I esultI $; ! ; ! ! 8
L $ $,VVV. ; %5 (0 8
! ; ! ! 8
! $! ! $; ! ! $ # $
$ $! ! $! $
; ! $! $

@ ! $ $
@ $ * ! ! !
! $ * ! 4 $
. $ $! ! 8
$! L ! L ; ! !
! $ %5 6 $ $ %5 & *

Question 3: Which is the forecasted trend of the demand for energy audits?

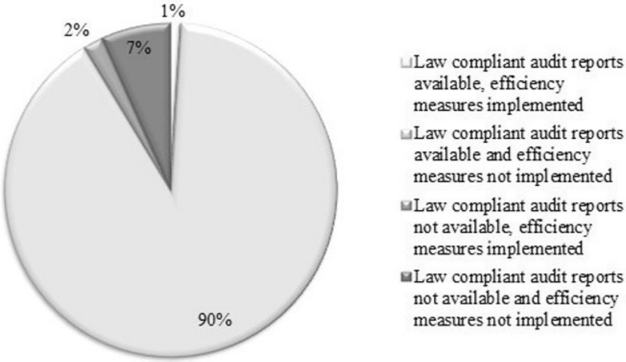


65l !
/ l $ $ $; C ,%5 60

/esult 1l 9 (5Z $ *
$ # ! (; %5 (9 $ * $
$ $ $ * ! $ $
* ! ; $ $ 4 $
$ L - ./ $ 8
W $ $ $ - ./ 8

/esult 1l L ; $
* $ $ $ $
! $ $! $ $ 8 !
; ! $ $
! $ $! # ! ($; %5 (
! $ - ./ 8
! $ L $ $ $ $

Question 4: What is the status of auditing reports and measures regarding law compliance?

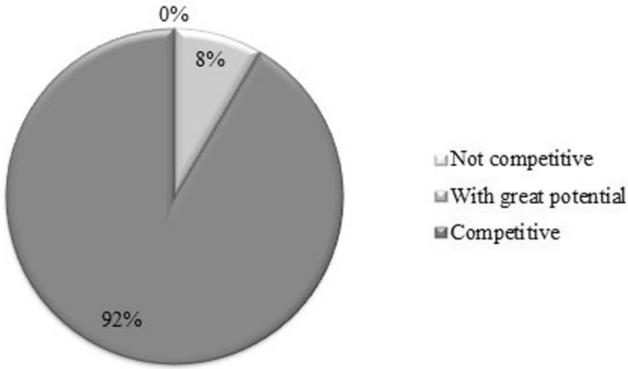


6 I / !
/ I $ $ $; C ,%5 60

Iesult 1I $! ! # =
)= 6%4 8 L ! $! 8
$; $ $! !
$ $ $;
* $ $ $; $
! P Q
P Q ! 7 ! - . / $ $ 8
!

Iesult **1**I . $! !
> ; $ * !
$; $ $ $)# 87 7 ! *
7 ! $ $ $ $
: %5%5; * $ $! ! ! !
! $!8
! * $ " ! 8
! !
. $ > ; $ $
$ $! L
! !

Question 5: How would you define the KIBS energy services market?



6%I $ < $ - ./ !
/ I $ $ $; C ,%5 60

/esult 1I $! - ./ $!8
W $! ! ; $
! ! > ; - ./ 8
< ! ; ! 8
! * ! $! ! $ $ $ 8

/esult 1I C $ $; - ./ 8
$ $ 8
!
. $ L ; $ $ $

7 ; $ $ $! $
W $ $! $
$! ; * $! I - ./ <
! $ 8
!; $ $ $ 8 ! * $
$!)# 87 ; $ " $

Conclusions

. $ < ; - ./
!) $; !
$ $ 7 ! *
7 ! ; $ $ $! ! $ $ $

$)# 87 %5 ($ # 8
/@)
/ $! $ $! :
- ./ ,- ./ ! ! 8
! 0 < $! 8
! ; !! ; ; 8 ;
9 $ $ $; $ 8 ! $ $ 8
/ ; ! $! $ 8 !
- ./ / ! $ L W $ L
$ $

7. Proposals for innovative and responsible business practices for sustainable energy and social responsibility

7.1. Development of an improved framework for innovative and responsible business processes for sustainable energy

7. 1. 1. General context of the proposal

As laid out earlier, the European action plans for energy efficiency are important for the environment but also for the national economies (Figure 163).

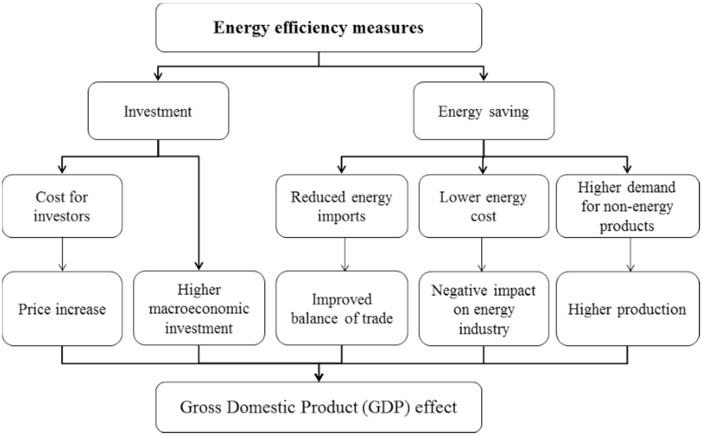


Figure 163: Macroeconomic effects of energy efficiency measures to the industry
Source: *** ewi et al. (2014)

In absence of a uniform regulation in Europe, each member state developed its own standards, regulations, procedures and timing for the implementation of the European Energy Directive.

In Germany, the National Action Plan for Efficiency (NAPE) includes many measures targeting the final objective but still shows an unaddressed gap towards the national energy efficiency targets as data from the German federal Ministry of Economy and Energy (BMWi) an other sources confirm (Table 19).

The research detailed out in chapter 5 confirmed the importance of energy efficiency measures to the German enterprises as "the" measure to counteract the changes in energy economics. Several options of activities in energy efficiency were investigated, varying from employee training, installations of energy management systems and process improvements to the implementation of energy audits.

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4_8

Table 19 Energy efficiency targets and status in Germany 2011
Source: by author based on Lendermann (2015) and *** BMU (2015)

Energy concept of 2010	2011	**2020**	**2030**	**2040**	**2050**
Reduction in greenhouse gas emissions (compared to 1990)	**-26.4%**	-40%	-55%	-70%	-80%
Sahre of renewables in gross final energy consumption	**12.1%**	18%	30%	45%	60%
Share of renewables in electricity consumption	**20.3%**	35%	50%	65%	80%
Reduction in primary energy consumption (compared to 1990)	**-6%**	-20%			-50%

On the other hand, the study also showed that there is resistance and hesitation in implementing corresponding measures. The reasons are manifold. Faced with uncertainty in the stability of energy prices, missed political stability and absence of planning security as one factor in that context hinder the decision process of enterprises in questions of strategy developments and related investments. This factor is being intensified by amortization times for energy efficiency investments beyond the given internal policies and in many cases a low share of energy cost of the overall return. Another reason is investment competitions within the enterprises; hence the budget exists only once and all projects need to fight for it.

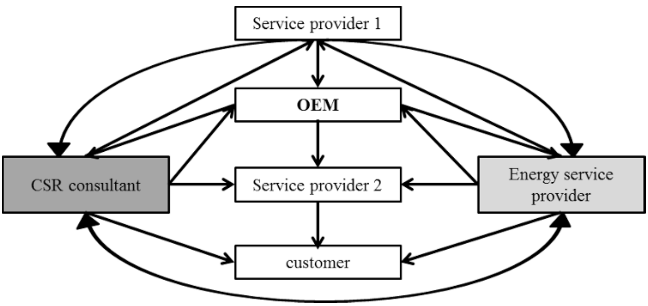


Figure 164: Energy & CSR KIBS in the context of Industrial Service Networks
Source: by author based on Esser and Seiter (2015)

In this context, energy KIBS are faced with a very specific situation. As external service providers, they rely strongly on the motivation levels for energy efficiency activities of the enterprises (Figure 164); without their order, the KIBS have no business.

Especially in times when the energy system is being modified, also the KIBS are faced with change and need to ensure they manage this change process effectively and successfully in order to remain on the market. The energy economical system currently undergoes a significant change from a traditional, fossil power station dominated set-up, towards a decentralized, flexible model focused on renewable energies and a strong focus on energy efficiency. As these changes are coming along with an increased level of complexity, the challenges for KIBS become even bigger. They need to ensure to be able to cover the expanded portfolio, focus on selected segments or start innovative co-operations with other KIBS. In this context, a high level of service quality is essential in order to ensure customer satisfaction, profitability and turnover growth – a mega challenge to be managed by the German energy consulting KIBS, of which 75% have only up to 5 employees.

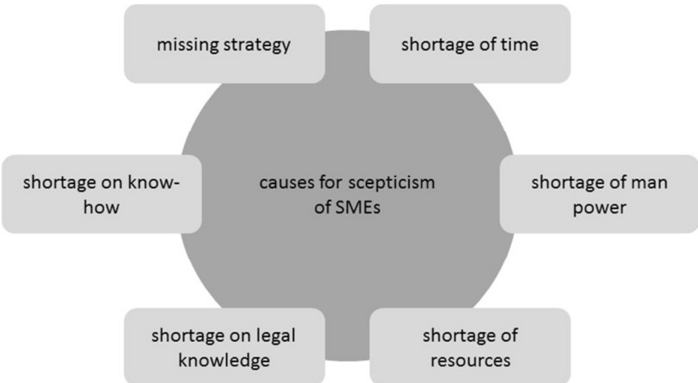


Figure 165: Reasons for skepticism at SMEs for sustainability
Source: by author, based on Grohte and Marke (2012)

For KIBS being involved in the segments of energy consulting and energy audits significant changes became effective with the introduction of the energy service law (EDL-G) in Germany (April 2015). As new legal systems usually are not totally perfect and user friendly in practical implementation, also in this case the concerned KIBS and enterprises were faced with challenges. The main challenges for the users can be summarized as follows:

- Unclear process description
- Process descriptions are spread over more than 15 documents. The same topics re referenced multiply and differently, causing misinterpretations.
- No demo audit report provided – authorities will decide case by case if requirements of the submitted reports are met

- High risk of failure
- High risk of rework and linked financial risk, as rework effort and cost not transferable to customer
- Unclear definition of enterprises being concerned by the audits
- Long process of approving the reports
- Unclear which documents are to be sent in in case of examination; as examination is possible in a four year period, creation process and timing for these “unknown” documents not acceptable

Especially SMEs as potential customers for the energy KIBS are additionally faced with a set of concerns in their process shifting towards sustainable business practice. Grohte and Marke (2012) in particular highlight several reasons for this behavior as outlined in Figure 165.

7. 1. 2. Objectives and methodology

From this context, the author set the objective to develop (based on the findings throughout this main research and its side investigations) a model to address the mentioned existing issues by:

- providing process clarification
- providing an accredited audit report template and tool
- addressing the resource challenge for the energy consulting KIBS with up to 5 employees
- providing a marketing and acquisition platform for the small energy audit KIBS
- contributing to an improved fulfilment process of the federal target rate of CO_2 savings
- monitoring and evaluation of the achieved CO_2 savings
- providing a “one place to go platform” to enterprises with nationwide stations for energy audits
- providing price security for the enterprises and a fair, common financial basis for the auditors and consultants
- providing a platform for audit training / seminars
- addressing and helping eliminating the reasons for the scepticism of SMEs for sustainability activities

The model development process

During the development process several techniques as described by Scholl (2014) and Meffert et al. (2015) were used, such as: brainstorming (collection of many innovative ideas in short time), expert discussions, SWOT-analysis (Strength, Weakness, Opportunities, Threats matrix) and mind mapping (information and ideas are developed from a central point which allows for a wide range of innovative ideas), sometimes in a mix.

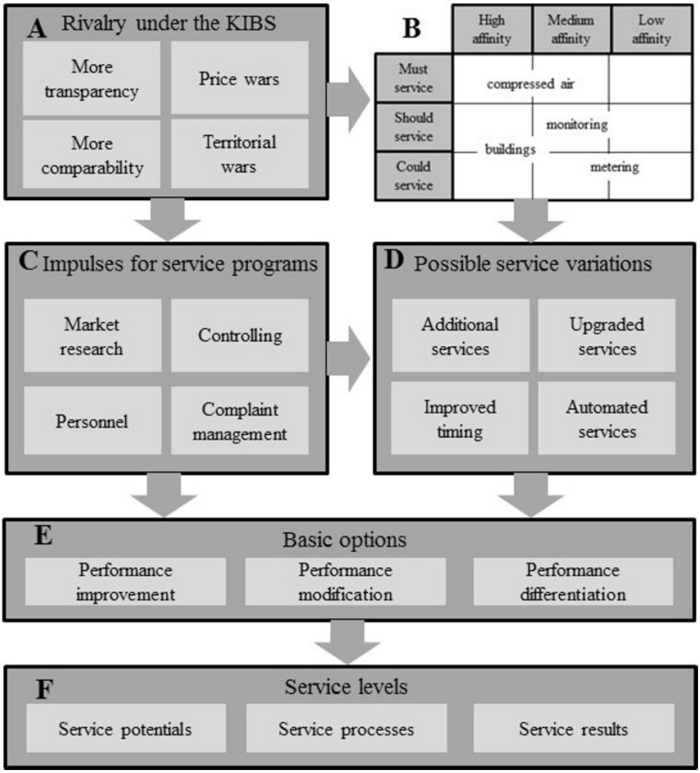


Figure 166: Profiling elements and affinities of planned services
Source: by author, based on Meffert et al. (2015) and Haller (2015)

As outlined earlier, the potential services energy audits KIBS can provide is as manifold as the number of different experts required to fulfil them at a high level of quality. As a first step, the planned services had therefore to be profiled and set in relation to affinities (Figure 166).

Today, the market is characterized by a high level of rivalry under the KIBS expresses in price wars and territorial conflicts (section A, Figure 166).

As a consequence and in combination with the increasing complexity of service elements the affinity of the KIBS for certain elements is dropping (section B).

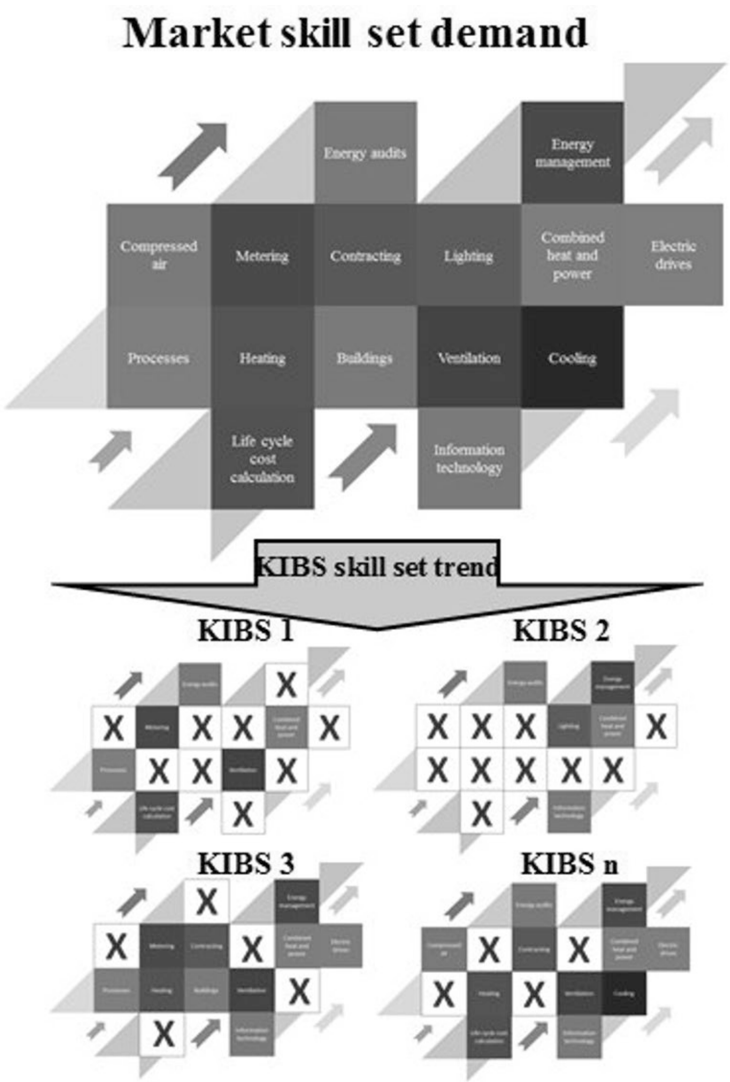


Figure 167: Complexity of the market demand development of cross-sectional technologies and lagging behind KIBS skill set development
Red "X" representing skill gaps – exemplarily KIBS 1 to KIBS n
Source: by author based on his research and professional experience

At the same time, the enterprises are confused about the available services by the individual KIBS and the complexity of the set of services is continuously increasing by new technologies and regulations added to the market (Figure 167). This makes it very hard for the KIBS to keep their skill sets up to date, illustrated by the "X"es in Figure 167. Consequently the quality levels of the services provided by the KIBS are decreasing ("every KIBS wants to offer every service" but "cannot keep up with the required skills" effect).

In step two (section C) service programs were analysed through market research and the option for a complaint management was evaluated, which jointly with controlling and the right personnel are to support the quality process. Jointly with the elements of section D (possible service variations) the basic options for the model were defined (section E), followed by the definition of the different service levels (section F).

The main objectives during this process (Figure 167) were driven by the three main factors:

- business success of the model
- customer loyalty
- employee loyalty

Business success of the model

Business success depends on the achievement of the corporate objectives (centre triangle in Figure 168). They are the "roof of the building". Following the service value chain, several factors permanently influence the corporation from outside and inside, such as the weather works on a house. The roof is set on several pillars namely market, cost and internal objectives which are to be met. The foundation of the "house of success" is set by the three quality parameters (bottom section in Figure 168). If those are not met, the whole building will not stand the influences from the "weather" and collapse.

Customer loyalty

In order to achieve a high level of customer loyalty, the customer needs to be satisfied. A high level of satisfaction can be achieved by delivering a high level quality service at a high level of trust. In that context several external factors influence the corporation permanently.

Employee loyalty

A high level of employee loyalty on a reduction of employee fluctuation on the other hand can be achieved by a high level of satisfaction at the employees end; resulting in high motivation and performance. In that context several internal factors influence the corporation permanently.

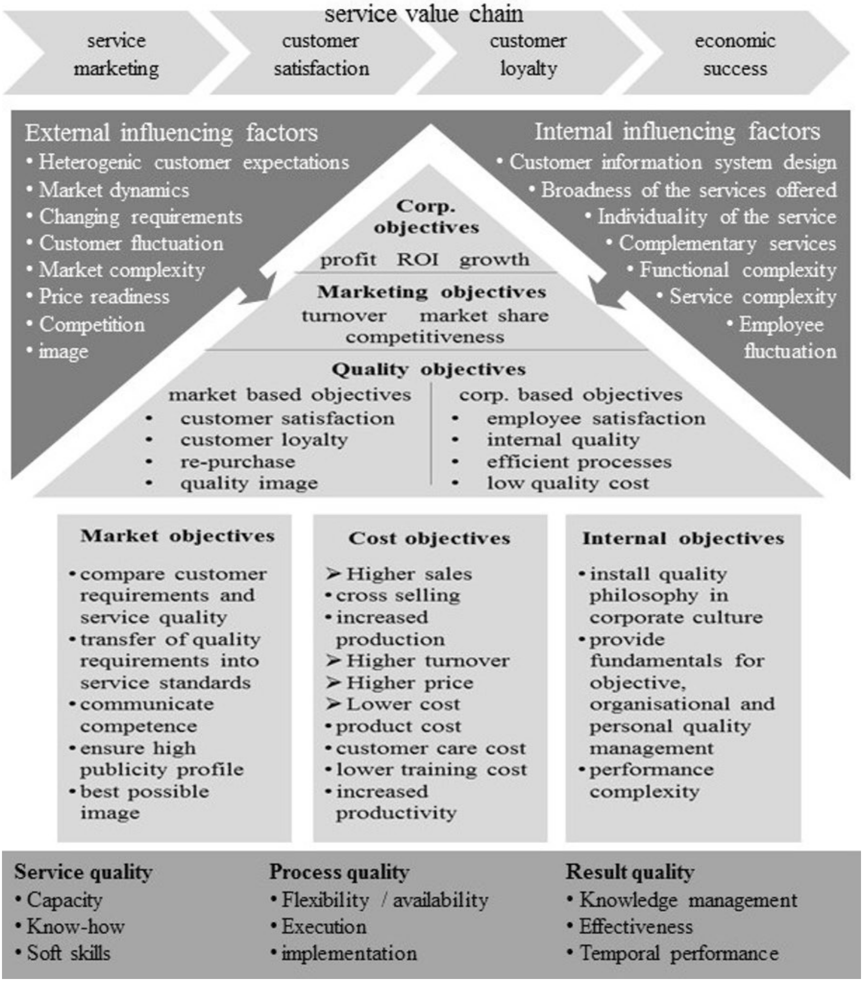


Figure 168: Service value chain and its influences in energy consulting KIBS
Source: by author with elements from Meffert et al. (2015)

The model

With this theoretical background in mind, the model practically was set two ways. Section one focused on the organisational setup in order to provide the framework for a successful achievement of the objectives set. In section two, improvements in the effectiveness of the customer acquisition process were approached.

Section one: organisational set-up

As mentioned earlier, Germany is home for several hundred BAFA-certified energy auditors, operating mainly independent across the country. The new umbrella brand model foresees to take advantage of their nationwide distribution and individual skills and experience (Figure 169).

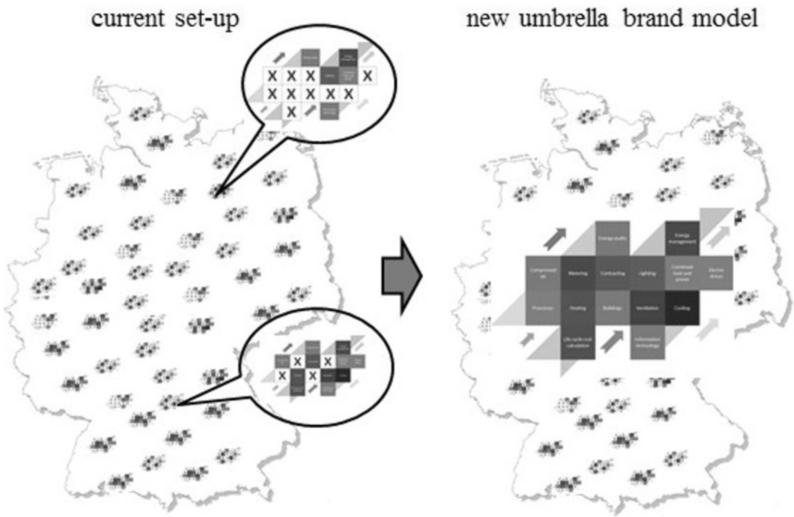


Figure 169: German energy audit KIBS on the map, each with its individual skill gaps (exemplary)
Source: by author based on his research

With the new umbrella brand model, an umbrella structure will be created for the energy KIBS to get effectively structured and relieved from time and resource consuming acquisition activities. On a voluntary basis the KIBS can join the umbrella brand on a co-operational basis without losing their independence.

However, there is no automatic “join the team” button; the selection process instead needs to follow clear guidelines in order to ensure the partner meets the specifications. Those can be entered in the cooperation partner evaluation matrix which produces the corresponding spider chart of qualification (Figure 170). The important detail during the evaluation and interpretation process is to ensure all partners have the ideal mix of social, personal and expert competencies.

An important element of this cluster set-up is the unexampled ability to wipe all concerns of the SMEs supporting their scepticism on implementing sustainable strategies out. The cluster concept comes along requiring just a minimal time of the SMEs and solves all concerns of the shortages mentioned earlier in Figure 165.

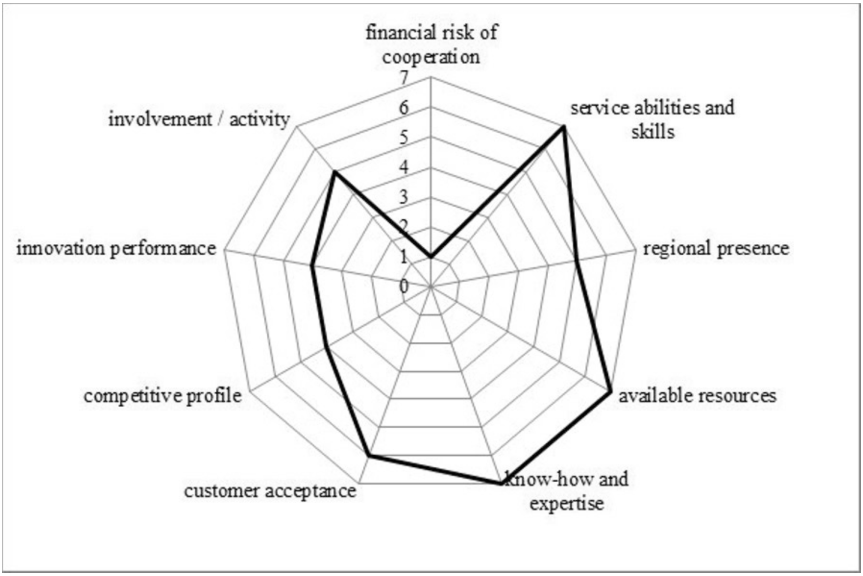


Figure 170: Cooperation partner spider chart of qualification
Source: by author based on his research

The umbrella brand secures business deals with customer and passes them to the KIBS. As the umbrella brand serves nationwide as one brand and service provider, marketing, communication, special deals and PR are much easier and more effective to be managed. By that also customers with multiple sites in different geographical areas find in the umbrella brand a business partner on a “one-place-shopping” basis, instead of having to find service providers for any single site individually. Consequently also the customer can manage the energy efficiency activities much more cost-efficient and productive.

In order to ensure high quality standards, the customers are requested to evaluate the KIBS after the service is provided which creates trust and quality image at the customer. To further improve the quality standards, the KIBS participating in the model will frequently be trained in seminars and congresses of the umbrella brands own academy (Figure 171).

The KIBS can focus on their initial business performing energy audits instead of “wasting” time writing offers and “knocking-doors” at potential customers. Being free to take an order offered by the umbrella brand, the KIBS keep their independence, and also still are allowed to make acquisitions by their own.

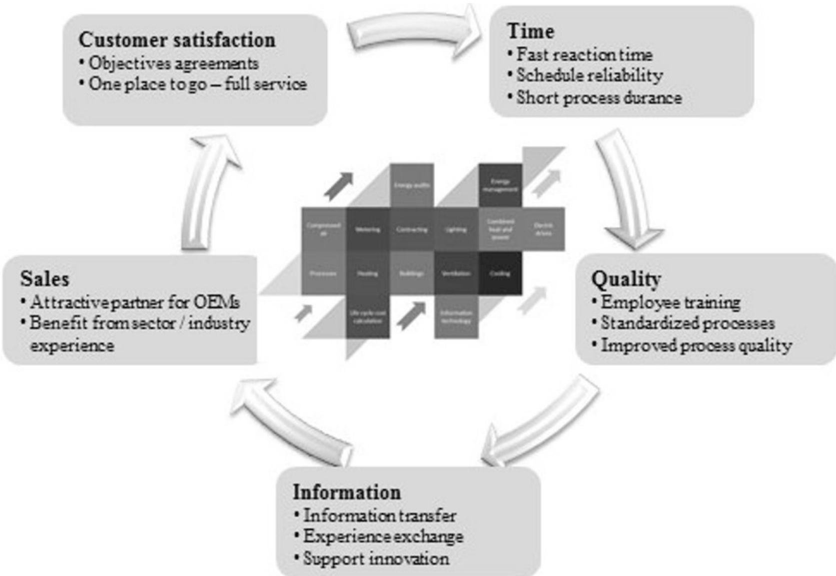


Figure 171: Quality circle
Source: by author based on his research

If they take an order acquired by the umbrella brand however, they will have to follow clearly defined processes, have predefined prices and get special tools for the audit execution. These special tools and processes are coordinated with and approved by the BAFA-authorities ensuring that the entire process follows the defined governmental requirements. By that, all involved parties have the assurance, that the audit reports follow the set rules and any unforeseeable and incalculable rework is avoided. This in combination with predefined prices ensures a planning security for all involved parties.

In addition the energy and CO_2 savings potential and planned energy efficiency activities will scientifically be recorded and monitored for further analysis and reporting to the governmental National Action Plan for Efficiency (NAPE) authorities.

7. 1. 3. Analysis and initial results of first evaluations of the framework

Section one of the model addresses already all defined objectives:

- providing process clarification
- providing an accredited audit report template and tool
- addressing the resource challenge for the energy consulting KIBS with up to 5 employees
- providing a marketing and acquisition platform for the small energy audit KIBS
- contributing to an improved fulfilment process of the federal target rate of CO_2 savings
- monitoring and evaluation of the achieved CO_2 savings
- providing a "one place to go platform" to enterprises with nationwide stations for energy audits
- providing price security for the enterprises and a fair, common financial basis for the auditors and consultants
- providing a platform for audit training / seminars
- addressing and helping eliminating the reasons for the scepticism of SMEs for sustainability activities

However, in order to design the structure also efficient for the umbrella brand a few process and structural improvements were developed.

Section two: improvements in the customer acquisition process

The acquisition process of the so far designed model still can be improved. Instead of approaching enterprises to offer them energy efficiency audits for their production facilities only, a concept was developed to include their sales outlets also.

For this purpose, the learning energy efficiency networks (LEEN) concept was further developed. The existing LEEN concept is set on a network model of approximately ten enterprises which agree to organise themselves in an energy efficiency network. In this network, led by an energy expert, energy audits are being performed in each of the member companies. The results are being presented in group meetings in which all network members attend. Through this concept, all members are learning from each other wherefore the learning curve and the process time is much shorter compared to individual energy audits without a network being connected. In addition, the efficiency effects are around 30-50% higher compared to individual standalone audits. The dilemma though is that the acquisition process to find enterprises joining such networks still is very time consuming und in effective. The biggest hurdle in this process is the resistance to "open the door" to other companies and data security.

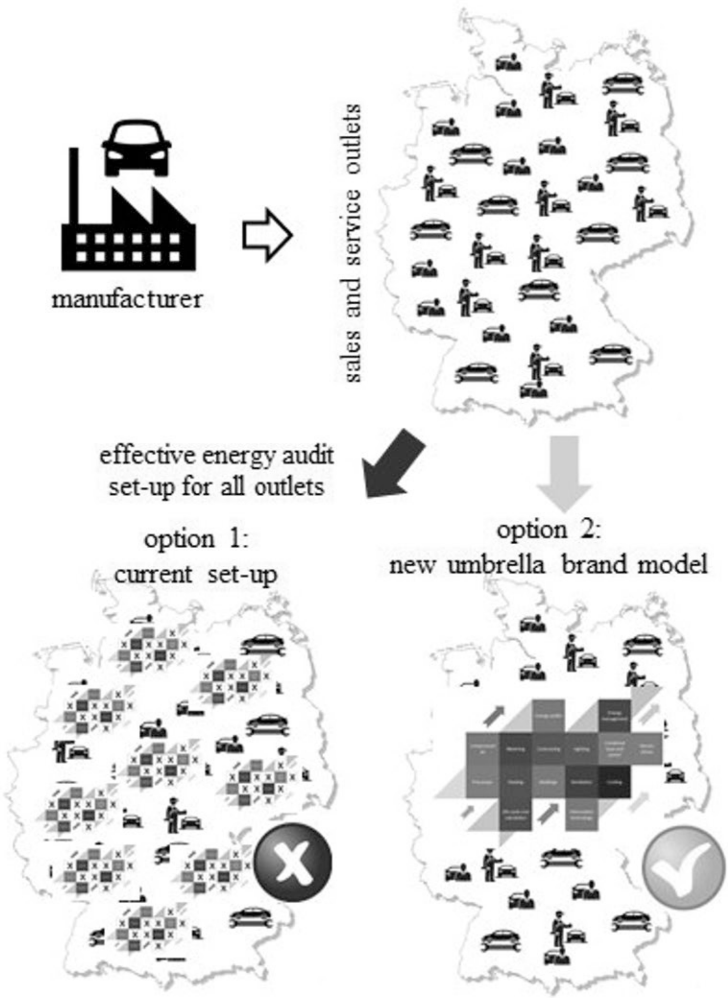


Figure 172: German energy audit KIBS and large corporations on the territorial map (exemplarily)
Source: by author based on his research

In order to address these challenges, the author developed this model further to an innovation-oriented umbrella brand cluster (for innovation-oriented cluster management also refer to Dovbischuk (2015). The improved version is based on section one of the proposed model. With the market power of the network concept of energy KIBS all over the country, the before mentioned large enterprises can be approached with a new proposal: a climate protection initiative throughout their distribution footprint. With the exiting KIBS network, the customers' sales sites can additionally be grouped and assigned to a KIBS in the network, potential KIBS skill gaps can be covered by assistance of a neighbouring KIBS offering that skill set. Instead of having each sales site to organize an energy audit itself (option 1 in Figure 172), the audit processes will now being organized, coordinated and managed by the umbrella brand cluster (option 2 in Figure 172). For the KIBS the process designed in section one is being followed. In addition, the KIBS can benefit here from a high potential that identified measures will be implemented and require further support through the KIBS. For the customer corporation (example of a car manufacturer in Figure 172), the audit process is designed as a "big bang" event with minimal effort and high efficiency.

The benefits for the corporation are manifold:

- the project can be marketed as climate protection initiative and be used in Marketing campaigns as well as in frequent events for the press
- the image of the corporation and the sales outlets will benefit from a significant boost which never could be achieved through a standard marketing campaign
- competitions between the networks can be organized for further increase the motivation and power of innovation
- dealers will identify and implement energy savings potentials reducing their cost and hereby increase their profitability
- corporation and dealers can be included in the governmental national climate protection initiative which further improves the image
- During the time span of the project a defined number of network meetings will be held for the exchange of experience between the network members; in addition efficiency related topics will be presented by and discussed with expert speakers

Section two of the model addresses selected objectives even further (underlined below):

- providing process clarification
- providing an accredited audit report template and tool
- addressing the resource challenge for the energy consulting KIBS with up to 5 employees
- providing a marketing and acquisition platform for the small energy audit KIBS

- contributing to an improved fulfilment process of the federal target rate of CO_2 savings
- monitoring and evaluation of the achieved CO_2 savings
- providing a “one place to go platform” to enterprises with nationwide stations for energy audits
- providing price security for the enterprises and a fair, common financial basis for the auditors and consultants
- providing a platform for audit training / seminars
- addressing and helping eliminating the reasons for the scepticism of SMEs for sustainability activities

General evaluation

Networks bundle the strengths of the members by at the same time minimizing the weaknesses. A good example of effectively working networks is the MetropolarSolar association, where the author is an active member of. This network was honoured for its contribution in the promotion of renewable energies with the German Solar Award 2015. These results could only be achieved by bundling the strength of the individual members.

During the energy efficiency summit, developed and managed by the author early December 2015 in Cologne, the author discussed the idea of his concept with selected academics and experts with positive assessments.

Thereafter, several meetings with energy KIBS as well with potential customers (large corporations) have taken place signalling the viability and good potential of the model. As a consequence, the proposed umbrella brand cluster model with section one and section two is currently being set-up and implemented by the author as innovation cluster jointly with well-respected universities in his region. Due to its essential to radical levels of innovation, it can be defined as business model revolution, following the definition of business models described in chapter 1.

With a potential wider launch throughout Europe, the proposed model will help to drastically and quickly identify energy efficiency potentials in enterprises and ensure that the defined European objectives for the reduction of greenhouse gases can be achieved or even overachieved.

7.2. Development of an integrated model for sustainable energy and social responsibility

7. 2. 1. General context of the model

Climate change is already directly negatively impacting industry sectors depending on the weather conditions, such as water economics, agriculture, forestry, tourism, mobility, insurances as well as energy economics; indirectly also connected sectors are concerned. Already 2007, the Intergovernmental Panel on Climate Change (IPCC) defined eight key strategies supporting the activities minimizing these effects (*** IPCC), one of which, energy efficiency, was addressed in detail earlier by developing a model to further improve existing systems:

- Switch to climate neutral fuels
- Heat and electricity recuperation
- Renewable energies
- Recycling
- Product improvements
- Reduction of all greenhouse gases, not just CO_2
- Material efficiency
- Energy efficiency

Since then, climate change progresses and arrived at a very critical stage. Additional elements had to be added to the before mentioned key strategies, making the topic even more complicated. In many regions on earth, the resource water became one of the leading bottlenecks; diseases are expanding with the expansion of the habitats of their carriers through global warming; other health issues expand, such as the number of heat-related dead. It’s time for action.

Sustainability developed as a key slogan and keyword for any activity trying to address such issues. However, there are more issues partly related to ecologic challenges, the social elements, in combination with the economic factor being named corporate social responsibility (compare chapter 2). At the end however, it’s not the corporations driving many of the beforehand mentioned factors, it is the consumers. It is the consumers influencing and directing which products and services are provided by the corporations; it is the consumers defining whether a product is being produced fair and environmentally friendly; it is the consumers deciding which political forces will be governing for the next period. It’s the consumers deciding by their votes and purchase decisions which path the economies on earth take. As a study by the media group Havas in twenty countries revealed, the willingness of the consumers to pay a few cents extra for fair traded products is disillusioning, the interest on the related social and ecological backgrounds is even lower (Gassmann, 2014). However, the study also revealed a trend change indicating a future significantly increasing need for such information (Figure 173). In other words, the trend positively develops from a status of social irresponsibility towards social responsibility, indicated also by Popa and Salanta (2014).

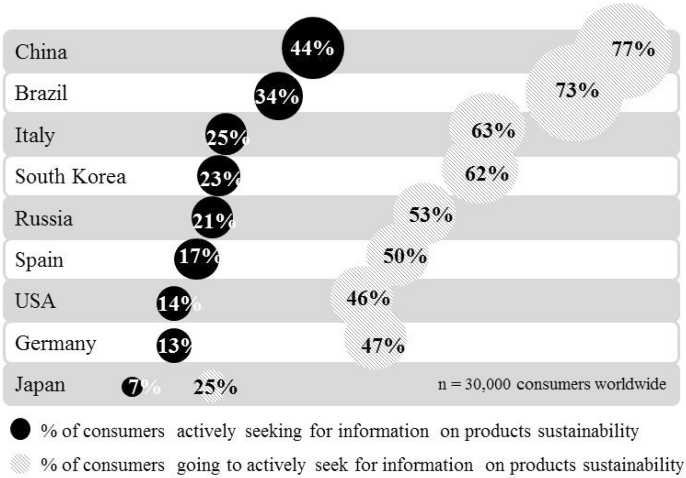


Figure 173: Sustainable consume
Source: Gassmann (2014)

The chart shows, that the consumers in countries with a serious for everyone sensible climate change issue such as the smog challenge in Shanghai/China for instance, the sensitivity and motivation towards more sustainability is larger compared to countries with fewer issues in that regard. By interpreting the chart however, it needs to be considered, that sustainability of products is differently interpreted by the different consumers; one might think of renewable energies, another of fair labour conditions, ban of child labour or combinations.

Corporations tend to define sustainability by corporate sustainability (CS) or corporate social responsibility (CSR) (see also chapter 2). As laid out before, the first corporations started to implement CSR some time ago; others follow successively, also in the SME sector. Implemented often as social innovation or social entrepreneurship (Hadad and Gauca, 2014), CSR developed through several levels and reached at a high degree.

In this context, ecological topics experience a renaissance. The group of Lifestyle of Health and Sustainability (LOHAS) jointly with the average consumer are faced with an increasing number of problems and challenges regarding social and ecologic issues. As a consequence, they develop a sensitivity which more and more results also in boycotts of un-sustainable enterprises (Lotter and Braun, 2014). This effect was confirmed by a study the institute of trade research performed in 2010. Their results show that out of more than 1,000 interviewed consumers, in Germany 60% shifted their consumption behaviour considering the aspects of sustainability. This trend not only concerns the sales sector, but also the human resources in their competition on top talents.

The individual moves here more and more in a critical and substantial role and is in process of making use of its power changing things in the market. Based on that finding the model of CSR had to me developed further and expanded by focusing on the individual.

7. 2. 2. Objectives and methodology

As laid out so far, there is a positive trend towards a more sustainability focused life style. Sustainability however is differently understood. In this context, innovative initiatives offering a “drop-in centre” for consumers to collect neutral, objective information are important elements in order to assist speeding this trend development up, as the research regarding the sustainability initiative “ACT-ORANGE… save our planet” (chapter 6) could poof.

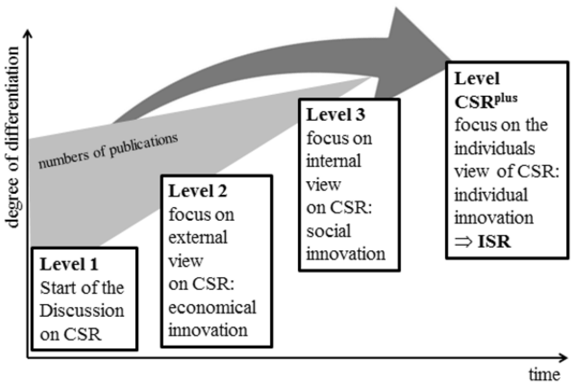


Figure 174: Evolution path from CSR to CSR^{plus} = ISR
Source: by author based on input from Mory (2014), Schneider (2015) and Altenburger (2013)

Initiatives are one way of providing awareness building information to the consumers; corporations are another. With that idea in mind, the objective was to design a model taking advantage of the already existing CSR concept (chapter 2) and the observed trend development of consumers towards more sustainability consciousness and develop both jointly to a next level.

In the context of the reducing numbers of publications and the accompanying trend shift from external to a more internal examination of CSR, based on several authors (Mory, 2014; Schneider, 2015; Altenburger 2013; Hering et al., 2010) and his own findings, the author proposes a next evolution level of Corporate Social Responsibility (CSR) towards CSR^{plus} , the Individual Social Responsibility (ISR) (Figure 174).

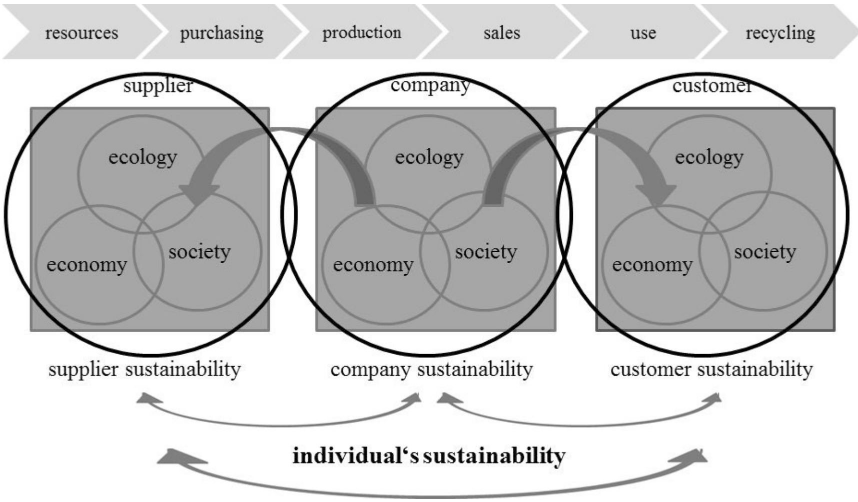


Figure 175: Companies in the context of ISR
Source: by author based on input from Mory (2014), Schneider (2015) and Altenburger (2013)

By expanding the so far corporate focused arrangement of economical, ecological and social factors by the individual component, allows ISR in this new stage of development for a further improvement of the firm's turnover. As learned from the author's interviews, the level of motivation of individuals being picked up in their comfort zones is much higher compared to being placed in a defined and restricted context. Consequently, firms need to change towards new innovative awareness raising training concepts, pick-up the participants in their comfort zones without simultaneously losing the focus on the corporate interest. This certainly is a balancing act which needs to be taken care of by trained experts.

In the first dimension of the model, the individual represents different roles. On one hand, every employee of the company or the supplier is an individual and an employee at the same time. Every employee is on the other hand also a customer and as such also an individual. In all these functions, the individual affects the customer, company and/or supplier sector (Figure 175). In this model, in all levels of supplier, company and customer sustainability the individual is the only common element. By focusing on picking up the individual in its comfort zone will reduce effort and cost and get the awareness creation build-up much more efficient. An individual being well aware of and actively practicing sustainable and environmental behaviour will do that in any function currently being administered, being as consumer, employee or private person.

In the second dimension, this created awareness will not be limited to one of the aforementioned IPCC factors alone. In contrary, this awareness development process can be expanded from energy efficiency to resource and material efficiency, water consumption etc.

The third dimension in Figure 175 offers the cooperation between the involved parties, namely the company, the suppliers, the customers, etc. and allows and even invites for joint awareness building activities and events; as such the model also offers side effects such as team building improvements.

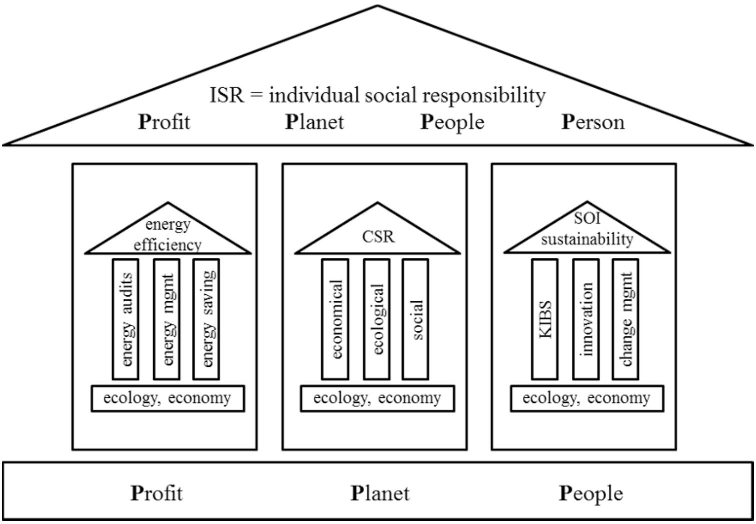


Figure 176: The house of ISR, from the “3-P”-model of CSR to the “4-P”-model of ISR
Source: by author based on his research

As discussed earlier, the traditional CSR is focusing on the “3-P” model, with the “3-P” being represented by Profit – Planet – People. With the earlier developed model of including the individual as “private person”, the 4th “P” (person) is being added to the model. Starting from the traditional "3-P"s, the enterprise has several options in developing towards its ISR role. The 3 pillars in the "House of ISR" (Figure 176) exemplarily represent the elements of the IPCC. In this connection each of its pillars constitutes its own "House" (for example in the context of energy efficiency) with its individual foundation (ecology, economy), its own pillars (energy audits, energy management, energy savings) and its own roof of objectives (energy efficiency) (Figure 176). Adding all it all up, the enterprise has composed its ISR model with the "4-P"s: "Profit – Planet – People – Person". Sustainability –Oriented Innovations (SOI) in this context can result in services and products being higher in cost than traditional innovations (Hansen and Klewitz, 2012).

In practise there are a countless number of enterprises counteracting in and representing national economies. Also countless is the number of sustainability strategies these enterprises practice.

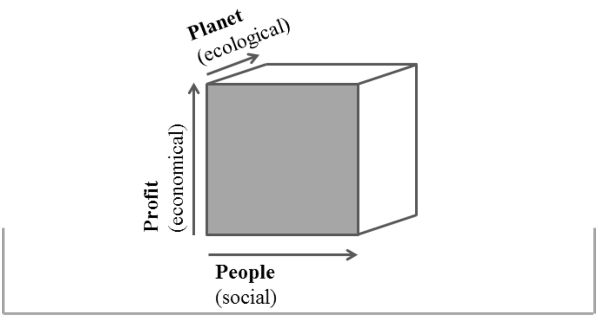


Figure 177: The "3-P" of CSR
Source: by author

So far not deeply investigated yet is the complex carry back of all these activities. The author therefore developed the "Matrix of ISR", as key element of his ecoistics philosophy.

Combining several cubes from the "3-P model of CSR" which puts profit (economical), planet (ecologic) and people (social) in relation (Figure 177), the author developed a matrix representing the relation of these elements for a companies and in combination of those for national economies.

As Figure 178 visualises, the profit axle represents several elements including fixed and financial assets, as well brand & image, knowhow and social factors. The people axle stands for society, partners (such as suppliers and others), employees, customers and investors. The two asset elements of the profit section combined with the elements customers and investors of the people section cover the traditional value definition (solid framed darker grey box in Figure 178). Adding the remaining elements of the profit and people sections and complementing the set with "planet" (ecologic) as the 3rd dimension, the sustainable company according to CSR is defined (dotted framed lighter grey box in Figure 178).

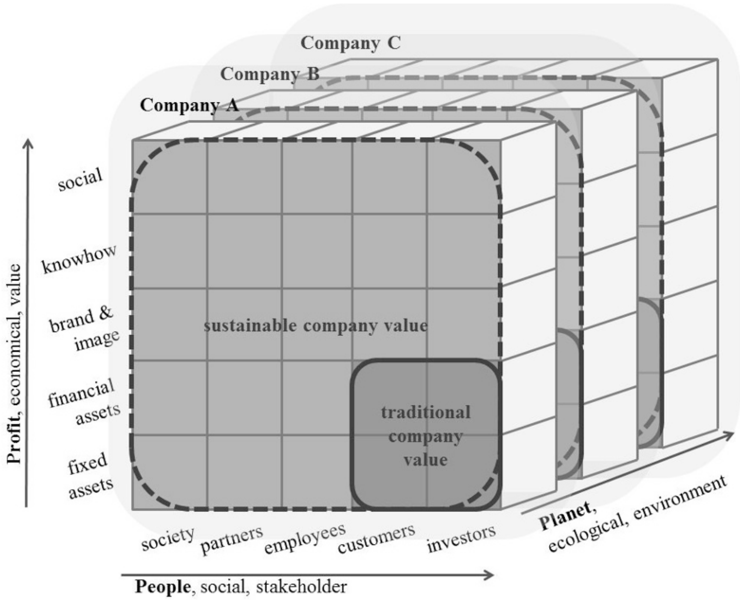


Figure 178: The "CSR 3-P"matrix of a company
Source: by author

This model describes the relations and correlations of corporate activities and its partners. Being active in business each enterprise is focusing on main objectives such as for example risk and cost reduction, value and market share. Any actions and activities in that context naturally correlate with and impact the way the enterprise arranges for example workspaces, deals with the market, appears to the society and influences the environment.

By their activities, business practices, products and services enterprises affect their. These surroundings are for example employees, shareholders, suppliers, customers, etc. In order to inform about their sustainable activities some enterprises publicise CSR reports with the objective to channel all these affects towards a positive public perception – the traditional model of CSR.

Looking at national economies many more companies need to be looked at, represented as company B and company C in Figure 178.

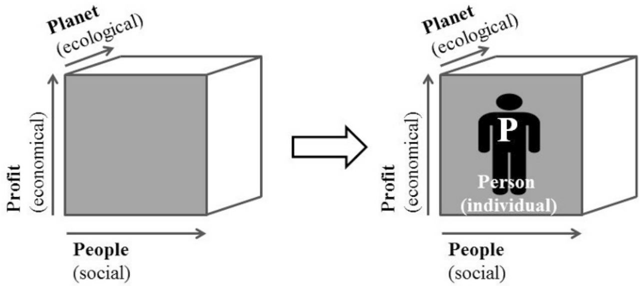


Figure 179: Evolution from the "3-P CSR" to the "4-P of ISR"
Source: by author

Following the traditional CSR model, an enterprise will never be able to reach all these individuals, nor will a national economy as such be able to benefit effectively from the enterprises single activity. Therefore, ISR is adding a fourth dimension to this matrix: the personal level of the individual as illustrated in Figure 179. Transferring this fourth dimension into the company matrix we get Figure 180.

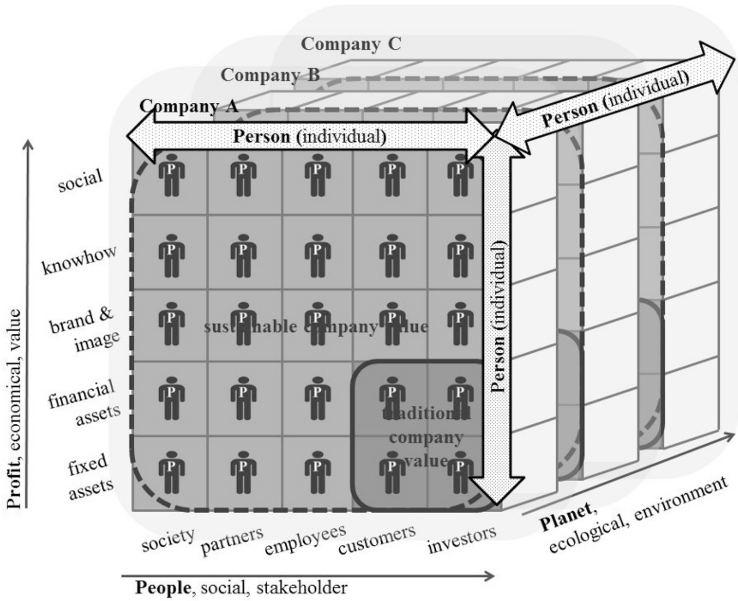


Figure 180: The "ISR 4-P" matrix of a company
Source: by author

The “ISR matrix”- model is adding also the indirect contacts of enterprises expanding the described CSR process. This combination includes now all possible counter actors of the enterprises. The “matrix of ISR” so far focused on one enterprise only, which naturally is overburdened trying to address all individuals. In combination and cooperation with all the other enterprises (represented through company B and C in Figure 180), such an effort will jointly be easily manageable, resulting in the “ISR sustainable public economy value” (Figure 181).

Pulling the “Matrix of ISR” to the energy network concept in chapter 7.1, the extended the power of the combined efforts of the single enterprises changes the impossible to be possible and efficient and effective energy efficiency are al of a sudden possible. This effect is strengthened on one hand by the interactions between the enterprises; on the other hand the individuals benefit from the inputs from various sectors they are interacting with in other companies or public life (such as sustainable health, food, etc.) which they can bring to their colleagues and enterprises. One option within this model can be to train employees differently. Instead of sending them to trainings they have to addend in order to learn how to be for instance more energy efficient for the company, they could be send to trainings to be trained how to generally save energy, starting from their individual lives.

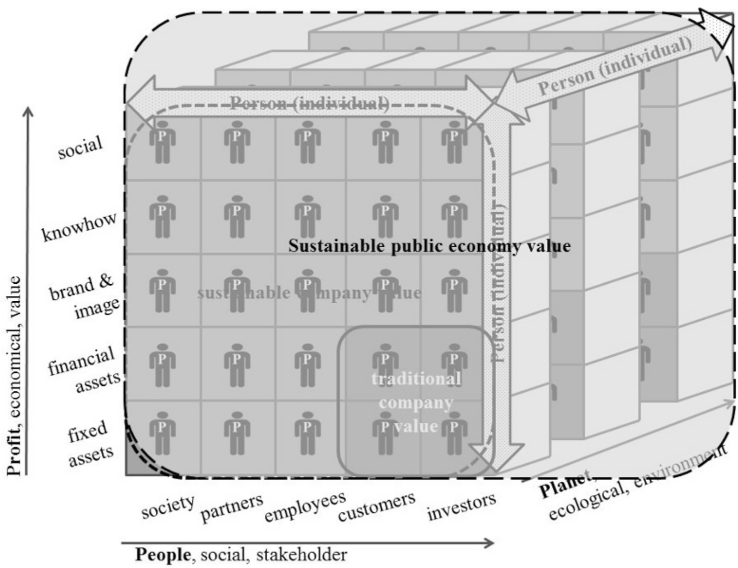


Figure 181: The ISR sustainable public economy value
Source: by author

This new approach however would offer focus more on the private lives of the employees and critics could argue that the company training budget is used for private purposes. However, motivating people to be more sustainability focused privately and generally, will result in a more for instance energy efficiency behaviour in the company and thus reduce the company's energy cost. Consequently, the company's overall budget increased through funding training for "private purpose". As these trained employees will also use their knowledge in other situations of life other than as an employee, there will be sharing of information and saving of for instance energy cost outside the company. Consequently the benefit will be across the national economy.

The earlier mentioned risk of SOIs resulting in higher cost compared to conventional innovations consequently will be eliminated by this joint effort approach of the ISR matrix model.

7. 2. 3. Analysis and results of first evaluations of the proposal

In order to evaluate the model, the author interviewed attendees of his seminars and in-house trainings during 2015. The interviewees were asked 1) on their motivation to join the trainings as well as 2) on their assessment of two different training set-ups for trainings.

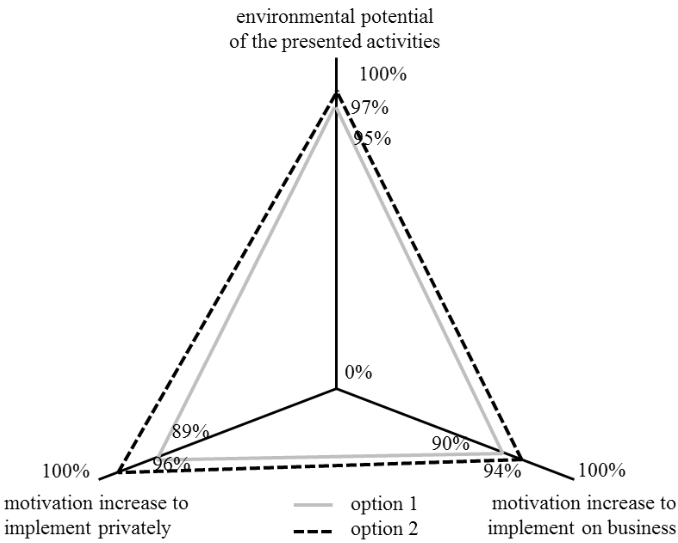


Figure 182: Comparison between the two training methodologies
Source: by author based on his research

The training topic should be: “awareness creation for energy savings and environmental friendly behaviour”:

- Option 1: training methodology “thinking from the company’s perspective” – in other words: awareness build-up to achieve energy savings for the company
- Option 2: training methodology “think from your individual perspective” – in other words: awareness build-up to achieve energy savings for the participant (privately)

The hypothesis to be assessed was that people who are privately sensible on environmental issues transfer this awareness easier to their business activities as the other way around.

The evaluation of fifty-one interviews during the open seminars resulted in training option 2 to be rated as the most efficient methodology (option 1: 17; option 2: 32; don’t know: 2 rates).

The concept for an in-house training was designed in two shifts. The first group of attendees (n=32) was trained according option 1, the second group (n= 29) according option 2. After the sessions, the participants in both groups were asked to rate the effectiveness of the attended concept in terms of the potential environmental impact, motivation increase through the training to become more efficient privately as well as on business. Also here, option two was the favorited training set-up (Figure 182).

Surprisingly the level of persons trained according to option 2 also on business indicated higher motivation levels compared to the persons trained with option 1. The motivation for becoming more sensitive on the private side was also higher for the option 2 group.

Consequently, the effect of pickup-up people in their comfort zones is very important and also a very effective methodology for awareness build-up (Figure 182). This result confirms the compiled hypothesis.

As this result however is based on a very small focus group of 61 attendees, it cannot be interpreted being scientifically representative. Consequently further research in this field is needed and planned by the author at a later stage.

However, the result from the in-house training study confirmed the results from the interviews of the attendees of the open seminars indicating that it makes sense to “back-focus” from the corporate emphasis to the individual.

Discussing the concept and results of the related research with key members at the multi-stakeholder-forum of the German sustainability council in April 2016 confirmed that the concept is well though through and presents one potential next step in the development process of CSR.

7.3. Effects of the proposed models for sustainable energy economics in Germany in relation to CSR

As is known, lone warriors can be successful when approaching their individual objectives; this can be transferred also to economies, societies and enterprises. Collectively however, individual power can be combined and much more effective; especially when addressing common objectives, such as climate change, energy efficiency and healthy economies.

During an actual project in the energy sector, the author developed an extended model for energy efficiency networks for corporations. Combining strength and elimination weaknesses the model reaches a maximum degree of effectiveness compared to existing models.

During an additional actual project, the author evaluated different awareness creation methodologies for CSR. Combining the learnings from both models, the "Matrix of ISR" model was developed. This final model allows combining strengths and knowledge of any sector and any enterprise towards one healthy economy and environment, including energy efficiency.

Discussing these effects with experts from German universities and associations, it turned out that such a business model has potential to become an innovative success model shortly. Especially in the context of the mandatory reporting on sustainability activities for larger companies starting 2017 and the related effects towards SMEs the combination of energy efficiency and sustainability projects develop towards an economic and ecological business model. However, as mentioned earlier this certainly is a balancing act for the involved companies and needs to be supported and managed by trained experts.

Therefore the author founded a consulting and research institute to focus on the development of a concept for a pilot project to

- further research the context and impacts of ISR to enterprises, society and individuals, including the impact and opportunities for energy efficiency
- develop and offer training programs addressing these dimensions
- develop and consult companies on sustainable ISR concepts and strategies

Under the lead of the mentioned institute and in cooperation with selected partners from the education and research sector, from concerned ministries and trade associations as well as selected enterprises, this project is currently in process of being set-up. Details can be found on www.ecoistics.institute.

Conclusion

Climate change, increasing shortage of resources, growing numbers of weather extremes nowadays is dominating the news. The stream of refugees heading towards Europe already is a major challenge to be managed and threatens the team spirit of the European countries. South Africa is faced with the largest drought ever recorded and the temperature on earth is nearing the critical 2°C maximum warming level – an alert signal indicating that further refugee phenomenon caused by climate and weather changes a potential worsening threats. During the recent global climate conference in Paris this value was even intensified to 1.5°C if our planet seriously is to be saved – the increase of the average temperature for instance in Germany reached a level of 1.4°C in 2015 already.

As one consequence of these developments, the energy economics are changing world wide impacting the way enterprises used to historically do their business. Factors such as energy efficiency, renewable energies, resource efficiency and sustainability voluntarily or forced by laws get more and more on the agendas of today's enterprises. In particular in Germany in the context of the nuclear exit and the shift to renewable energies, many studies and researches were undertaken which proved that such "radical" and fast changes of the system are technically as well economically doable. The evolution of such changes in energy economics, the context of greenhouse gas emissions and climate change as well as the correlation to sustainable business practices, CSR and innovation are analysed in the first section of the paper. It shows that social cost parameters are permanent companions and are an important field in the society. "Who will be paying for it" are buzz phrases often being connected to the energy transition in Germany - a study published in the Scientific American journal indicates a potential solution scenario.

Parameters being affected by the cost discussions are not only the expansion of renewable energies, the installation of charging stations for electric cars or the shift towards "green" traffic in general. It's also about the economy itself, the employees and the enterprises which at the end are paying this change. On the other hand the energy transition is proven to be a job creator, especially in the sectors of energy efficiency, renewable energy, energy storage, sustainable water and transport and material and resource efficiency. Sustainability and Corporate Social Responsibility (CSR) are effects gaining more and more importance and accompany the changes in energy economics.

The aforementioned studies also indicated that the energy prices in Germany (electricity and heat) increased extraordinarily compared to the European neighbour

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4

countries, challenging the competitiveness of German enterprises in the global market. The recent low price levels of oil and gas even strengthen this phaenomenon.

Another consequence of the changes in the German energy economics concerns the power producers. As the German energy framework was built mainly on fossil and nuclear producers, these are faced with major threats and weaknesses in the new grid situation, shifting from the traditional centralized set-up towards a decentralized renewable energy dominated concept. Having realised or even ignored the upcoming changes, the large producers shifted very late from fossil to renewable sources and struggle actually with serious financial issues.

But how do enterprises deal with these changes? Which measures are favoured by enterprises? Which worries concern enterprises in this context and which treats are they faced with? Are the enterprises aware of the legal changes coming along with these changes, how do they get informed? How do enterprises judge the ongoing trends and what do they wish from politics? In which relation are such developments with corporate social responsibility? Which business practices are being used to tackle such effects? So far such questions were not scientifically evaluated yet, indicating a gap in the actual scientific research. With the research of this doctoral thesis we intended to contribute closing this gap.

In chapter 1, “current tendencies regarding sustainable energy strategies and knowledge intensive business services”, we looked into the conceptual framework of today’s innovative business services. After identifying the defining elements of the concept of innovative business practices we evaluated the available considerations of sustainable energy in today’s business concepts; important elements here were the characteristics of business performance indicators in the energy economics. Next we analysed the actual approaches and perspectives in the development of sustainable energy strategies. Starting with the definition of energy economics, the factors of energy economics influencing responsible business practices were identified. After explaining selected tendencies in sustainable energy systems, today’s classifications of knowledge intensive business services (KIBS) were investigated. KIBS by definition play a very important role in the energy economics. Being a very complex and multidimensional construct, energy economic systems require a well-orchestrated team play of experts. Planning energy efficiency measures for instance requires very profound and deep knowledge on potential correlations between the various cross-sectional technologies.

Chapter 2 focuses on “present approaches and tendencies in sustainable energy strategies in relation to corporate social responsibility”. In this chapter, we analysed specific aspects regarding corporate social responsibility (CSR) which can be found in energy economics. After reviewing specific elements and instruments of CSR which can be used to support sustainable energy strategies, we critically evaluated selected approaches in sustainable social responsibility and energy. As such, social and ecological challenges like climate change, resource availability, changes concerning energy economics, etc. enterprises often perceive as threats. As of late, more and more organizations translate these challenges as chances for innovation, especially as sustainability and social responsibility factors are developing to become important purchase decision elements of customers and enterprises.

Chapter 3 presents “today’s approaches of innovation in the context of sustainable energy strategies”. Starting with the definition of innovation, we analysed its relation to energy strategies. The innovation process in the energy business of KIBS was reviewed, as well as the steps and phases of the innovation process. Coming from the innovation analysis and its correlations, the different kinds of innovation in the context of energy economics was described. As an important element, the supporting role of the open innovation approach in energy networks was analysed. The presentation of trends of corporate social innovation and their correlation with CSR and KIBS acting in the field of energy closed this chapter. CSR is evolving to become a trend in the society and 93% of the CEOs worldwide see CSR as the critical innovative factor for future business success. Innovation can be defined as improvement, novelty or newness. In the context of innovation, in literature two key focus areas addressing the innovation factor are identified: corporate social innovation and eco-innovation, defining CSR as important lever for innovations.

Finalizing the part of Literature review, chapter 4 highlights the “actual evolution of energy economics in Germany”. The German energy transition is understood and observed worldwide closely. From this context, the factors influencing the surroundings of energy economics were presented. To this, the Europe-2020-Strategy was investigated in relation to sustainable energy strategies, as well as industry norms in the context of energy efficiency were described. As important element of this chapter the chronicle of the German energy transition was laid out and impacts of changes in energy strategies to the German business sectors were explained. In this context gaps in research for sustainable energy strategies were identified and presented.

Contributing to the process of filling this gap, the following chapters focused in several researches on the impact of the mentioned changes to enterprises as well as on the role of selected factors on sustainable energy strategies and social responsibility.

Chapter 5, "study on the opinions of enterprises regarding the evolution of the energy sector" presents the results of the main study made in this doctoral research. Through a comprehensive field study we investigated the effects of changes in the energy economics on German enterprises during 2013 through 2015, also comparing the results with an accompanying study with enterprises in Romania (2013). The main objective of this research was to identify the effects enterprises are faced with by changing energy economics and which measures they prefer in order to face those. For the presented research the quantitative methodology was used, analysing the collected data of more than 2,000 questionnaires in each of the investigated years using the methodology of the one dimensional frequency scale. The feedbacks received through the questionnaires were evaluated and rated on a four point Likert Scale ranging from don't know to increased. The determined frequencies were visualized through bar pillar and circle diagrams. Research results showed that due to the fact that the changes in the energy system are already present and publicly discussed for a longer period of time in Germany, the companies were in a position to adjust to the changing energy economy system and prices. In addition, awareness and focus on environmental sustainability is at a higher level in the public discussion in Germany still. As a consequence of these two elements, they are already a step ahead and the system changes are rated already with a higher level of "normality" compared to Romania. This is resulting in a less extreme judgment of the impact of the changes in the energy economics to the enterprises. However, the research showed that the pendulum is still tending to the negative side. Comparing the responses of the enterprise, the following main findings could be observed:

- Whereas volatile energy prices still were of strong importance in 2013, this factor became less important in 2015. This effect results on one hand from more stabilized prices in 2015 compared to 2013. On the other hand, the enterprises are more experienced and better prepared to balance such effects.
- The changes in the energy economics are still being negatively perceived by the entrepreneurs, whereat being slightly improving.
- Amongst the mostly named wished addressed to politics, better coordinated political activities in relation to energy economics were strongly expressed.
- The enterprises rate energy efficiency measures as "the" most important element to counteract the changes in energy economics.

In chapter 6,"studies regarding innovative and responsible business practices for sustainable energy strategies in Germany", two supplementing researches were performed: a) the role of leadership for sustainability and innovative sustainable initiatives as well as b) the role of KIBS in the context of energy economics.

a) Innovative initiatives: Innovative initiatives supporting and promoting activities and projects focusing on sustainability are very important. As one option supporting such "sustainability initiatives" sponsoring was analysed first theoretically and secondly evaluated through a field research through an implemented project. The aim of this study was to evaluate whether sponsoring is an effective and accepted instrument to support innovative initiatives focusing on sustainability promotions. A major experience and finding throughout the existence of the initiative until today, many sponsors would be found so far with an increasing trend. Unexpectedly and contrary to accepted opinion, all of the sponsors refused a sponsoring in the traditional way and resigned from the typical two-way-deliverable concept of the traditional sponsoring definition. They all intended to support the initiative which they defined worthwhile to be supported - supported for the sake of sustainability. Two major findings could be identified during the sponsor acquisition process. Firstly, the developed POS and marketing material, through delivering an important impression of professionalism played an essential role in the decision making process of the sponsors. Secondly, press releases, media support, award nominations, patron-ships and invitations to international events, all at an early stage of the project, resulted in an increased level of awareness, which in addition supported the sponsor acquisition. As a result, the research confirmed that social entrepreneurship and leadership for sustainability are indeed important measures promoting projects and initiatives focusing on sustainability.

b) KIBS: KIBS are facing specific business environments. Especially in the energy service sector, radical system changes as during the German energy transition can be experienced. The objective of this research was to evaluate whether such system changes on one hand can provide major business opportunities for energy services KIBS (KIBS focused on energy audits and energy management systems) as well as for related supporting services being specialized in the areas of metering and monitoring, telecommunication, educational services, IT-services, etc. The 2nd objective here was to find out how sensitive KIBS react to by-products coming along with the changes although not being desired. So, most of the mentioned opportunities are short-term or for a selected group of KIBS only. Some of these opportunities will be opening up quickly; others require a longer breath in order to be reached. As a result from the main research in chapter 5, energy efficiency turned out to be a very important element for enterprises, especially for KIBS focusing on energy and energy efficiency services. To deep dive this KIBS group further, in total 153 concerned KIBS and energy experts were interviewed. The focal point was on opportunities and challenges which KIBS experience or expect as a consequence from the ongoing changes in the German energy economic system, focusing on the following focus groups:

- Industry and academic experts on German Energy Efficiency Summit 2015 in Cologne,
- Exhibiting KIBS at the energy efficiency conference 2015 in Frankfurt,
- Members of the German Energy Auditor Network Association,
- In-house training and seminar participants in the field of energy efficiency topics.

The questions used in the interviews were to test the following hypotheses:

1) Resulting from changes in the German energy sector a high number of auditors will be specializing in KIBS.
2) After the legal deadline for the audits on December 5, 2015, the demand for energy audits will slow down and the demand for metering services will increase.
3) Due to the lack of official sample report formats, software KIBS will develop a market for legal compliant audit report tools. Those as well as the installation of identified efficiency measures will be quickly adopted in the market.
4) A very competitive market for KIBS energy audit services will develop.

As a result, all hypotheses of the KIBS research could be confirmed with the exception of number three which only partly could be verified.

Based on the findings and learnings from the main as well the supplementing studies made during this research, in chapter 7, “proposals regarding improved business models for innovative and responsible business practices for sustainable energy and Social responsibility”, the author developed two models supporting a) the efforts of quickly reducing greenhouse gas emissions by increasing the national levels of energy efficiency and b) the efforts of increasing the performance levels of sustainability and CSR.

a) Based on the findings during the performed researches, the energy efficiency network model was developed further. As is known, lone warriors can be successful when approaching their individual objectives; this can be transferred also to economies, societies and enterprises. Collectively however, individual power can be combined and much more effective; especially when addressing common objectives, such as climate change, energy efficiency and healthy economies. During an actual project in the energy sector, the author developed and evaluated an extended model for energy efficiency networks for corporations. By combining strength and eliminating weaknesses of standalone KIBS into the corporate energy efficiency cluster, the model reaches a maximum degree of effectiveness compared to existing standalone models. In addition, it eliminates concerns and roadblocks of the enterprises hindering them in the "old approach" to actively tackle and execute energy efficiency measures.

b) During an additional project, the author evaluated different awareness creation methodologies for CSR. Based on the learnings and findings during the accompanying research this was developed further towards a next level CSR = CSR^{plus} = ISR, an innovative approach for enterprises and national economies to tackle the changes not only in energy economics; a philosophy named ecoistics by the author. Combining the partner integration model and the open innovation approach, the CSI model reflects the key section for energy service focused KIBS, a major element of the improved energy efficiency cluster model and additionally is also a vital part of the CSR^{plus} model focusing on the individuals. This model allows combining strengths and knowledge of any sector and any enterprise towards one healthy economy and environment, including energy efficiency.

First evaluations with industry experts have on one hand confirmed the viability of this concept, on the on the other hand they indicated that such a new process certainly is a balancing act which needs to be taken care of by trained experts. Consequently, the author founded a *consulting and research institute for sustainability^{plus}* with the objective to

- further research the context and impacts of ISR to enterprises, society and individuals, including the impact and opportunities for energy efficiency
- develop and offer training programs addressing these dimensions
- develop and consult companies on sustainable ISR concepts and strategies.

In cooperation with universities and enterprises, this institute is currently setting-up a pilot project on extended energy efficiency and sustainability. During this project several hundred small and medium sized enterprises will be guided through a process ensuring significantly improved energy efficiency and CSR^{plus} levels. The project will be accompanied by selected universities with the objective to further research the topics of innovative and responsible business practices for sustainable energy strategies and corporate social responsibility. Details can shortly be found on www.ecoistics.institute.

Contributions and ways to exploit the research results:

Based on the objectives of the research, the findings have resulted in a series of contributions described below:

- Identification of today’s innovative and responsible business practices in the energy sector
- Clarification of the concept of sustainable energy and business performance indicators in the energy area
- Explanation of tendencies in sustainable energy economics in relation to CSR
- Evolution of the energy economics in Germany
- Classification of KIBS in energy economics
- Opinions of enterprises regarding the evolution of the energy sector
- Development of an improved framework to support innovative and responsible business practices for sustainable energy
- Development of an integrated model for sustainable energy and social responsibility
- In addition, the developed models will be tested and evaluated in practice. The pilot project is going to officially start in September 2016 covering several hundred small and medium sized enterprises. During the project, additional research will be conducted intending to develop the concept further. Details can be found on www.ecoistics.institute.

Bibliography

Abdallah, K.B., Belloumi, M., & De Wolf, D., (2013*), Indicators for sustainable energy development: A multivariate co-integration and causality analysis from Tunisian road transport sector*, in „Renewable and Sustainable Energy Reviews", vol.25, pp. 34–43.

Abdallah, S., Bressers, H. and Clancy J., (2015), *Energy reforms in the developing world: sustainable development compromised?*, in "International Journal of Sustainable Energy Planning and Management", vol. 05, 2015, pp.41,56

Abrell, C., (2012), *Transformational Leadership's Effectiveness,* in: Organizational Change, Dortmund, dissertation TU Dortmund university

Altenburger, R., (2013), *Gesellschaftliche Verantwortung als Innovationsquelle*, in Altenburger, R. (ed.), CSR und Innovationsmanagement – Gesellschaftliche Verantwortung als Innovationstreiber und Wettbewerbsvorteil, Springer Gabler, Berlin-Heidelberg

Altenburger, R., (2015), *Nachhaltiges Innovationsmanagement,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.595-606, Springer Gabler Verlag, Berlin Heidelberg

Altobelli, C. & Hoffmann, S., (2011), *Grundlagen der Marktforschung,* UVK-Verlagsgesellschaft-mbH, Konstanz-München

Andruleit, H., Bahr, A., Babies, H., Franke, D., Messner, D., Pierau, R., Schauer, M., Schmidt, S. & Weihmann, S., (2013), *Energiestudie 2013 - Reserven, Ressourcen und Verfügbarkeit von Energierohstoffen,* available at http://www.bgr.bund.de/DE/Themen/Energie/Downloads/Energiestudie_2013.pdf?__blob=publicationFile&v=5, [accessed 2014-03-23]

Apergis, N., Aye, G., Barros, C., Gupta R. and Wanke. P., (2015), *Energy efficiency of selected OECD countries: a slacks based model with undesirable outputs*, in "Energy Economics", vol.51, 2015, pp.45-53

Averdung, A. (2014), *Erfolgreiches Management von Marketingagenturen im Wandel – differenzierende Kompetenz als strategischer Wettbewerbsvorteil*, Springer-Fachmedien, Wiesbaden

Barbian, D., (2001), *Ökonomie und Sustainable Development - Entwicklung eines Ansatzes zur Umsetzung von Nachhaltigkeit,* Shaker-Verlag, Aachen, 2011

Bardt, H. and Chrischilles, E. (2014), *Marktwirtschaftliche Stromerzeugung und Energiewende*, Institut der deutschen Wirtschaft, Köln

Bardt, H. and Kempermann, H., (2013), *Folgen der Energiewende für die deutsche Industrie*, Institut der deutschen Wirtschaft, Köln

G. Weber, *Sustainability and Energy Management*, Sustainable Management, Wertschöpfung und Effizienz, https://doi.org/10.1007/978-3-658-20222-4

Barthemely, J., (2003), *The seven deadly sins of outsourcing*, in: "Academy of Management Executive", 17 (1), pp. 99-120

Barthelemy, J. and Quelin, B., (2006), *Complexity of outsourcing contracts and ex post transaction costs: an empirical investigation*, in: "Journal of Management Studies", 43 (8): pp. 1775-1797

Bartussek, S., (2013), *Konzeptionelle Überlegungen zur Erbringung produktbegleitender Dienstleistungen - make, buy or cooperate?*, Wissenschaftlicher Verlag, Berlin

Bauer, T., (2013), *Innovationen in Familienunternehmen – eine empirische Untersuchung*, Springer-Fachmedien, Wiesbaden

Bauernhansl, T., (2014), *Energieeffizienz in Deutschland – eine Metastudie*, Springer-Verlag, Berlin Heidelberg

Baum, G., (2013), *Innovationen als Basis der nächsten Industrierevolution*, in: Sendler, U. (ed.), Industrie 4.0 – Beherrschung der industriellen Komplexität mit SysLM, Springer-Verlag, Berlin/Heidelberg

Becker, J. & Winkelmann, A., (2014), *Handelscontrolling – Optimale Informationsversorgung mit Kennzahlen*, Springer-Verlag, Berlin-Heidelberg

Berk, M., Bollen, J., Eerens, H., Manders, A. & van Vuuren, D., (2006), *Sustainable energy: trade-offs and synergies between energy security, competitiveness, and environment.,* MNP report 500116001/2006, available at http://pblweb10.prol-ocation.net/sites/default/files/cms/publicaties/500116001.pdf, [accessed 2014-03-11]

Bessant, J.,(2005), *Managing Innovation beyond the Steady State*, in "Technovation Journal", vol. 25, pp. 1366-1376

Bettzieche, J., (2015), *Feind fährt mit*, in „bizz energy today", vol. 4, no.09, pp.48-53

Binder, A., (2014), *Innovation in erfolgreichen Familienunternehmen – Untersuchung der frühen Phase von Innovationen in der chemischen Industrie*, Springer-Fachmedien, Wiesbaden, 2014

Blaettel-Mink, B. and Menez, R., (2015), *Kompendium der Innovationsforschung*, Springer-Fachmedien, Wiesbaden

Blazejczak, J., Braun, F., Edler, D, & Schill W., (2010), *Ausbau erneuerbarer Energien erhöht Wirtschaftsleistung in Deutschland,* in „DIW-Wochenbericht Nr. 50/ 2010", vol. 77, no.50, pp.10-16

Blesl, M, and Kessler, A., (2013), *Energieeffizienz in der Industrie*, Springer Verlag, Berlin Heidelberg

Blohm, I., Fähling, J., Leimeister, J., Krcmar, H., and Fischer, J., (2011*), Accelerating customer integration into innovation processes using pico-jobs*, in "International Journal of Technology Marketing", vol.6, no.2, pp.130-147

Botsis, D., Hansknecht, S., Hauke, C., Janssen, N., Kaiser, B. & Rock, T., (2015), *Kennzahlen und Kennzahlensysteme für Banken*, Springer-Fachmedien, Wiesbaden

Brandenburg, F., (2002), *Methodik zur Planung technologischer Produktinnovationen*, Shaker-Verlag, Aachen

Brauner, C., Seidel, R. and Wacha, J., (2012), *Change Management im Vertrieb*, Haufe Mediengruppe, Freiburg/München

Brehends, S., (2012), *The Significance of the Urban Context for the Sustainability Performance of International Roadrail Transport*, in „Procedia- Social and Behavorial Sciences", 54, pg. 375-386

Bretzke, W-R., (2014), *Nachhaltige Logistik – zukunftsfähige Netzwerk- und Prozessmodelle*, Springer-Verlag, Berlin Heidelberg

Brocken, N., Short, S. Rana, P. and Evans, S., (2014), *A literature and practice review to develop sustainable business model archetypes*, in "Journal of Cleaner Production", vol.65, pp.42-56

Bröker, O., (2014), *Full Service Contracts für industrielle Dienstleitungen – qualitativ- und quantitative-empirische Analysen zur praxisnahen Beurteilung des Geschäftsmodells*, Verlag Dr. Kovac GmbH, Hamburg

Bruhn, M., (2010), *Sponsoring - Systematische Planung und integrativer Einsatz,* Gabler Verlag, Wiesbaden

Bruhn, M. and Hadwich, K., (2015), *Interaktive Wertschöpfung durch Dienstleistungen – eine Einführung in die theoretischen und praktischen Problemstellungen*, in: Bruhn. M. and Hadwich, K. (eds.), Interaktive Wertschöpfung durch Dienstleistungen – strategische Ausrichtung von Kundeninteraktionen, Geschäftsmodellen und sozialen Netzwerken, Springer-Fachmedien, Wiesbaden, 2015

Brunnengräber, A. & Di Nuci, M., (2014), *Wettlauf der Systeme. Der Startschuss für das Rennen zwischen fossilen und erneuerbaren Energien ist gefallen*, in Brunnengräber, A. and Di Nuci, M., (eds.), Im Hürdenlauf zur Energiewende – von Transformationen, Reformen und Innovationen, Springer-Fachmedien, Wiesbaden, pp. 15-32

Bruton, J. (2011), *Unternehmensstrategie und Verantwortung – wie ethisches Handeln Wettbewerbsvorteile verschafft*, Erich Schmidt Verlag, Berlin

Bullinger, H., (1994), *Einführung in das Technologiemanagement*, Springer Verlag, Stuttgart

Bureau, D., Fontagné, L. and Martin, P., (2013), *Energy and Competitiveness*, available at http://www.cae-eco.fr/IMG/pdf/cae-note006-en.pdf, [accessed 2014-03-11]

Burr, W., (2014), *Markt- und Unternehmensstrukturen bei technischen Dienstleistungen*, Springer Fachmedien, Wiesbaden

Calota, E., (2015), *Tranzitita sectorului de energie din Romania*, Romanian-German Energy Efficiency Conference "Renewable Energies and Energy Efficiency in the Romanian Infrastructure: Energy Production", 09. Dec. 2015, Duisburg, Germany, available at http://www.export-erneuerbare.de/EEE/Redaktion/DE/ Downloads/Publikationen/Praesentationen/2015-12-08-iv-rumaenien-02-anre.pdf?__blob=publicationFile&v=2, [accessed 2016-01-29]

Catoiu, I., Tudor, L. and Bisa, C., (2016), *Knowledge Intensive Business Services and Business Consulting Services in Romanian Changing Economic Environment,* in: "Amfiteatru Economic Journal", Vol. XVIII, Nr. 41, pp. 40-54, Feb. 2016

Chesborough, H.W., (2003), *Open innovation – the new imperative for creating and profiting from technology*, Harvard Business School Press

Chesborough, H.W., Vanhaverbeke, W. and West, J., (2006), *Open innovation: researching a new paradigm*, Oxford University Press, USA

Chiesa, V., Manzini, R. and Pizzurno, E., (2004), *The externalisation of R&D activities and the growing market of product development services*, in: "R&D Management", 34 (1), pp. 65-75

Christof, K. & Pepels, W., (1999), *Praktische quantitaive Marktforschung,* Verlag-Franz-Vahlen-GmbH, München

Cornwell, T., Weeks, C. and Roy, D., (2005), *Sponsorship-linked marketing: opening the black box,* in: "Journal of Advertising", vol.34, issue 2, pp.21-42

Costa-Campi, M. and Trujillo-Baute, E., (2015), *Retail price effects of feed-in tariff regulation*, in "Energy Economics", vol.51, 2015, pp.157-165

Cuganesan, S., Rooney, J. and Silvi, R., (2006), *Examining outsourcing agreements: the role of contractual and accounting controls*, available at: http:// papers.ssrn.com/sol3/papers.cfm?abstract_id=913281, [accessed 2015-09-12]

Dahan, E. and Hauser, J., (2002), *The virtual customer*, in "Journal of Product Innovation Management", vol.19, no.5, pp.332-353

Dahlander, L. and Gann, D.M., (2010), *How open is innovation?,* in "Research Policy", vol.38, no.6, pp.699-709

Dal-Bianco, E., (2015), *Nachhaltigkeit messbar machen – Integration von ISO26000 in die Sustainability Balanced Scorecard,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.311-324, Springer Gabler Verlag, Berlin Heidelberg

Den Hertog, P., (2000), *Knowledge intensive business services as co-producers of innovation*, in International Journal of Innovation Management, 4 (4)

Deutinger, G., (2013), *Kommunikation im Change – Erfolgreich kommunizieren in Veränderungsprozessen,* Springer-Verlag, Berlin/Heidelberg

Di Nuci, M., (2014), *The Roll-out of smart metering between discording interests and institutional inertia. What can be learnt from the pioneer countries?*, in Brunnengräber, A. & Di Nuci, M., (eds.), (2014), Im Hürdenlauf zur Energiewende – von Transformationen, Reformen und Innovationen, Springer-Fachmedien, Wiesbaden, pp. 265-287

Dietzfelbinger, D., (2015), *Praxisleitfaden Unternehmensethik – Kennzahlen, Instrumente, Handlungsempfehlungen*, Springer-Fachmedien, Wiesbaden

Doepfer, B., (2014), *Co-Innovationskompetenz – strategisches Unternehmertum im regionalen Wertschöpfungsnetzwerk am Beispiel der Automobilindustrie*, in Peschlaner, H. and Doepfer, B., (eds.), Wertschöpfungskompetenz und Unternehmertum – Rahmenbedingungen für Entrepreneurship und Innovation in Regionen, Springer-Fachmedien, Wiesbaden

Doll, C. & Essen, H. (2008), *Road infrastructure cost and revenue in Europe*, Produced within the study Internalisation Measures and Policies for all external cost of Transport (IMPACT) – Deliverable 2, Delft, CE.

Doppler, K. and Lauterburg, C., (1997), *Change Management*, Campus-Verlag, Frankfurt/New York

Dovbischuk, I., (2015), *Sustainable regional development through the establishment of innovation-oriented cluster management*, Verlag Dr. Kovac, Hamburg

Drosse, V., (2014), *Managerial Accounting – Kosten-und Leistungsrechnung, Investitionsrechnung, Kennzahlen*, Schäffer-Poeschel-Verlag, Stuttgart

Dudzik, T., (2006), *Die Werbewirkung von Sportsponsoring,* Deutscher Universitäts-Verlag, Wiesbaden

Ebner, G. and Goiser, T., (2015), *CSR und Risikomanagement,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.571-580, Springer Gabler Verlag, Berlin Heidelberg

Eckardt, S., (2015), Messung des Innovations- und Intrapreneurship-Klimas – eine quantitativ-empirische Analyse, Springer-Fachmedien, Wiesbaden

Eggert, M. and Fliess, S., (2015), *Service Value aus Kundensicht – Kundenaktivitäten als Ausgangspunkt,* in: Bruhn. M. and Hadwich, K. (eds.), Interaktive Wertschöpfung durch Dienstleistungen – strategische Ausrichtung von Kundeninteraktionen, Geschäftsmodellen und sozialen Netzwerken, Springer-Fachmedien, Wiesbaden, 2015

Eggink, M. (2012), *Innovation system performance: how to address the measurement of a system's performance*, in: „Journal of Innovation and Business Best Practices", vol. 2012, pp.1-9

Ehrenmann, F., (2015), *Kosten- und zeiteffizienter Wandel von Produktionssystemen – ein Ansatz für ein ausgewogenes Change Management von Produktionsnetzwerken*, Springer-Fachmedien, Wiesbaden

Eiselt, J., (2012), *Dezentrale Energiewende – Chancen und Herausforderungen*, Springer-Fachmedien, Wiesbaden

Eller, T.F., (2015), *Eine konzeptionelle Analyse der Service Profit Chain*, in Meyer, A. (ed.), Aktuelle Aspekte in der Dienstleistungsforschung, Springer Fachmedien, Wiesbaden

Engel, C., Hanzel, R. and Helm, R., (2015), *Gestaltung von internationalen Service-Netzwerken im industriellen Anlagengeschäft,* in Grünert, L., Horbarth, P. and Seiter, M. (eds.), Steuerung von industrial service networks, zfbf-Sonderheft 69/15, pp.79-94, Handelsblatt Fachmedien, Düsseldorf

Enste, D. and Wildner, J., (2014), *Mitverantwortung und Moral – eine unternehmerische Reflexion*, Institut der deutschen Wirtschaft, Köln

Erber, S., (2005), *Eventmarketing - Erlebnisstrategien für Marken,* mi-Fachverlag, Redline GmbH, Landsberg am Lech

Esser, L. and Seiter, M., (2015), *Industrial Service Networks – Spezifika und Überblick über den Stand der Forschung,* in Grünert, L., Horbarth, P. and Seiter, M. (eds.), Steuerung von industrial service networks, zfbf-Sonderheft 69/15, pp.1-16, Handelsblatt Fachmedien, Düsseldorf

Fell, H. (2013), *Globale Abkühlung*, Beuth-Verlag, Berlin-Wien-Zuerich

Fernandez, I., (2013), *Cybersecurity for Industrial Automation & Control Environments*, in: Frost & Sullivan Whitepaper, available at: http://www2.schneider-electric.com/documents/support/white-papers/white-paper-cybersecurity-for-industrial-automation-control.pdf, [accessed 2015-10-26]

Ferreira, A., Nunes, M., Teixeira, S.and Martins, L., (2014), *Technical-economic evaluation of cogeneration technology considering carbon emission savings*, in "International Journal of Sustainable Energy Planning and Management", vol. 02, 2014, pp.33-46

Franceschini, F., Galetto, M. & Maisano, D., (2007), *Management by Measurement – Designing key indicators and performance measurement systems*, Springer-Verlag Berlin, Heidelberg, New York

Freund, D., (2013), *Wertschöpfende und innovationsorientierte Unternehmensführung*, Springer-Verlag, Berlin/Heidelberg

Fries, A., Riess, B. and Brink, A., (2015), *CRI Corporate Responsibility Index 2013 – Erfolgsfakoren unternehmerischer Verantwortung,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.359-380, Springer Gabler Verlag, Berlin Heidelberg

Gardner, M.P. and Shuman, P.J., (1987), *Sponsorship: an important component of the promotion mix*, in: "Journal of Advertising", vol.16, issue 1, pp.11-17

Gassmann, M, (2014), *Die grüne Lüge – Nachhaltigkeit ist wichtig sagen alle, doch die deutschen Konsumenten handeln anders*, in „Die Welt", 26.Aug.2014, p.12

Gassmann, O. and Enkel, E., (2004), *Towards a theory of open innovation: three core prpcess archetypes,* Tagungsband R&D Management Conference (RND'04), Lissabon

Gebauer, J., (2014), *Nachhaltigkeitsberichterstattung zivilgesellschaftlciher Organisationen – Beobachtungen zu einem 'emerging topic',* in Fifka, M., CSR und Reporting, pp.133-148, Springer-Verlag, Berlin Heidelberg

Gelbmann, U, Rauter, R., Engert, S. and Baumgartner, R.J., (2013), *CSR-innovations in SMEs (small and medium sized enterprizes)*, in Altenburger, R. (ed.), CSR und Innovationsmanagement – Gesellschaftliche Verantwortung als Innovationstreiber und Wettbewerbsvorteil, Springer Gabler, Berlin-Heidelberg

Geisendorf, S., (2001), *Evolutorische ökologische Ökonomie*, Metropolis-Verlag, Marburg

Gerkhardt, M. and Frey, D., (2006), *Erfolgsfaktoren und psychologische Hintergründe in Veränderungsprozessen*, in. „OrganisationsEntwicklung", vol.4, pp.48-59

Gerth, C., (2013), *Business Process Models – Change Management*, Springer-Verlag, Berlin/Heidelberg

Gerybadze, A., (2004), *Technologie- und Innovationsmanagement – Strategie, Organisation und Implementierung*, Franz Vahlen, München

Geschwill, R., (2015), *Der Rhythmus der Innovation – was Manager und Unternehmen von Jazzern und anderen Künstlern lernen können*, Springer-Fachmedien, Wiesbaden

Giese, A., (2012), *Differenziertes performance measurement in supply chains*, Springer-Fachmedien, Wiesbaden

Gilles, C., Knöpfel, H., Koch, G., Pannenbäcker, K., Pérez-Polo, F. & Seabury, C., (2004), *Comparison between ICB and other Project Management Standards*, International Project Management Association, [online], IPMA, available at http://aeipro.com/files/aeipro/informe_de_la_comparacion.29.pdf, [accessed 2014-10-10]

Gladen, W., (2014), *Performance measurement – controlling mit Kennzahlen*, Springer-Fachmedien, Wiesbaden

Graf, N., (2014), *Innovationen im Personalmanagement – die spannendsten Entwicklungen aus der HR-Szene und ihr Nutzen für Unternehmen*, Springer-Fachmedien, Wiesbaden, 2014

Grieshuber, E., (2015), *CSR als Hebel für ganzheitliche Innovation,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle

Unternehmensführung in Theorie und Praxis, pp.581-594, Springer Gabler Verlag, Berlin Heidelberg

Grimshaw, D. and Miozzo, M., (2006), *Institutional effects on the IT outsourcing market:analyzing clients, suppliers and staff transfer in Germany and the UK*, in: "Organization Studies", 27 (9), pp. 1229-1259

Grohte, A. and Marke, N., (2012), *Nachhaltiges Wirtschaften – eine besondere Herausforderung für KMU*, in Grohte, A. (ed.) Nachhaltiges Wirtschaften für KMU, oekom-Verlag, München

Großklaus, R., (2014), *Von der Produktidee zum Markterfolg – Innovationen planen, einführen und erfolgreich managen*, Springer-Fachmedien, Wiesbaden, 2014

Grunwald, G. & Hempelmann, B., (2012), *Angewandte Marktforschung,* Oldenbourg-Verlag, München

Günther, M., (2105), *Energieeffizienz durch Erneuerbare Energien – Möglichkeiten, Potentiale, Systeme*, Springer Fachmedien, Wiesbaden

Hadad, S. and Gauca, O., (2014), *Social impact measurement in social entrepreneurial organizations*, in "Management & Marketing - Challenges for the Knowledge Society", vol. 9, no.2, pp. 119-136

Hartweg, H., Kaestner, R, Lohmann, H., Proff, M. and Wessels, M., (2015), *Verbesserung der Performance durch Open-Innovation-Ansätze*, Springer-Fachmedien, Wiesbaden

Haller, S., (2015), *Dienstleitungsmanagement - Grundlagen, Konzepte, Instrumente*, Springer Fachmedien, Wiesbaden

Hansen, E. and Klewitz, J., (2012), *Publicly mediated inter-organisational networks – a solution for sustainability-oriented innovation in SMEs?,* in Wagner, M. (ed.), entrepreneurship, innovation and sustainability, Greenleaf Publishing, Sheffield, pp. 254-278

Heesen, B. & Gruber, W., (2014), *Bilanzanalyse und Kennzahlen – fallorientierte Bilanzoptimierung*, Springer-Fachmedien, Wiesbaden

Heitkamp, C. and Rasmus, A., (2014), *Organisationale Kooperationsfähigkeit – wie Gründer die Wettbewerbsfähigkeit ihres Unternehmens steigern können*, in: Walter, A., Rasmus, A., Riesenhuber, F. Schmidthals, J. and Dickel, P. (eds.), Fallstudien zur Gründung und Entwicklung innovationsorientierter Unternehmen, Springer-Fachmedien, Wiesbaden

Hennike, P., (2010), *Ohne eine Effizienzrevolution sind nachhaltige Energiesysteme nicht realisierbar*, in: Dratwa,.F, Ebers, M., Pohl, A., Spiegel, B. and Strauch, G., (eds.), Energiewirtschaft in Europa – im Spannungsfeld zwischen Klimapolitik, Wettbewerb und Versorgungssicherheit, Springer-Verlag, Berlin-Heidelberg

Hentze, J. and Thies, B., (2012), *Unternehmensethik und Nachhaltigkeitsmanagement*, Haupt Verlag, Bern-Stuttgart-Wien

Hentze, J. and Thies, B., (2014), *Stakeholder-Management und Nachhaltigkeitsreporting*, Springer-Verlag, Berlin Heidelberg

Hering, R, Schuppener, B. and Schuppener, N., (2010), *Leadership statt Management: Führung durch Kommunikation*, Haupt-erlag, Bern, Stuttgart, Wien

Herrmann, A. & Homburg, C., (2000), *Marktforschung,* Betriebswirtschaftlicher-Verlag-Gabler-GmbH, Wiesbaden

Hermanns, A., (1989), *Sponsoring - Zukunftsorientiertes Instrument der Marktkommunikation,* in Hermanns (ed.), Sport- und Kultursponsoring, Verlag Franz Vahlen GmbH, München, pp. 1-14

Herstatt, C. and Nedon, V., (2014*), Open Innovation – eine Bestandsaufnahme aus Sicht der Forschung und Entwicklung*, in: Schulz, C. and Hölzle, K., (eds.), Motoren der Innovation – Zukunftsperspektiven der Innovationsforschung, Springer-Fachmedien, Wiesbaden

Hieke, S., Grunert, K. and Wills, J., (2015), *Nachhaltige Gütesiegel und ihre Rollen im Verbraucherverhalten*, in Weber, T. (ed.), CSR und Produktmanagement – langfristige Wettbewerbsvorteile durch nachhaltige Produkte, pp.69-96, Springer-Verlag, Berlin-Heidelberg

Hobday, M., (2000), *The project based organization: an ideal form for managing complex products and systems?,* in „Research Policy Journal", No.29, pp.871-893.

Hockerts, K. and Morsing, M., (2006), *A literature review on corporate social responsibility in the innovation process*, Copenhagen Business school (CBS), Center for corporate social responsibility

Hoffmann, O., (2014), *Innovation neu denken – histozentrierte Analyse der Innovationsmechanismen der Uhrenindustrie*, Springer-Fachmedien, Wiesbaden

Hogreve, J. and Velleuer, M., (2015), *Industrial Service Networks erfolgreich steuern,* in Grünert, L., Horbarth, P. and Seiter, M. (eds.), Steuerung von industrial service networks, zfbf-Sonderheft 69/15, pp.35-59, Handelsblatt Fachmedien, Düsseldorf

Hohan, A., Weber, G. and Rizea, C., (2014), *Case study of implementing an information security management framework in a green energy production plant*, in: proceedings of the 2014 International Conference on Production Research – regional Conference Europe, Africa and Middle East, and 3rd International Conference on Quality and Innovation in engineering and Management, Cluj-Napoca, Romania, 07/01-07/05/2014, pp. 241-247, Technical University of Cluj-Napoca, Romania

Homburg, C. & Krohmer, H., (2009), *Marketingmanagement,* Gabler-GWV-Fachverlage-GmbH, Wiesbaden

Howells, J., (2006), *Outsourcing for innovation: systems of innovation and the role of knowledge intermediaries,* in: Miozzo, M. and Grimshaw, D., Eds., 2006, Knowledge intensive business services: organizational forms and national institutions, pp. 61-81. Cheltenham, UK: Edward Elgar

Hube, G. and Engelhardt, F., (2014), *Strategisches Innovationsmanagement für kleine und mittlere Unternehmen*, in Granig, P., Hartlieb, E. and Lercher, H., (eds.), Innovationsstrategien – von Produkten und Dienstleistungen zu Geschäftsmodellinnovationen, Springer-Fachmedien, Wiesbaden, 2014

Jacobson, M. & Delucchi, M., (2009), *A plan to power 100% of the planet with renewables*, in "Scientific American", November 2009

Jasch, C., (2015), *CSR und Berichterstattung,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.595-606, Springer Gabler Verlag, Berlin Heidelberg

Jetschny, W. and Franke-Jordan, S., (2011), *Lösungsfindung im Innovationsprozess*, in Schmauder, M. (ed.), Technologietransfer - Anbahnung und Durchführung von Forschungskooperationen, CIMTT Zentrum für Produktionstechnik und Organisation, TU Dresden, pp. 89-97

Journard, R. and Gundmundsson, H., (2010), *Indicators of environmental sustainability in transport,* available online: https://halshs.archives-ouvertes.fr/file/index/docid/492823/filename/Indicators_EST_May_2010.pdf,[accessed 2016-02-02]

Kandemir, T. and Görgülü, M., (2010), *The role of energy economics in sustainable development*, 2nd International Symposium on Sustainable Development, June 8-9, 2010, Sarajevo

Kaschny, M., Nolden, M. and Schreuder, S., (2015), *Innovationsmanagement im Mittelstand – Strategien, Implementierung Praxisbeispiele*, Springer Fachmedien, Wiesbaden

Kaudela-Baum, S., Holzer, J. and Kocher, P.Y., (2014), *Innovation Leadership – Führung zwischen Freiheit und Norm*, Springer-Fachmedien, Wiesbaden

Kausch, P., Bertau, M., Gutzmer, J. & Matschullat, J., (2011), *Energie und Rohstoffe,* Spektrum-Akademischer-Verlag, Heidelberg

Kausch, P., Bertau., M., Gutzmer, J. & Matuschallat, J. (2014), *Strategische Rohstoffe – Riskovorsorg*e, Spriner-Verlag, Berlin-Heidelberg

Keller-Kern, H. and Prox, C., (2014), *CSR auf dem Prüfstand – die Sicht der Deutschen auf die gesellschaftliche Verantwortung der Wirtschaft*, in Kirchhof, A-C. and Nickel, O. (eds.), CSR und Brand Management – Marken nachhaltig führen, pp.37-52, Springer-Verlag, Berlin Heidelberg

Kemfert, C.,(2013), *Kampf um Strom,* Murmann-Verlag, Hamburg

Kermeli, K., Graus, W. and Worrell, E., (2014), *Energy efficiency improvement potentials and low energy demand scenario for the global industrial sector*, in "Energy Efficiency", vol.7, issue 6, 2014, pp.987-1011

Kerzner, H., (2011), *Strategic Planning for Project Management Using a Project Management Maturity Model*, New Jersey, NJ: John Wiley and Sons

Kiesewetter, G., Borken-Kleefeld, J., Schöpp, W., Heyes, C.,Thunis, P., Bessagnet, B., Terenoire, E. & Fagerli, H., Nyiri, A. & Amann, M., (2015), *Modelling street level PM10 concentrations across Europe: source apportionment and possible futures*, in "Atmos. Chem. Phys.", vol. 15, pp.1539–1553

Kirschner, R.J., (2012), *Methodische offene Produktentwicklung*, TU München

Kleidon, A.,& Renner, M., (2013), *Geoengineering kann den Klimawandel nicht aufhalten,* Max-Plack-Gesellschaft, available at http://www.mpg.de/7649323/ geoengineering_klimawandel_wasserkreislauf, [accessed 2015-08-20]

Kloss, I., (1998), *Werbung,* Oldenbourg Verlag, München

Knab, S., Rohrbeck, R. and Konnertz, L., (2014), *Kooperative Geschäftsmodellentwicklung für systemische Nachhaltigkeitsinnovationen: eine Fallstudie im deutschen Smart-Energy-Markt*, in: Schallmo, R.A., (ed.), Kompendium Geschäftsmodellinnovation – Grundlagen, aktuelle Ansätze und Fallbeispiele zur erfolgreichen Geschäftsmodellinnovation, Springer-Fachmedien, Wiesbaden

Koch, J., (2012), *Marktforschung,* Oldenbourg-Wissenschaftsverlag, Nürnberg

Kohleick, H., (2008), *Designing outsourcing relations in knowlegde intensive business services*, Kölner Wissenschaftsverlag, Cologne

Kohlhof, J., Dettmann, U. and Berner C., (2006), *Ethik im Unternehmen – Leitfaden für die ethische Auditierung nachhaltigen Wirtschaftens*, Beuth Verlag, Berlin

Kolb, A. & Wacker, M., (1995), *Calculation of energy consumption and pollutant emissions on freight transport routes*, in „The Science of the Total Environment", vol.169 (1-3), pp.283-288.

Kolbusa, M., (2013), *Umsetzungsmanagement – Wieso aus guten Strategien und Veränderungen häufig nichts wird,* Springer-Gabler-Verlag, Wiesbaden

Kotler, P., (1982), *Marketing Management,* J.B.Metzlersche Verlagsbuchhandlung und Carl Ernst Poeschel Verlag GmbH, Stuttgart

Kotter, J.P., (1996), *Leading change*, Harvard Business School Press, Boston

Kuhlen, B., (2005), *Corporate Social Responsibility (CSR) – die ethische Verantwortung von Unternehmen für Ökologie, Ökonomie und Sozioales*, Deutscher Wissenschaftsverlag (DWV), Baden-Baden

Kunert, S., (2014), *Open Innovation im Ideenmanagement*, in: Scholl, W., Schmelzer, F., Kunert, S., Bedenk, S., Hüttner, J, Pullen, J. and Tirre, S. (eds.), Mut zu Innovationen – Impulse aus Forschung, Beratung und Ausbildung, Springer Verlag, Berlin-Heidelberg

Kuratko, D., Hornsby, J. and Hayton, J., (2015), *Corporate entrepreneurship: the innovative challenge for a new global economic reality*, in “Small Bus Econ”, vol.45, pp.245-253

Krause, H. & Arona, D., (2010), *Key Performance Indicators – bi-lingual compendium*, Oldenbourg Wissenschaftsverlag, München

Krell, P., (2014), *Immaterielle Belohnungen, individuelle Kreativität und Innovationen in KMU – eine empirische Analyse des mittleren und oberen Managements*, Springer-Fachmedien, Wiesbaden

Kreis, M., (2015), *Mutmacher: Unternehmen stärken durch mutige Führung*, Springer-Fachmedien, Wiesbaden

Kreutzer,R., (2014), *Notwendigkeit eines Change-Managements im Online-Zeitalter – Grundprinzipien zu einer erfolgreichen digitalen Transformation*, Springer-Fachmedien, Wiesbaden

Kronenberg, C., Ortner, S., Peters, M. and Zampol, C., (2010), *Die Erfassung der Risikowahrnehmung von Unternehmern*, in: Pechlaner, H., Raich, M., Schön, S. and Matzler, K., (2010) Change Leadership – den Wandel antizipieren und aktiv gestalten, Gabler-Verlag/Springer-Fachmedien, Wiesbaden

Kroy, W., (1995), *Technologiemanagement für grundlegende Innovationen*, in Zahn, E. (ed.) Handbuch Technologiemanagement, Stuttgart, pp. 57-79

Krüger, W., (2014), *Strategische Erneuerung: Probleme und Prozesse*, in: Krüger, W. and Bach, N., (eds.), Excellence in Change – Wege zur strategischen Erneuerung, Sringer-Fachmedien, Wiesbaden

Küchler, S., (2013), *Ausnahmeregelungen für die Industrie bei Energie- und Strompreisen*, FÖS – Forum Ökologisch-Soziale Marktwirtschaft, Berlin

Kühnapfel J., (2014), *Vertriebskennzahlen – Kennzahlen und Kennzahlensysteme für das Vertriebsmanagement*, Springer-Fachmedien, Wiesbaden

Kusiak, A., (2007), *Innovation science: a primer*, in “International. J. Computer Application in Technology”, vol. 28, no. 2-3, p.148

Langeheine, J., (2012), *Energiepolitik in Deutschland,* Athene-Media-Verlag, Heidelberg

Langner R., (2011), *Cracking Stuxnet, a 21st-century cyber weapon*, available at: http://www.ted.com/talks/ralph_langner_cracking_stuxnet_a_21st_century_cyberweapon/transcript?language=en, [accessed 2015-10-26]

Lauer, T., (2014), *Change Management – Grundlagen und Erfolgsfaktoren*, Springer-Verlag, Berlin/Heidelberg

Leiponen, A., (2005), *Organization of knowledge and innovation: the case of Finish business services*, in: “Industry and Innovation”, 12 (2): pp. 185-203

Leiponen, A., (2006), *Managing knowledge for innovation: the case of business-to-business services*, in: "Journal of Product Innovation Management", 23 (3): pp. 238-258

Lendermann, M., (2015), *Policy measures to increase energy efficiency in Germany's industrial sector,* South-African-German Energy Efficiency Conference "Energy Efficiency in the Industry", 16. June, 2015, Berlin, Germany

Lerch, C., (2015*), Interaktion von Produkt- und Dienstleistungsinnovationen – eine Anlayse von Wechselwirkungen in Industrieunternehmen*, Springer-Fachmedien, Wiesbaden

Lesmeister, F., (2001), *Verbesserte Produktplanung durch den problemorientierten Einsatz präventiver Qualitätsmanagementmethoden*, RWTH, Aachen

Levinson, W. A. & Rerick, R., (2002), *Lean Enterprise: A Synergistic Approach to Minimizing Waste*, ASQ Quality Press, Milwaukee, WI

Lisson, M., (2015), *Das novellierte EDL-G: 2015 die aktuelle Situation für Großunternehmen in Deutschland und in der EU,* Deutscher Kongress für Energie-Effizienz, 01-02.12.2015, Köln, Germany

Loew, T., Clausen, J. and Rohde, F., (2011), CSR und Risikomanagement – gesetzliches und frewilliges Risikomanagement und die Rolle von Corporate Social Responsibility (CSR), institute4sustainability, available at: http://www.4sustainability.de/fileadmin/redakteur/bilder/Publikationen/Loew-Clausen-Rohde_CSR_und_Risikomanagement_2011.pdf, [accessed 2016-02-02]

Lorenzi, P., (2003*), Entwicklung einer Qualitätsmanagementmethode für die antizipative Kundenbedarfsanalyse*, RWTH, Aachen

Lorson, P., Quick, R. & Wurl, H., (2013), *Grundlagen des Controllings*, Wiley-VCH Verlag, Weinheim

Lotter, D. and Braun, J., (2014), *Der CSR-Manager – Unternehmensverantwortung in der Praxis*, Altop-Verlag, München

Lozano, R., (2015*), A holistic perspective on corporate sustainability drivers*, in „Corp. Soc. Responsib.Environ. Mgmt.", issue 22, pp.32-44

MacDonell, M., Raymond, M., Burganowski, R., Vetrone, A. & Alonzo, S., (2014), *Considering Environmental Health Risks of Energy Options:Hydraulic Fracturing and Nuclear Power*, in "Proceedings of the 28th EnviroInfo 2014 Conference", Oldenburg, Germany September 10-12, 2014, available at http://enviroinfo.eu/sites/default/files/pdfs/vol8514/0135.pdf, [accessed: 2014-10-16]

Macharzina, K. and Wolf, J., (2012), *Unternehmensführung*, 7th edition, Gabler Verlag, Wiesbaden

Maier, A., Brad, S., Nicoară D. and Maier, D., (2013), *Business Success through Innovation Management; a Literature Review of Innovation Process Models*, in "International Journal of Social and Human Sciences", special issue 74, p. 16-19

Maier, D., Olaru, M., Weber, G. and Maier, A., (2014), *Business success by understanding the process of innovation*, in: proceedings of 9th European Conference on Innovation and entrepreneurship (ECIE 2014), Belfast, Northern Ireland, 09/18-09/19/2014, pp. 534-538, University of Ulster Business School and School of Social Enterprises

Maubach, K., (2014), *Energiewende – Wege zu einer bezahlbaren Energieversorgung*, Springer-Fachmedien, Wiesbaden

Mare, C., Dragoş, S.L., Lazăr, D.T. and Dragoş, C.M., (2013), *Consumer protection through prices: an analysis of the energetic sector in European Union countries*, in: "Amfiteatru Economic Journal", vol. XV, no. 34/2013, pp.327-341

Marin, G. (2013). *A comparative study on the European renewable energy sources facing globalization*, in "Management & Marketing", Vol. 8, No. 4, pp. 723-746.

Marin, G. & Weber, G., (2014), *Considerations on strategic policies and evaluation criteria for a sustainable transport*, in: proceedings of 13th International Conference on Informatics in Economy, Education, Research & Business Technologies, Bucharest, Romania, 05/15-05/18/2014, Bucharest University of Economic Studies (ASE),

Matuszek, G., (2013*), Management der Nachhaltigkeit*, Springer-Gabler-Verlag, Wiesbaden

McManners, P., (2014), *Corporate strategy in the age of responsibility*, Gower Publishing Limited, Farnham

Mescheder, B. and Sallach, C., (2012), *Wettbewerbsvorteile durch Wissen – Knowledge Management, CRM und Change Management verbinden*, Springer Verlag, Berlin/Heidelberg

Meffert, H., Bruhn, M. and Hadwich, K., (2015), *Dienstleistungsmarketing – Grundlagen, Konzepte, Methoden,* Springer Fachmedien, Wiesbaden

Michelsen, G. and Adomßent, M., (2014), *Nachhaltige Entwicklung: Hintergründe und Zusammenhänge*, in: Heinrichs, H. and Michelsen, G. (eds.), Nachhaltigkeitswissenschaften, pp.3-54, Springer-Verlag, Berlin Heidelberg

Mihic, M. (2011), *Strategic Project Management,* Beograd, BGg: Zaduzbina, Andrejevic

Miles, I., (2001), *Knowledge intensive business services revisited,* Maklu, Antwerp

Miles, I., Kastrinos, N., Flanagan, K., Bilderbeek, R., den Hertog, P., Huntink, W. and Bouman, M., (1994), *Knowledge intensive business services: their roles as users, carriers and sources of innovation*, University of Manchester (PREST), Manchester

Milke, K., (2014), *Rechte für Menschen – Regeln für Unternehmen: Was erwartet die Zivilgesellschaft von Markenunternehmen und einer fairen und zukunftsfähigen Wirtschaft?,* in Kirchhof, A-C. and Nickel, O. (eds.), CSR und Brand Management – Marken nachhaltig führen, pp.63-76, Springer-Verlag, Berlin Heidelberg

Miozzo, M. and Grimshaw, D., (2005), *Modularity and innovation in knowledge intensive business services: IT outsourcing in Germany and the UK*, in: "Research Policy", 34: pp. 1419-1439

Miozzo, M. and Grimshaw, D., (2006), *Knowledge intensive business services: understanding organizational forms and the role of country institutions*, UK: Edward Elgar, Cheltenham

Mory, L., (2014), *Soziale Verantwortung nach innen – Dimensionen, Wirkungsbeziehungen und Erfolgsgrößen einer internen CSR*, Springer Fachmedien, Wiesbaden

Morrison-Paul, C. and Siegel, D., (2006), *Corporate social responsibility and economic performance*, in "Journal of Productivity Analysis", vol. 26, iss.3, pp.207-211

Mükusch, C., (2011), *Vernetzte Sicherheit*, Springer-Fachmedien, Wiesbaden

Müller, E., Engelmann, J., Löffler, T. and Strauch, J., (2013), *Energieeffiziente Fabriken planen und betreiben,* Springer-Verlag, Berlin Heidelberg

Müller-Seitz, G., (2015), *Strategische Führung in Industrial Service Networks: Leitgedanken zu Chancen und Grenzen aus Sicht von KMU,* in Grünert, L., Horbarth, P. and Seiter, M. (eds.), Steuerung von industrial service networks, zfbf-Sonderheft 69/15, pp. 17-34, Handelsblatt Fachmedien, Düsseldorf

Müller-Schwemer, T. & Sorg, G., (2006), *Was Sie schon immer über Sponsoring wissen wollten*, in „Marketing- und Vertriebspower durch Sponsoring", Springer-Verlag, Berlin, pp. 1-38.

Namokel, H. and Rösner, D., (2010), *Change Management*, Symposium Publishing GmbH, Düsseldorf

Niederhausen, H. & Burkert, A., (2014), *Elektrischer Strom – Gestehung, Übertragung, Verteilung, Speicherung und Nutzung elektrischer Energie im Kontext der Energiewende*, Springer-Fachmedien, Wiesbaden

Nitsch, J., (2015), *Energiepreise sind Innovationstreiber*, in „Sonne, Wind & Wärme", vol.39, issue 7/8, pp.22-24

Noe, M, (2014), *Change-Prozesse effizient durchführen – mit Projektmanagement den Unternehmenswandel gestalten*, Springer-Fachmedien, Wiesbaden

Oerkermann, G., (2015), *Nachhaltige Produktgestaltung*, in Weber, T. (ed.), CSR und Produktmanagement – langfristige Wettbewerbsvorteile durch nachhaltige Produkte, pp.149-160, Springer-Verlag, Berlin-Heidelberg

Olaru, M., Stoleriu, G. & Sandru, D., (2011), *Preocupations of SMEs in Romania regarding social performance in relation with the criteria of the 2010 edition of the*

European Model of Excellence Model, in „Amfiteatru Economic Journal", vol. XII, no.27, pp.10-27.

Olaru, M., Stoleriu, G. & Sandru, I.M.D., (2011b), *Social responsibility concerns of SME's in Romania, from the perspective of the requirements of the EFQM European Excellence model,* in „Amfiteatru Economic Journal", vol. XIII, no.29, pp.56-71.

Olaru, M., Pirnea, I.C., Hohan, A. & Maftei, M., (2014), *Performance indicators used by SMEs in Romania related to integrated management systems*,in „Procedia Social and Behavioral Sciences Journal", Elsevier, Vol.109, pp.949-953

Olaru, M., Sandru, M. & Pirnea, I.C., (2014b), *Monte Carlo method application for environmental risks impact assessment in investment projects*, in „Procedia Social and Behavioral Sciences Journal", Elsevier, Vol.109, pp.940-943.

Olbrich, R., Battenfeld, D. & Buhr, C., (2012), *Marktforschung,* Springer-Gabler-Verlag, Berlin-Heidelberg

Ortner, G., (2015), *Projektmanagement Outsourcing – Chancen und Grenzen erkennen*, Springer-Gabler-Verlag, Berlin-Heidelberg

Osburg, T. and Schmidpeter, R., (2013), *Gesellschaftliche Innovation als Managementprinzip,* in Altenburger, R. (ed.), CSR und Innovationsmanagement – Gesellschaftliche Verantwortung als Innovationstreiber und Wettbewerbsvorteil, Springer Gabler, Berlin-Heidelberg

Osterloh, M. and Boos, L., (2001), *Organisatorische Entwürfe von wissensintensiven Dienstleistungsunternehmen*, in: Dienstleitungsmanagement: Grundlagen, Konzepte, Erfahrungen. Gabler, Wiesbaden

Palanichamy, C., Naveen, P., Ing, W., Danquah, M. and Indumathi, J., (2015), *Energy efficiency enhancement of fossil-fueled power systems*, in "International Journal of Energy Economics and Policy", vol.5, issue 3, 2015, pp.765-771

Parker, J., (2012), *KPIs for business analysis and project management*, in *Business analysis and requirements management blog,* March 22 [online], available at http://blog.enfocussolutions.com/Powering_Requirements_Success/bid/128923/KPIs-for-Business-Analysis-and-Project-Management., [accessed 2014-10-10]

Pescher, J., (2010), Change Management – Taxonomie und Erfolgsauswirkungen, Gabler-Verlag, Wiesbaden

Petersen, D., (2011), *Den Wandel verändern – Change-Management anders gesehen*, Gabler-Verlag, Wiesbaden

Petersen, D. and Witschi, U., (2015), *Wandel durch Vernetzung – das Praxisbuch für nachhaltiges Change-Management*, Springer-Fachmedien, Wiesbaden

Pittner, M., (2014), *Strategische Kommunikation für LOHAS – nachhaltigkeitsorientierte Dialoggruppen im Lebensmitteleinzelhandel*, Springer Fachmedien, Wiesbaden

Pleschak, F. and Sabisch, H., (1996), *Innovationsmanagement*, Stuttgart

Popa, M. and Salanta, I., (2014), *Corporate social responsibility versus corporate social irresponsibility*, in “Management & Marketing - Challenges for the Knowledge Society”, vol. 9, no.2, pp. 137-146

Porter, M., (1991), *Nationale Wettbewerbsvorteile – erfolgreich konkurrieren auf dem Weltmarkt*, Droemer Knaur, München

Posselt, G., (2014), *Mitarbeiter führen mit Kennzahlen – attention leadership*, Springer-Fachmedien, Wiesbaden

Praag, C. and Versloot, P., (2007), *What is the value of entrepreneurship? A review of recent research*, in “Small Bus Econ”, vol.29, issue 4, pp.351-382

Preiss, P., Roos, J. & Friedrich, R., (2013), *Assessment of Health Impacts of Coal Fired Power Stations in Germany by Applying* EcoSenseWeb, Greenpeace & University of Stuttgart, available at https://www.greenpeace.de/sites/files/publications/greenpeace-studie-tod-aus-dem-schlot-s01652.pdf, [accessed 2015-08-20]

Preston, R., (2004), *Why outsource?*, available at: http://www.networkcomputing.com/careers-and-certifications/why-outsource/a/d-id/1210303,[accessed 2015-09-12]

Quaschning, V., (2016), Nur mäßig schlau: Der Smartmeterwahn, in „JOULE – Magazin für Energieprofis“, issue 1/2016, p.35

Reitz. F, Gerbaulet, C., Hischhausen, C., Kemfert, K., Lorent, C. & Oel, P., (2014), *Verminderte Kohleverstromung könnte zeitnah einen relevanten Beitrag zum deutschen Klimaschutzziel leisten*, in „DIW-Wochenbericht“, nr. 47-2014, pp. 1219-1229

Rest, J., (2011*), Grüner Kapitalismus- Klimawandel, globale Staatenkonkurrenz und die Verhinderung der Energiewende*, Springer-Fachmedien, Wiesbaden

Rinaldi, S. M., Peerenboom, J. P. and Kelly T. K., (2001), *Identifying, Understanding, and Analyzing Critical Infrastructure Interdepencies*, in: “IEEE Control Systems Magazine”

Rodrigue, J-P., Slack, B. & Comtois, C., (2013), *Green Supply Chain Management*, in J-P Rodrigue, J.P., Notteboom, T. and Shaw, J., (eds.), The Sage Handbook of Transport Studies, Sage, London

Rogers, E., (1983), *Diffusion of Innovations*, The Free Press, New York

Rohde, C., Rosenow, J., Wyre, N. and Giraudet, L., (2015), *Energy saving obligations – cutting the Gordian Knot of leverage?*, in “Energy Efficiency”, vol.8, issue 1, 2015, pp.129-140

Rosenstiel von, L., Hornstein von, E. and Augustin, S., (2012), *Change Management Praxisfälle – Veränderungsschwerpunkte Organisation, Team, Individuum,* Springer-Verlag, Berlin/Heidelberg

Rothe, M., (2015), *Absicherung des Innovationserfolges unter Berücksichtigung des Open-Innovation-Ansatzes*, Fraunhofer-Verlag, Stuttgart

Rothwell, R., (1992), *Successful industrial innovation: critical factors for the 1990s*, in "R&D Management", vol. 22, no. 3, pp. 221-39

Rothwell, R., (1994), *Towards the fifth-generation innovation process*, in "International Marketing Review", vol.11, no. 1, p. 7-31

Russwurm, S., (2013), *Software: Die Zukunft der Industrie*, in: Sendler, U. (ed.), Industrie 4.0 – Beherrschung der industriellen Komplexität mit SysLM, Springer-Verlag, Berlin/Heidelberg

Sachse, M., (2010), *Negative Kommunikationseffekte von Sponsoring und Ambush-Marketing bei Sportgroßveranstaltungen*, Gabler Springer Verlag, Wiesbaden

Sahut, J.M. and Peris-Ortiz, M., (2014), *Small business, innovation and entrepreneurship*, in "Small Bus Econ", vol.42, issue 4, pp.663-668

Sandru, M., Olaru, M., Pirnea, C. and Weber, G., (2014), *Multi project management KPIs*, in: proceedings of , 10h European Conference on Management, Leadership and Governance ECMLG 2014, Zagreb, Republic of Croatia, 11/13-11/14/2014, pp. 522-532, Vern' University of Applied Sciences

Saunders, H., (2015), *The unexploited potential for natural gas to greatly increase energy efficiency*, in "Energy Efficiency", vol.8, issue 2, 2015, pp.403-415

Schabbach, T. & Wesselak, V., (2012), *Energie – Die Zukunft wird erneuerbar*, Springer-Verlag, Berlin-Heidelberg

Schäfer, H., (2015), *Nachhaltigkeitsindizes,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.595-606, Springer Gabler Verlag, Berlin Heidelberg

Schalmo, D. and Brecht, L., (2014), *Prozessinnovation erfolgreich anwenden - Grundlagen und methodisches Vorgehen*, Springer-Verlag, Berlin und Heidelberg

Schaltegger, S. and Hansen, E., (2013), *Unternehmerische Nachhaltigkeitsinnovationen durch nachhaltiges Unternehmertum*, in Altenburger, R. (ed.), CSR und Innovationsmanagement – Gesellschaftliche Verantwortung als Innovationstreiber und Wettbewerbsvorteil, Springer Gabler, Berlin-Heidelberg

Schaltegger, S. (2014), *Nachhaltigkeitsberichterstattung zwischen Transparenzanspruch und Management der Nachhaltigkeitsleistung*, in Fifka, M., CSR und Reporting, pp.21-34, Springer-Verlag, Berlin Heidelberg

Schaltegger, S. (2015), *Die Beziehung zwischen CSR und Corporate Sustainability,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.199-210, Springer Gabler Verlag, Berlin Heidelberg

Scheffler, J., (2014), *Die gesetzliche Basis und Förderinstrumente der Energiewende – aktueller Stand des EEG und des KWK-G*, Springer-Fachmedien, Wiesbaden

Schenk, M., Wirth, S. & Mueller, E., (2010), *Factory Planning Manual – Situation-driven production and facility planning*, Springer-Verlag, Berlin-Heidelberg-New York

Schießl, N., (2015), *Innovation und Entrepreneurship - Intrapreneurship-Potentiale bei Mitarbeitern – Entwicklung, Optimierung und Validierung eines Diagnoseinstruments*, Springer-Fachmedien, Wiesbaden

Schinnenburg, H. and Schambeck, C., (2015), *Nachhaltiges Change Management,* in Griese, K.-M. (ed)., Nachhaltigkeitsmarketing, pp.401-421, Springer Fachmedien, Wiesbaden

Schleer, C., (2014), *Corporate Social Responsibility und die Kaufentscheidung der Konsumenten*, Springer Fachmedien, Wiesbaden

Schmidpeter, A., (2015b), *CSR, Sustainable Entrepreneurship und Social Innovation – Neue Ansätze der Betriebswirtschaftslehre,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp. 135-145, Springer Gabler Verlag, Berlin Heidelberg

Schmiedeknecht, M. and Wieland J., (2015), *ISO26000, 7 Grundsätze, 6 Kernthemen,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.299-310, Springer Gabler Verlag, Berlin Heidelberg

Schneider, A., (2015), *Reifegradmodell CSR – eine Begriffserklärung und Abgrenzung*, in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp. 21-42, Springer Gabler Verlag, Berlin Heidelberg

Scholl, W., (2014), *Innovationskultur, Innovationsprozesse und Innovationserfolge*, in: Scholl, W., Schmelzer, F., Kunert, S., Bedenk, S., Hüttner, J, Pullen, J. and Tirre, S. (eds.), Mut zu Innovationen – Impulse aus Forschung, Beratung und Ausbildung, Springer Verlag, Berlin-Heidelberg

Schreck, P., (2015), *Der Business case for Corporate Social Responsibility,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.71-88, Springer Gabler Verlag, Berlin Heidelberg

Schulte, S., (2006), *Integration von Kundenfeedback in die Produktentwicklung zur Optimierung der Kundenzufriedenheit*, Ruhr-Universität, Bochum

Schulz, O., (2015), *Nachhaltige ganzheitliche Wertschöpfungsketten,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp.325-338, Springer Gabler Verlag, Berlin Heidelberg

Schuster, T & Collenberg, L., (2015), *Finanzierung: Finanzberichte, -kennzahlen, -planung*, Springer-Verlag, Berlin-Heidelberg

Schwarz, S. and Hofmann, J., (2013), *Attribute Idea Evaluation – Anwendung einer neuen Methode zur Bewertung von Service Innovationen*, in „11th International Conference on Wirtschaftsinformatik“, Leipzig

Seiter, M. and Marquard, C., (2015), *Steuerung der Partner in Industrial Service Networks – Anreizsysteme als zentrales Steuerungsinstrument,* in Grünert, L., Horbarth, P. and Seiter, M. (eds.), Steuerung von industrial service networks, zfbf-Sonderheft 69/15, pp.60-78, Handelsblatt Fachmedien, Düsseldorf

Shah, V. and Bandi, R.K., (2003), *Capability development in knowledge intensive IT-enabled services*, in: "European Journal of Work and Organizational Psychology", 12 (4), pp. 418-427

Siebert, Y., (2013), *Einstellungs- und Verhaltenwirkungen im Event-Sponsoring - Wirkungsmodell, Befunde und Implikationen,*Springer-Fachmedien, Wiesbaden

Sohre, A., (2014), *Strategien in der Energie- und Klimapolitik – Bedingungen strategischer Steuerung der Energiewende in Deutschland und Großbritannien*, Springer-Fachmedien, Wiesbaden

Solorio, I, Öller, E. & Jörgens, H., (2014), *The German energy transition in the context of the EU renewable energy policy – a reality check*, in Brunnengräber, A. and Di Nuci, M., (eds.), Im Hürdenlauf zur Energiewende – von Transformationen, Reformen und Innovationen, Springer-Fachmedien, Wiesbaden, pp.189-200

Sommer, A., (2012), *Managing Green Business Model Transformations*, Springer Verlag, Heidelberg/New York/London

Spraggins, H. B., (2010), *The impact of rail freight transportation upon environmental sustainability,* in „Journal of Academy of Business and Economics", 10(2), pp. 91

Spindler, G.-I., (2011), *Querdenken im Marketing – Wie Sie die Regeln im Markt zu Ihrem Vorteil verändern*, Gabler-Verlag, Wiesbaden

Stark, W., (2013), *Verantwortung und Innovation: corporate social innovation,* in Altenburger, R. (ed.), CSR und Innovationsmanagement – Gesellschaftliche Verantwortung als Innovationstreiber und Wettbewerbsvorteil, Springer Gabler, Berlin-Heidelberg

Staufer, I.M., (2015), *Akzeptanz ökologischer Produktinnovationen im Automobilbereich*, Springer-Fachmedien, Wiesbaden

Steinhauer, R., (2015*), Strategische Flexibilität bei Geschäftsmodell-Evolutionen*, Verlag Dr. Kovac, Hamburg

Stollenwerk, A., (2012), *Wertschöpfungsmanagement im Einkauf – Analysen – Strategien – Methoden – Kennzahlen*, Springer-Fachmedien, Wiesbaden

Stolzenberg, K. and Heberle, K., (2013), *Change Management – Veränderungsprozesse erfolgreich gestalten – Mitarbeiter mobilisieren. Vision, Kommunikation, Beteiligung, Qualifizierung*, Springer Verlag, Berlin/Heidelberg

Studt, J., (2013), *Persönliches Change Management*, Springer Gabler Verlag, Wiesbaden

Suchanek, A., (2015), *Unternehmensethik*, Mohr Siebeck Verlag, Tübingen

Suchanek, A., (2015b), *Vertrauen als Grundlage nachhaltiger unternehmerischer Wertschöpfung,* in Schneider, A. and Schmidpeter, R. (eds)., Corporate Social Responsibility - verantwortungsvolle Unternehmensführung in Theorie und Praxis, pp. 59-70, Springer Gabler Verlag, Berlin Heidelberg

Sundt, S. and Rehdanz, K., (2015), *Consumers' willingness to pay for green electricity: a meta-analysis of the literature*, in "Energy Economics", vol.51, 2015, pp.1-8

Surugiu, I., Weber, G. & Mailinger, W., (2015), *Sustainability in transport – a study regarding energy efficiency in maritime, road and rail transport*, Supplement of "Quality Access to Success", Vol. 16, nr. 1, pp. 281-289, 2015, Editura SRAC, Bucureşti, România

Sweeny, J., (2013), *Economics of energy*, Stanford University vol.4.9, article 48, available at: http://web.stanford.edu/~jsweeney/paper/Energy%20Economics.PDF, [accessed 2016-04-13]

Tantau, A.D. and Nichifor, M.N., (2014), *Specific business models in the wind energy field in the European Union: comparative study on Romania and Germany*, in "Management & Marketing – Challenges for the Knowledge Society", vol.9, no.3, pp.301-316

Teucher, T., (2013), *Die Reise einer Idee – Nachhaltigkeit*, in "forum – nachhaltig wirtschaften", no.01/2013, pp.42-44

Tilmes, S. (2013), *The hydrological impact of geoengineering in the Geoengineering Model Intercomparison Project (GeoMIP*), in "Journal of Geophysical Research: Atmosphaire", vol. 118, issue 19, 16 October 2013, pp.11,036–11,058

Todorovic, M., Zorica, M. & Bjelica D.; (2013), *Measuring Project Success in Project-Oriented Organizations*, in „Management Journal for Theory and Practice Management", no.68, pp.41-48.

Trout, J. and Wied, L., (2014), *Positionierung von Innovationen*, in Granig, P., Hartlieb, E. and Lercher, H., (eds.), Innovationsstrategien – von Produkten und Dienstleistungen zu Geschäftsmodellinnovationen, Springer-Fachmedien, Wiesbaden, 2014

Vahs, D. and Schäfer-Kunz, J., (2012), *Einführung in die Betriebswirtschaftslehre*, 6th edition, Schäfer-Poeschel-Verlag, Stuttgart

Vahs, D. and Brem, A., (2013), *Innovationsmanagement – von der Idee zur erfolgreichen Vermarktung,* Schäffer-Poeschel-Verlag, Stuttgart

Van de Ven, A., (1986), *Central problems in the management of innovation,* in "Management Science", vol.32, no.5, pp.590-607

Van de Vrande, V., de Jong, J.P., Vanhaverbeke, W. and de Rochemont, M., (2009), *Open innovation in SMEs: trends, motives and management challenges*, in "Technovation", vol.29, no.6, pp.423-437

Vitt, J., Franz, P., Kleinfeld, A. and Thorns, M, (2011), *Gesellschaftliche Verantwortung nach DIN ISO 26000*, Beuth Verlag, Berlin-Wien-Zurich

Wänn, A., Connolly, D. and Gallachoir, B., (2014), *Investigating 100% renewable energy supply at regional level using scenario analysis*, in "International Journal of Sustainable Energy Planning and Management", vol. 03, 2014, pp.21-32

Wakefield, K. and Bennett, G., (2010), *Affective intensity and sponsor identification*, in: "Journal of Advertising", vol. 39, issue 3, pp.99-111

Wallikewitz, D. and Schymczyk, D., (2015), *Corporate Social Responsility in Energieversorgungsunternehmen: Chancen und Herausforderungen zwischen sozialer Verantwortung, Unternehmenskommunikation und ökonomischer Betrachtungsweise*, in Weber, T. (ed.), CSR und Produktmanagement – langfristige Wettbewerbsvorteile durch nachhaltige Produkte, pp.209-226, Springer-Verlag, Berlin-Heidelberg

Walliser, B., (1995), *Sponsoring,* Betriebswirtschaftlicher Verlag Gabler, Dr. Th. Gabler GmbH, Wiesbaden

Walraven, M., Bijmolt, T. and Koning, H., (2014), *Dynamic effects of sponsoring: how sponsorship awareness develops over time,* in: "Journal of Advertising", vol. 43, issue 2, pp.142-154

Wara, M., (2014), *Building an effective climate regime while avoiding carbon and energy stalemate* (January 10, 2014), available at http://ssrn.com/abstract=2377447 or http://dx.doi.org/10.2139/ssrn.2377447, [accessed 2015-08-20]

Weber J., Hamprecht M. & Goeldel H., (1995), *Benchmarking des Controlling: Ein Ansatz zur Effizienzsteigerung betrieblicher Controllingbereiche,* in „krp", vol. 39 (1), pp.15–19

Weber, G., Bodemann, M. & Hohan, A., (2014a), *Change management in enterprises to face the changes in energy economics*, in: proceedings of 2014 International Conference on Production Research – regional Conference Europe, Africa and Middle East, and 3rd International Conference on Quality and Innovation in engineering and Management, Cluj-Napoca, Romania, 07/01-07/05/2014, pp. 527-532, Technical University of Cluj-Napoca

Weber, G. (2014b), *ACT-ORANGE – Sponsoring als kommunikationspolitisches Instrument zur Imageförderung der Erneuerbaren Energien, Energieeffizienz und alternativer Antriebe*, Shaker-Verlag, Aachen

Weber, T., (2014c), *Nachhaltigkeitsberichterstattung als Bestandteil marketingbasierter CSR-Kommunikation*, in Fifka, M., CSR und Reporting, pp.95-106, Springer-Verlag, Berlin Heidelberg

Weber, G. (2015), *German enterprises and the changes in energy economics due to increased concerns regarding environmental sustainability*, in "Management & Marketing - Challenges for the Knowledge Society", vol. 10, no. 1, pp. 72-89, DOI: 10.1515/mmcks-2015-0006

Weber, G., Olaru, M. and Surugiu, I., (2015a), *Impacts of changing energy economic systems to the strategy of enterprises – a trend development case study*, in: Supplement of "Quality Access to Success", Vol. 16, nr. 1, pp. 246-252, 2015, Editura SRAC, Bucureşti, România

Weber, G., (2015b), *Leadership for sustainability through supporting sponsorship-related innovative initiatives*, in: proceedings of , 3rd International Conference on Management, Leadership and Governance ICMLG 2015, Auckland, New Zealand, 02/12-02/13/2015, pp. 324-330, Auckland University of Technology and Massey University New Zealand

Weber, T., (2015c), *Klein aber oho – Drehgeber, Schleifringe, Kupplungen und Co fallen in Windturbinen kaum auf, solange sie funktionieren - auch sie bringen Innovation*, in „Erneuerbare Energien", vol.26, issue 7/8, pp.28-29

Weber, T., (2015d), *Wartung für alles – von der Wohnplattform auf See bis zu Blitzschäden: unabhängige Instandhalter reparieren in Offshore-Windparks alles*, in „Erneuerbare Energien", issue 26, vol.12, pp.38-40

Weber, G., Mateescu, R., Lange, S. and Rauch, M., (2016), *Knowledge intensive Business Services (KIBS) in the context of changing energy economics in Germany*, in: "Amfiteatru Economic Journal", Vol. XVIII, Nr. 41, pp. 89-103, Feb. 2016

Weber, G., Olaru, M. & Marin, G. (2016a), *Study regarding the correlation between the changes in the energy economy and the competitiveness of companies in Germany and Romania*, in Nicolescu, O. and Lloyod-Reason, L. (eds.), Challenges, Performances and Tendencies in Organisation Management, pp.341-349, World Scientific Publishing, Singapore

Weis, B., (2014), *Praxishandbuch Innovation – Leitfaden für Erfinder, Entscheider und Unternehmen*, Springer-Fachmedien, Wiesbaden

Welmer, F., (2014), *Wie lange reichen unsere Rohstoffvorräte? – was sind Reserven und Ressourcen?,* in „uwf", vol.22, issue 2-3, 2014, pp.125-132

Werther, S. and Jacobs, C., (2014), *Organisationsentwicklung – Freude am Change - Inhalte und Anlässe – Innovation,* in: Brodbeck, F., Kirchler, E. and Woschée, R., (eds.), Die Wirtschaftspsychologie, Springer-Verlag, Berlin-Heidelberg

Wiehl, M., (2014), *Benefits of fostering renewable energies and energy efficiency*, Indo-German Energy Efficiency Conference "Energy Efficiency in the Industry and in Buildings", 18. Nov. 2014, Pune , India

Wiesener, O., (2014), *Mit mehrstufigem Wissenserwerb zu mehr Innovationserfolg – eine konzeptionelle und empirische Untersuchung in technischen* Industrien, Springer-Fachmedien, Wiesbaden

Wilfing, S., (2013), *Management organisationaler Anpassungsprozesse – Transformationsvorhaben durch geeignete Informationsbasis erfolgreich planen und umsetzen*, Springer-Gabler-Verlag, Wiesbaden

Willocks, L.P. and Lacity, M.C., (2006), *Global sourcing of business and IT services*, Palgrave Macmillan, New York

Wöhe, G., (1986), *Einführung in die allgemeine Betriebswirtschaftslehre,* Verlag-Franz-Vahlen-GmbH, München

Woisetschläger, D., (2006), *Markenwirkung von Sponsoring,* Deutscher Universitätsverlag, Wiesbaden

Wosnitza, F. and Hilgers, H.G., (2012), *Energieeffizienz und Energiemanagement*, Springer Fachmedien, Wiesbaden

Wüpper, T., (2016), *Für die Braunkohle wird es eng – Ein Betrieb der CO_2-intensiven Kraftwerke ist langfristig mit den Klimazielen unvereinbar*, in „Die Rheinpfalz", issue 31, 06.Feb.2016

Zehrer, A. and Mössenlechner, C, (2010), *Leadership-Kompetenzen in Krisensituationen*, in: Pechlaner, H., Raich, M., Schön, S. and Matzler, K., (2010) Change Leadership – den Wandel antizipieren und aktiv gestalten, Gabler-Verlag/Springer-Fachmedien, Wiesbaden

Ziesing, H., (2014), *Monitoring der Energiewende – ist Deutschland schon auf dem Zielpfad?*, in Brunnengräber, A. and Di Nuci, M., (eds.), Im Hürdenlauf zur Energiewende – von Transformationen, Reformen und Innovationen, Springer-Fachmedien, Wiesbaden, pp. 353-368

Zimmermann, G., (2015), *Erfolgreiche Gestaltung von Veränderungen*, in: Zimmermann, G., (ed.), Change Management in Versicherungsunternehmen – die Zukunft der Assekuranz erfolgreich starten, Springer-Fachmedien, Wiesbaden

Zink, K., (2015), *Das Projekt PaGIMO – Beteiligung und Integration als Voraussetzung erfolgreicher Veränderung*, in: Zink, K., Kötter, W., Longmuß, J. and Thul, M., (eds.), Veränderungsprozesse erfolgreich gestalten, Springer-Verlag, Berlin/Heidelberg

Ziolkowska, J. and Ziolkowski, B., (2015), *Energy efficiency in the transport sector in the EU-27: a dynamic dematerialization analysis*, in "Energy Economics", vol.51, 2015, pp.21-30

*** acatech, (2012), *Die Energiewende finanzierbar gestalten – effiziente Ordnungspolitik für das Energiesystem der Zukunft*, acatech – Deutsche Akademie für Technikwissenschaften, Springer Verlag, Berlin-Heidelberg

*** AHK Germany-Romania, (2013), *Industrieeffizienz, Prozessindustrie und Logistik in Rumänien*, Deutsch-Rumänische Industrie- und Handelskammer, Bucharest, available at http://www.efficiency-from-germany.info/EIE/Redaktion/ Datenmigration/ marktanalyse-rumaenien-2013- industrie, property=pdf, bereich=eie, sprache=de,rwb=true.pdf, [accessed 2014-03-10]

*** BAFA, (2015), *Besondere Ausgleichsregelung – Erste Daten zum Antragsverfahren 2015*, available at http://www.bafa.de/bafa/de/energie besondere_ ausgleichsregelung_eeg/publikationen/statistische_auswertungen/besar_erste_daten_ zum_antragsverfahren_2015.pdf, [accessed 2015-08-20]

*** BAFA, (2015a), *Merkblatt für Energieaudits nach den gesetzlichen Bestimmungen der §§ 8 ff. EDL-G*, available at http://www.bafa.de/bafa/ de/ energie/ energie_audit/publikationen/index.html, [accessed 2015-08-14]

*** BAFA, (2015b), *Energieaudits nach EDL-G – Hinweise zur Registrierung von Energieaudits durchführenden Personen*, available at http://www.bafa.de/ bafa/ de/energie/energie_audit/publikationen/index.html, [accessed 2015-08-14]

*** BAFA, (2015c), *Energieberatung im Mittelstand – Hinweise zur Beraterankennung,* available at: http://www.bafa.de/bafa/de/ energie/energieberatung _mittelstand/publikationen/hinweise_zur_beraterankennung.pdf, [accessed 2015-09-13]

*** BAFA, (2015d), *Energieaudits nach EDL-G – Hinweise zur Registrierung von Energieaudits durchführenden Personen,* available at: http://www.bafa.de/ bafa /de/energie/energie_audit/publikationen/hinweise_registrierung_energieaudit oren.pdf, [accessed 2015-09-13]

*** BAFA, (2015e), *Merkblatt für Energieaudits nach den gesetzlichen Bestimmungen der §§8 ff. Des EDL-G*, available at: http://www.bafa.de/ bafa/de/ energie/energie_audit/publikationen/merkblatt_energieaudits.pdf, [accessed 2015-09-13]

*** BAFA, (2016), *Jahresstatistik 2015 – Förderung von Energieberatungen im Mittelstand*, available at: http://www.bafa.de/bafa/de/ energie/energiebera-tung_mittelstand/publikationen/jahresstatistik_2015.pdf, [accessed 2016-02-08]

*** bdew, (2013), *Strompreisanalyse Mai 2013,* available at http://www. bdew.de/internet.nsf/id/123176ABDD9ECE5DC1257AA20040E368/$file/13%20 05%2027%20BDEW_Strompreisanalyse_Mai%202013.pdf, [accessed 2014-03-02]

*** BDI and VCI, (2011), *Die Steuerbelastung der Unternehmen in Deutschland - Fakten für die politische Diskussion 2011,* Institut der deutschen Wirtschaft Köln

Medien GmbH, available at http://www.bdi.eu/download_ content/BDI_VCI__ Steuerbelastung_der_Unternehmen_2011.pdf , [accessed 2014-03-10]

*** BET, (2010), *Marktplatz Energie - Kernkraftwerk Laufzeitverlängerung,* available at: https://www.yumpu.com/de/document/view/2944268/marktplatz-energie-10-2010-bet-aachen, [accessed 2013-07-05].

*** Beuth, (2011*), DIN EN ISO 50001- Energy management systems – Requirements with guidance for use (ISO 50001:2011); German version EN ISO 50001:2011,* industry standard, available at http://www.beuth.de

*** Beuth, (2012*), Energieaudits – Teil 1: Allgemeine Anforderungen; Deutsche Fassung EN 16247-1:2012*, industry standard, available at http://www.beuth.de

*** Beuth, (2014*), Energy audits – Part 5: Competence of energy auditors; German version prEN 16247-5:2014,* industry standard, available at http://www.beuth.de

*** BMA, (2012), *CSR made in Germany*, German Federal Ministry of Labor, available at: http://www.bmas.de/SharedDocs/Downloads/DE/PDF-Publikationen-DinA4/a408-csr-made-in-germany.pdf?__blob=publicationFile&v=2, [accessed 2016-01-31]

*** BMWi, (2010), *Energy made in Germany – energy efficiency in industry, building service, technology and transport,* available at http://www.efficiency-from-germany.info/ENEFF/Redaktion/EN/Downloads/Publikationen/energy_efficiency_made_in_germany.pdf?__blob=publicationFile&v=4, [accessed 2016-02-07]

*** BMWi, (2013), *Energiedaten: Ausgewählte Grafiken,* available at http://www.bmwi.de/BMWi/Redaktion/PDF/E/energiedaten-ausgewaehlte-grafiken,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2014-03-11]

*** BMWi, (2014a). *Eckpunkte für die Reform des EEG,* available at http://www.bmwi.de/BMWi/Redaktion/PDF/E/eeg-reform-eckpunkte,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2014-03-13].

*** BMWi, (2014b),. *Anlage zu den „Eckpunkten für die Reform des EEG*, available at http://www.bmwi.de/BMWi/Redaktion/PDF/E/eeg-reform-eckpunkte-anlage,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2014-02-16]

*** BMWi, (2014c), *3. Nationaler Energieeffizienzaktionsplan (NEEAP) 2014 der Bundesrepublik Deutschland – gemäß der Richtlinie des Europäischen Parlaments und des Rates vom 25.10.2012 zur Energieeffizienz (2012/27/EU),* available at: http://www.bmwi.de/BMWi/Redaktion/PDF/M-O/nationaler-energieeffizienz-aktionsplan-2014,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2015-09-13].

*** BMWi, (2014d), *Richtlinie über die Förderung von Energieberatungen im Mittelstand*, available at: http://www.bmwi.de/BMWi/Redaktion/PDF/P-R/richtlinie-ueber-die-foerderung-von-energieberatungen-im-mittelstand,property=pdf, bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2015-09-13]

*** BMWi, (2014e), *Wirtschaftsfaktor Mittelstand – Zahlen und Fakten zu den deutschen KMU,* available at http://www.bmwi.de/BMWi/Redaktion/PDF/W/ wirtschaftsmotor-mittelstand-zahlen-und-fakten-zu-den-deutschen-kmu,property =pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2016-02-07]

*** BMWi, (2014f), *German Mittelstand: Motor der deutschen Wirtschaft,* available at https://www.bmwi.de/BMWi/ Redaktion/ PDF/ Publikationen/ factbook-german-mittelstand,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2015-10-28]

*** BMU (2012), *Energy management systems in practice – ISO 50001: a guide for companies and organizations*, available at http://www. Umweltbundesamt .de/sites/default/files/medien/publikation/long/4013.pdf, [accessed 2015-08-21]

*** BMU, (2012a). *Erneuerbare Energien. Motor der Energiewende,* Berlin: Bundesministerium für Umwelt, Naturschutz und Rektorsicherheit, available at http://www.erneuerbare-energien.de/fileadmin/Daten_EE/Dokumente__PDFs _/Motor_der_Energiewende_bf.pdf, [accessed 2014-03-10].

*** BMU, (2012b). *Erneuerbar beschäftigt! Kurz- und langfristige Wirkungen des Ausbaus erneuerbarer Energien auf den deutschen Arbeitsmarkt,* Berlin, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, available at http://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/EE_besc haeftigt_bf.pdf , [accessed 2014-03-10].

*** BMU, (2012c), *Nachhaltig und verantwortlich investieren – ein Leitfaden – die UN-Principles for responsible Investment (PRI*), German Federal Ministry of Environment, Berlin, avaialable at http://www.bvi.de/fileadmin/ user_ upload/UNPRI.pdf, [accessed 2016-02-02]

*** BMU, (2013), *Aktuelle Vorhaben zum Klimaschutz und zur Umsetzung der Energiewende – Fachtagung am 13. und 14. Juni 2013 in Berlin,* available at http://www.bmub.bund.de/service/publikationen/broschueren-bestellen/#cr14, [accessed 2014-02-17].

*** BMU, (2014), *Environmental information for products and services – requirements, instruments, examples,* available at http://www. bmub. bund. de/fileadmin/Daten_BMU/Pools/Broschueren/umweltinfos_produkte_dilei_bro schuere_en_bf.pdf, [accessed 2016-02-06].

*** BMU, (2014a), *Gesellschaftliche Verantwortung von Unternehmen – eine Orientierungshilfe für Kernthemen und Handlungsfelder des Leitfadens DIN ISO 26000,* available at http://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/csr_iso26000_broschuere_bf.pdfhttp://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/umweltinfos_produkte_dilei_broschuere_en_bf.pdf, [accessed 2016-02-06].

*** BMU, (2014b), *The German Government's Climate Action Programme 2020 - Cabinet decision of 3 December 2014,* available at http://www.bmub. bund. de/fileadmin/Daten_BMU/Pools/Broschueren/aktionsprogramm_klimaschutz_2020_broschuere_en_bf.pdfhttp://www.bmub.bund.de/fileadmin/ Daten _BMU/ Pools/Broschueren/umweltinfos_produkte_dilei_broschuere_en_bf.pdf, [accessed 2016-01-31].

*** BMU, (2015), *Climate Action in Figures – Facts, Trends and Incentives for German Climate Policy,* available at http://www.bmub.bund.de/ fileadmin/ Daten _BMU/Pools/Broschueren/umweltinfos_produkte_dilei_broschuere_en_bf.pdf, [accessed 2016-02-07].

*** Bundesregierung, (2010), *Energiekonzept für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung,* available at http://www.bundes-regierung .de/Content/Archiv/ DE/Archiv17/_Anlagen/2012 /02/energiekonzepte-final.pdf ;jsessionid=924A9A6175AF354A7BA222713D0865 FDs1t1?__blob=publi cation-File&v=5, [accessed 2014-02-17]

*** capgemini consulting, (2015), *Superkräfte oder Superteam: wie Führungskräfte ihre Welt wirklich verändern können – Change Management Studie 2015*, Capgemini Consulting Deutschland, München, available at https://www.de. capgemini-consulting.com/resource-file-access/resource/pdf/change-management-studie-2015_4.pdf, [accessed 2015-10-26]

***Deloitte Consulting, (2005), *Calling a change in the outsourcing market: the realities for the world's largest organizations,* available at: http://www .syllogos.gr/links/docs/OutsourcingStudyRV1.pdf, [accessed 2015-09-12]

***dena, (2013), *Dämmung von Anlagen in Industrie und Gewerbe – Kosten sparen und Effizienz steigern*, Besscom AG, Berlin

*** DENEFF, (2015), *NAPE verfehlt 20%-Energiesparziel*, in IKZ-energy, vol.9, issue 11/12-2015, p.65

*** DENEFF, (2015a), Branchenmonitor Energieeffizienz 2015, available at http://www.deneff.org/fileadmin/downloads/DENEFF_Branchenmonitor_Energieeffizienz_2015.pdf, [accessed 2016-02-08]

*** DIHK, (2014), *DIHKs,* available at http://www.dihk.de/en, [accessed 2014-03-03]

*** DIW, (2007), *Klimawandel kostet die deutsche Volkswirtschaft Milliarden*, in DIW-Wochenbericht 11/2007, pp.165-170

*** DIW, (2015), *Beschäftigung durch erneuerbare Energien in Deutschland: Ausbau und Betrieb, heute und morgen*, DIW Politikberatung, available at http://www.diw.de/documents/publikationen/73/diw_01.c.510565.de/diwkompakt_2015-101.pdf, [accessed 2015-08-20]

*** DLR, Fraunhofer IWES, IfnE, (2010), *Leitstudie 2010*, available at http://www.fvee.de/fileadmin/politik/bmu_leitstudie2010.pdf, [accessed 2014-03-14].

*** DWD (2015), *Klimawandel und Gesundheit - Einfluss und Auswirkungen des Klimawandels auf die Pollenbelastung*, available at http://www.dwd.de/bvbw/appmanager/bvbw/dwdwwwDesktop?_nfpb=true&_pageLabel=dwdwww_start&_state=maximized&_windowLabel=T99803827171196328354269&T99803827171196328354269gsbDocumentPath=Content%252FOeffentlichkeit%252FKU%252FKUPK%252FHomepage%252FKlimawandel%252FKlimawandel__neu__Aktuelles__Pollenflog.html, [accessed 2015-08-20]

*** EEA, (2012), *Energy efficiency and energy consumption in industry (ENER25) – Assessment*, published April 2012, available at http://www.eea. europa.eu/downloads/5c0bc941-8af7-455a-b232-05d7b9d1f00b/1383739900/assessment.pdf, [accessed 2015-08-23]

*** EEA, (2013), *Trends and projections in Europe – tracking progress towards Europe's climate and energy targets until 2020*, available at http://www.eea.europa.eu/publications/trends-and-projections-2013, [accessed 2015-08-23]

*** EEA, (2015), *Sector shares of final energy consumption in Europe* , available at http://www.eea.europa.eu/data-and-maps/indicators/final-energy-consumption-by-sector-8, Last modified 12 Mar 2015, 11:36 AM, [accessed: August 14, 2015]

*** EEA (2015b), *Final energy consumption by transport mode*, available at http://www.eea.europa.eu/data-and-maps/daviz/final-energy-consumption-by-transport-1#tab-chart_2, [accessed 2015-08-14]

*** EFQM, (2016a), *Fundamentals of the EFQM model*, available at http://www.efqm.org/efqm-model/fundamental-concepts, [accessed 2016-02-06]

*** EFQM, (2016b), *Model criteria of the EFQM model*, available at http://www.efqm.org/efqm-model/fundamental-concepts, [accessed 2016-02-06]

***eurostat, (2015), *smarter, greener, more inclusive? – indicators to support the Europe 2020 strategy*, available at http://ec.europa.eu/eurostat/ documents/3217494/6655013/KS-EZ-14-001-EN-N.pdf/a5452f6e-8190-4f30-8996-41b1306f7367, [accessed 2016-04-17]

***ew, (2015), *Energiedienstleitungen spielen keine Rolle bei der Erreichung von Effizienzzielen*, in „ew aktuell“, 15. Oktober, available at https:// www. keosk.de/files/userfiles/user_1160/mag_34429/ew_aktuell_2015_10_29.pdf, [accessed 2015-10-29]

*** ewi, (2012), *Der Merit-Order-Effekt der erneuerbaren Energien - Analyse der kurzen und langen Frist,* available at http://www.ewi.uni-koeln.de /fileadmin/user_upload/Publikationen/Working_Paper/EWI_WP_12_14_Merit-Order -Effekt-der-Erneuerbaren.pdf, [accessed 2014-03-23]

***ewi (2013), *Potenziale für Erdgas im Straßenverkehr – eine ökonomische Analyse*, Energiewirtschaftliches Institut an der Universität zu Köln (ewi), Cologne

*** ewi, gws, prognos (2014), *Studie: Gesamtwirtschaftliche Effekte der Energiewende*, Projekt Nr.31/13, available at http://www.bmwi.de /BMWi/ Redaktion/PDF/Publikationen/gesamtwirtschaftliche-effekte-der-energiewende,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, [accessed 2015-08-20]

*** ewi, (2014a), *Kurzstudie: Die Energiewende, Herausforderung für Politik und Unternehmen*, available at http://www.ewi.uni-koeln.de/fileadmin/user_ upload/Publikationen/Studien/Politik_und_Gesellschaft/2014/EWI_Kurzstudie_Herausforderungen_Energiewende_2014.pdf, [accessed 2015-08-20]

*** EU, (2012*), DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC*, available at http://eur-lex.europa.eu/legal-content/EN/ TXT/?qid =1399375464230&uri=CELEX:32012L0027, [accessed 2015-08-14]

*** EU, (2012a), *ClimateCost: The full cost of climate change*, available at http://www.climatecost.cc, [accessed 2015-08-22]

*** FÖS, (2013*), Energiewende als lohnende Zukunftsinvestition begreifen – acht Thesen zur Strompreisdebatte*, available at http://www.foes.de/pdf/2013-03-Positionspapier-Strompreisdebatte.pdf, [accessed 2015-08-22]

*** FÖS, (2014), *Effizienzwende mit NAPA auf dem richtigen Weg -aber längst nicht am Ziel*, available at http://www.foes.de/pdf/2014-12-FOES-Stellungnahme-NAPE.pdf, [accessed 2015-08-23]

*** FÖS, (2014a), *Marktkräfte für Energieeffizienz nutzen*, available at http:// www.foes.de/pdf/2014-10-FOES-Oekonomische-Instrumente-fuer-Energieeffizienz.pdf, [accessed 2015-08-23]

*** FÖS, (2015), *Was Strom wirklich kostet - Vergleich der staatlichen Förderungen und gesamtgesellschaftlichen Kosten konventioneller und erneuerbarer Energien*, available at http://www.foes.de/pdf/2015-01-Was-Strom-wirklich-kostet-lang.pdf, [accessed 2015-08-21]

*** FÖS, (2015a), *Fehlinvestitionen der Energieversorgungsunternehmen E.ON und RWE*, available at http://foes.de/pdf/2015-03-Factsheet-Fehlinvestitionen-EON-RWE.pdf, [accessed 2015-0822]

*** FÖS, (2015b), *Effizienzberatung in Unternehmen voranbringen*, available at http://www.foes.de/pdf/2015-01-FOES-Stellungnahme-Energieaudits-Art-8-EED .pdf, [accessed 2015-08-22]

*** Gabler, (2014), *Kausalanalyse – Gabler das Wirtschaftslexikon*, available at http ://www.daswirtschaftslexikon.com/d/kausalanalyse/kausalanalyse.htm, [accessed 2014-03-03]

*** Greenpeace,(2011), *Der Plan - Deutschland ist erneurbar*, available at: http:// www.greenpeace.de/fileadmin/gpd/user_upload/themen/energie/20110501-Der-Plan-Energiewende-ohne-Atom-und-Kohle.pdf, [accessed 17 Feb. 2014]

***ICS-CERT, (2013), *ICS-CERT Monitor October, November, December 2013*, National Cybersecurity and Communications Integration Center, available at: https://ics-cert.us-cert.gov/sites/default/files/Monitors/ICS-CERT_Monitor_Oct-Dec2013 .pdf, [accessed 2015-10-26]

*** IHK, (2014), Faktenpapier – Strompreise in Deutschland 2014, available at http://www.ihk-limburg.de/blob/lmihk24/innovation/downloads/2299744/01 73147ab2fd7057aa09a250abe3610f/Faktenpapier_Strompreise_in_Deutschlan d_2014-data.pdf, [accessed 2015-08-22]

*** IHK, (2016), *Verpflichtende Energieaudits für Nicht-KMU: BMWi bestätigt Ermessensspielraum des BAFA und benennt den Zeitpunkt Ende April 2016 als Auslegungshilfe*, available at http://www.ihk-eforen.de/pages/viewpage. Action ?pageId=633372676, [accessed 2016-02-018]

*** IPCC, *world climate online reports*, available at http://www.ipcc.ch /publications_and_data/publications_and_data_reports.shtml, [accessed 2016-02-15]

*** IPCC (2014), *Climate Change 2014 – Synthesis Report*, available at http://www .de-ipcc.de/_media/SYR_AR5_LONGERREPORT_.pdf, [accessed 2015 -08-20]

*** IZA,(2013), *Labor Demand Effects of Rising Electricity Prices: Evidence for Germany,*Institute for the Study of Labour, available at http://ftp.iza.org/pp74.pdf, [accessed 2014-03-10].

*** Fraunhofer ISE, (2013), *Was kostet die Umwandlung von erneuerbaren Energien in Strom? - Studie vergleicht die Stromgestehungskosten von erneuerbaren Energien*, available at http://www.ise.fraunhofer.de/de/presse-und-medien/ pdfs-zu-presseinfos/2013/presseinformation-was-kostet-die-umwandlung-von-erneuerbaren-energien-in-strom.pdf, [accessed 2014-02-16].

*** McKinsey, (2014*), Studie: Viele Ziele der Energiewende in Deutschland bis 2020 kaum noch erreichbar*, available at http://www.mckinsey.de/studie-viele-ziele-der-energiewende-deutschland-bis-2020-kaum-noch-erreichbar, [accessed 2015 -08-20]

*** McKinsey, (2015*), Studie: Energiewende-Index Deutschland 2020 – positive Tendenzen, aber noch keine Trendwende*, available at http://www.mckinsey .de/sites/mck_files/files/mckinsey_energiewende-index_et_maerz_2015.pdf, [accessed 2015-08-20

*** Ökoinstitut e. V. & Prognos, (2009). *Modell Deutschland, Klimaschutz bis 2050,* available at http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF_ Modell_Deutschland_Endbericht.pdf, [accessed 2014-02-17].

*** Ökoinstitut e. V., (2010), *Erste Auswertungen der „Energieszenarien für ein Energiekonzept der Bundesregierung,* available at http://www.oeko.de /publikationen/forschungsberichte/studien/dok/657.php, [accessed 2014-02-17]

*** Outsourcing Times, (2005), *IT sourcing survey reveals most outsourcing contracts terminated prematurely,* available at: http://www.blogsource.org /2005/ 06/ page/4/, [accessed 2015-09-12]

*** Prognos, ewi, gws, (2010), *Energieszenarien für ein Energiekonzept der Bundesregierung,* BMWi, Basel, Köln, Osnabrück

*** Prognos, Ifeu and HRW, (2013), *Marktanalyse und Marktbewertung wie Erstellung eines Konzeptes zur Marktbeobachtung für ausgewählte Dienstleistungen im Bereich Energieeffizienz. Endbericht (überarbeitetet Fassung),* available at: http://www.bafa.de/bfee/informationsangebote/publikationen/studien/bafa_ marktanalyse_endbericht.pdf, [accessed 2015-09-12]

*** R2B, (2011). *Energieökonomische Analyse eines Ausstiegs aus der Kernenergie in Deutschland bis zum Jahr 2017,* BDI e.V., Köln

*** SRU (2011), *Wege zur 100 % erneuerbaren Stromversorgung.* Sachverständigenrat für Umweltfragen, Erich Schmidt Verlag GmbH & Co. KG, Berlin

*** SRU, (2013), *Shaping the electricity market of the future – special report*, available at http://www.umweltrat.de/SharedDocs/Downloads/EN/02_Special_ Reports/2012_2016/2014_02_SG_Shaping_the_Electricity_Market_of_the_Future .pdf?__blob=publicationFile, [accessed 2014-02-16]

*** statista, (2012), *Strompreise für Industriekunden in Europa 2012,* available at http://de.statista.com/statistik/daten/studie/151260/umfrage/strompreise-fuer-industriekunden-in-europa, [accessed 2014-03-02].

*** tenag, (2015), *Energy audits are mandatory in 18 EU states – an overview of the transposition of the EED in Europe*, available at https://www. tenag.de /media/file/EED_Overview_Europe.pdf, [accessed 2016-02-08]

***UBA (2012a), Energy Management Systems in Practice- ISO 50001: A Guide for Companies and Organisations, available at https://www. Umweltbundesamt .de/sites/default/files/medien/publikation/long/4013.pdf, [accessed 016-02-08]

*** UBA (2014), *Schätzung der Umweltkosten in den Bereichen Energie und Verkehr*, available at http://www.umweltbundesamt.de/publikationen/schaetzung-umweltkosten-in-den-bereichen-energie-0, [accessed 2015-08-20]

*** Umweltbundesamt, (2010), *2050: 100% Strom aus erneurbaren Energien,* Umweltbundesamt, Dessau-Roßlau – Germany

*** VfW, (2015), *Beeindruckende Zahlen kennzeichnen die Arbeit des VfW und seiner Mitglieder - Prozentuale Verteilung der einzelnen Contractingarten,* available at: http://www.energiecontracting.de/6-verband/wir-ueber-uns/vfw-in-zahlen.php, [accessed 2015-09-13]

*** ZNES, (2011), *Atomausstieg 2015 und regionale Versorgungssicherheit,* Zentrum für nachhaltige Energiesysteme, Deutsche Umwelthilfe, Universität Flensburg, Fensburg-Berlin