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Images of the Future City

Time and Space For Sustainable Development

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Foreword

Book Structure

There are four parts to this book. The first, *Points of Departure*, presents the study parameters in four chapters. This part contains an introductory discussion about the sustainable city and a description of the backcasting approach used. Further we report on the household perspective that permeates the study and serves as the basis for the proposed operational definition of a sustainable city. The final chapter introduces the generating principles for the six images of the future developed in later sections.

The second part is titled *Building Blocks* and examines the current situation, the dominating development tendencies and the change potential of

– the urban structure, meaning the physical *space*;
– the activity patterns and time use of the households, meaning *time*; and
– the efficiency of various ways to use energy, meaning the *technology*.

The part forms the documentation for the six images of the future that have been developed in several stages using scenario exercises comprising varied participant groupings. The different chapters are intended to shed light on the development direction, while attempting to identify possibilities for implementing a sustainable development.

Images of the Future is the title for the third part. The images presented here vary as they relate to space (urban structure) and time (tempo). The first chapters in this part contain verbal and pictorial descriptions in an effort to make the various alternatives as concrete and alive as is possible and reasonable. The last chapters include a quantitative description with a strict adjustment of the activity content so that the images fulfil the requirements for sustainable development we have formulated. Settlement densities and time use in the images of the future are also presented here.

The heading for the fourth and concluding part is simply *Perspectives*, including as it does material that in various ways evaluates the formulated images. An ethnologic study tests the possibilities for combining children and lack of a car, while a national economic study makes a first attempt at a preliminary evaluation of the consistency behind the assumption underlying the images of the future. These two are followed by a collected examination of the images, discussing such factors as energy use and scrutinizing the realizability of the images. The study as such is concluded with a summation, followed by appendices offering a relatively comprehensive material in support of different segments of the earlier presentation.

Reading Suggestions

The book can be read in several ways:

- A reader wishing to gain a quick orientation in the material can read through the Part I, the descriptions of images of the future in Chaps. 21–24 and the concluding Chap. 31. This run-through can well be supplemented by reading the introductions to the four parts.
- Persons interested in the continuing development in areas such as urban development, time and housing use, food, travel, consumption of durable goods or technology developments should read Part II more thoroughly. Each chapter here also contains a discussion of the conditions for a development in a more sustainable direction.
- Readers with a special interest in the quantitative specifications of energy use and exploitation ratios should go to Chaps. 25–28 in Part III. Chapter 27 contains a new calculation of the energy use of the energy consumption of residents in Sweden and Stockholm comprising data not previously published internationally.
- Finally, Part IV offers a study of some unintentionally environmentally adapted households, namely families with small children and no car, as well as a national economic view of the images of the future. To this is added the final, concluding chapter.

Preface

In 2007 the Intergovernmental Panel on Climate Change and Al Gore shared the Nobel Peace Prize "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change". A year earlier the *Stern Review on the Economics of Climate Change* had been published. The Nobel Prize laureates, and the fact that they received the Nobel Prize, have had enormous importance among the public for the dissemination of the conception of climate change as possibly the greatest threat of our time. The impact of the Stern review may be more internal to the academic world and to policy makers, but as perhaps the most influential report on economics and climate change and through its emphasis on the threat involved, its impact can hardly be underestimated. Reports such as those above can be said to have laid the foundation for this book. But instead of describing costs or effects of climate change, this book digs into the everyday life of city inhabitants, describing what kind of changes might be needed in for example travel, housing and eating if people's activities are not to contribute to climate change.

Two circumstances have been decisive for the structure of the study presented in this book. The first is that over the most recent decades the power of the sustainability question has been diluted in various ways. Social and economic aspects have been presented as equally critical. In this way there is a risk that the physical frame that the ecologic systems establish for life on earth become relativized or even completely forgotten and critical conditions tend to be treated as background material. The most important ones are that many of the resources we extract are finite, that the ecologic systems cannot withstand unlimited pressure, such as rapid changes in atmospheric composition, and that to a high degree today's civilisations presuppose continued exploitation of exactly those finite resources and continued use of nature as repository of many kinds of waste products.

The second circumstance is well described in the book McNeill's *Something New under the Sun*, whose subtitle is *An Environmental History of the Twentieth-Century World*. The book draws a succinct picture of how human activities over the last century serve as the basis for the dramatically changed conditions for many of the earth's species. Its author, John McNeil, points especially to the enormous expansion in population, production and energy consumption during the twentieth century. He believes that the historic course departs from earlier centuries in that in order to ensure an honest picture of events, rapid environmental changes must be noted.

We have taken the global environmental threats seriously and understand that the causes derive from human activities and structures. We think that it is in the cities that many new activities are born and disseminated. Seen from a global perspective, the city is well on its way towards becoming the dominant settlement type. Thus it is especially relevant to study the city from a sustainability point of view.

With this book we want to promote a serious discussion concerning those challenges presented by the demands for sustainability in both the design of and actual living in modern cities. It is not enough to simply point the way. Acceptable levels for resource consumption and environmental load must also be given.

This book has been written within the framework of the HUSUS Research Project, and acronym for Households and Urban Structures in Sustainable Cities. On the initiative of Peter Steen, who was research director for FOI, the Swedish Defence Research Agency, and leader of the Environmental Strategies Research Group (fms), a consortium of various skills and organisations was formed to manage this multi-disciplinary project. The parties involved were *fms*, itself a collaboration between FOI, the Department of Systems Ecology at Stockholm University and the Departments of Infrastructure and of Industrial Ecology at the Royal Institute of Technology (KTH), the Division of History of Science and Technology at KTH and a collaboration between the Department of Sociology and the Department of Economic History at Stockholm University. Peter Steen was the first project leader for the Husus-project. After his sudden death in year 2000, Arne Kaijser, Professor of History of Science and Technology, took over as project leader. The contributions from Peter and Arne, as well as from the fms director 2000–2003, Karl-Henrik Dreborg, were of crucial importance at the beginning of the project.

We want to thank Elin Löwendahl and Johan Swahn for comments on earlier versions. The two larger workshops within the projects have also inspired the book. The first one was at the Hotel Hilton in Stockholm and involved around 50 researchers from other projects tied to the Swedish Research Council's Formas focus on Sustainable Cities. The other was at the Bosön Conference Center on Lidingö Island and brought the participation of a collection of colleagues drawn mainly from KTH, FOI and Stockholm University.

The comprehensive work done by Ulrika Gunnarsson, doctoral student in the Department of Urban Planning and Environment (KTH), has been essential for the completion of the book. She has read it from cover to cover, corrected smaller errors and offered many excellent suggestions for improvements. We would like to thank Bridget Lewakowski who has been very helpful and put a lot of effort into the reference system and other practical matters of this English version of this book.

Comments and ideas have also come from researchers who participated in various segments of the Husus-project. In addition to those directly involved in the book, the following individuals have made larger and smaller contributions to the Husus project:

From fms: Per Bolund, Annika Carlsson-Kanyama, Karl-Henrik Dreborg, Sven Hunhammar, Daniel Jonsson, Marie Jungmar, Ahmad Kanyama, Jon Möller, Peter Steen and Anders Wadeskog.

From the Division of History of Science and Technology at KTH: Anna-Klara Eklundh, Håkan Forsell, Jan Garnert, Eva Jacobsson, Arne Kaijser och Kristina Pålsson.

From the social science environmental research group at Stockholm University: Erika Lundell.

The main part of the Husus-project was financed by the Swedish Council for Building Research (now Formas). At Formas the support from especially Henrik Nolmark during the whole project was very valuable. The Swedish Transport and Communications Research Board (now The Swedish Governmental Agency for Innovation Systems – Vinnova) also co-funded the project. The translation of this book into English would not have been possible without grants from above all Vinnova, but also from the Swedish energy agency and from Formas. We gratefully acknowledge their support.

For the translation of the book, we would like to thank Sven Borei, owner/manager of Transförlag, Lerum. Sven is former Chair of the Swedish Association for Professional Translators and also member of the local Municipal Council in Lerum, where his special assignment is long-range planning.

About the Authors

Three main authors have co-ordinated the work with this book. Several chapters have completely or partly been written by other researchers. Each chapter begins with information as to the author(s) responsible. However, editing has been done by the main authors, who also prepared the anonymous chapters together. The associate authors have also contributed many comments and viewpoints on other chapters than just their own.

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Part I
Points of Departure

The first part of the book contains the points of departure. Chapter 1 offers a perspective on the sustainable city through formulations of the study's basic questions, as well as providing a quick urban history looking towards the future. The backcasting approach used in the study is described in Chap. 2 together with some building blocks the study sets out from. This chapter also introduces the images of the future and the household perspective that will be dominating elements throughout the book. Chapter 3 defines the operational boundaries of the sustainable city and motivates our choice of energy as the investigative focus. Part I closes with Chap. 4 containing a thorough report of the dimensions behind the images of the future of a sustainable city, namely space in the form of urban structure and time expressed as the tempo that characterizes urban life. These are developed further in Part III.

Chapter 1
The Sustainable City

How might a city look and its life be lived if it satisfied the requirements for sustainable development? A city, in other words, whose residents used no more than their share of the earth's resources than what our globe can reasonably endure. That is the *main question* this book asks. It is an important question as just conurbations have shown themselves a special problem in discussions of how sustainable development might be attained and an especially hard one to master since it is a societal type that will always be dependent for its survival on external resources to feed its frequently rapid growth. At the same time and in other contexts, the city has quite contrarily been described as particularly well suited for developing resource efficient and thereby sustainable solutions to the shared support problems.

This book intends to investigate if, and if so how the city will be able to attain sustainability in 50 years or perhaps even longer. Six images of possible futures for a sustainable city, using Greater Stockholm as reference are created in the book. These images satisfy the criteria for sustainable development formulated on these pages. The different images of the future reflect variances in the design of the urban space and the households' time use. Our definition of a sustainable city is one in which the households can live a socially and economically tolerable life without therefore generating a higher resource utilization than what the globe can endure in the long run. Our *second question* concerns if the city and city life can change so as to satisfy these requirements for sustainable development. Our *third and last question* concerns the conditions necessary in order to realize the development of the type described in our images of the future – what are the obstacles, what the conditions to defeat these and what the possibilities in both the short and long run to support such development tendencies?

1.1 Historical Background

Urban residents have always been dependent on the receipt of resources from the country surrounding the city. Thus they tend to relate to nature in a more distant way. This development can be traced to the very first city-states some 6,000 years

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ago.[1] Both geographical and psychological distance grew between urban residents and their life necessities. Even though this has led to delusions about an urban liberation from nature, it must still have been clear over a long time that nature set limits for city life as well. For those city livers who farmed the land and kept domestic animals the connection was surely obvious, as it must have been for those who came into contact with the city's support questions – how edibles, energy raw materials and renewable building materials competed with the scarce access to fruitful land near the city. Other tangible reminders of urban vulnerability must have come via the frequently recurring wars and other crises. This dependency on nature and the surrounding countryside meant that the urban population could hardly rise above 10% until the transport system was mechanized. At that point the supporting countryside expanded and it became possible to support a larger share of urban residents, at the same time as the risk that their dependency on nature grew more and more distant.

The mirage of urban liberation from the chains of nature was perforce limited until the fossil fuel sources came into play, something that did not occur in large scale until the 1900s. As coal and oil came into use for transports, residential heating and as a cheap, effective production factor, possibilities for an unprecedented urban expansion grew. Agriculture was affected as land that once was used for energy production could now be cultivated and later again, as production was mechanized and intensified through artificial fertilization.

This in turn prepared the way for nation upon nation to transform its social structure from agrarian husbandry where the majority of their citizens living in the countryside to an urban condition where much more than half its population lived in conurbations. This urban transition process is still ongoing.[2] One of the first sectors to fall under this revolution was long-distance transportation to and from the city. This occurred when the steam engine was placed on wheels, increasing the urban countryside dramatically and with it the possibility for bringing resources to the city and removing harmful waste. The city's dependency on a nearby countryside ceased and with it the competition between different types of land use for local production of necessities. The intraurban transportation break through would wait, even if special systems for transporting energy, water and waste had been developed earlier. The expansion of these systems was an essential factor in enabling urban growth and functional viability.

Prior to that development the cities gained well-deserved approbation for their well-established environmental and hygienic problems. The increasing population density and the pollution emissions were the immediate reason. This was softened by the large-scale, resource efficient support systems. At the same time the risks and vulnerability increased as something could go wrong with the systems – the London cholera epidemics in the 1850s and in Hamburg 1892 were spread through the water systems.[3]

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[1] Soya, E. Postmetropolis, 2000.

[2] Nilsson, L. Den urbana transitionen, 1989.

[3] Evans, R. Death in Hamburg, 1987.

As a result of the denseness, dirt and illnesses in the city, many dreamt about escaping to more open, healthier surroundings. However, for a long time it was only the wealthiest who could realize this dream and the poor urbanites had to make do with a rundown slum in the inner city or the horrendous shantytowns in the urban periphery. However, at the same time as the dense western city became more bearable thanks to the new infrastructure systems and the fact that industrial facilities moved out, the possibilities for growing numbers to settle in more garden-like conditions expanded. The motorization of shorter transport using electrical trolleys, motorized busses and a growing use of cars opened up the urban forecourts to an increasingly comprehensive exploitation and settlement. With that the spread and the tendency for splitting of the dense city began and is still continuing. In order to retain the urban characteristics of spatial concentration and melting pot for cultural and financial processes, the quick, energy demanding and increasingly long-distance transports of people and goods became a necessity.

If the proximity to foodstuffs and other natural necessities at one time was the deciding bottleneck for urban development, now it was the nearness to and intercourse with other people and organizations that controlled the urban expansion possibilities. It was in the concentrated and fully artificially constructed urban setting that trade and other economic transactions accelerated. It was also primarily there that innovations and new cultural forms gained footholds and social movements grew. Work separation and specialization gained their most marked expressions there.

It is in the cities and then especially the metropolis that the pulse is more rapid than in the countryside. Consumption habits are more prolix, fashion shifts and identity changes are quicker and have stronger break-through in the city where the differences between different levels of well-to-do and the masses are clearer. It is the proximity and of late the increasingly rapid communications that have given and still give the city many of its advantages. The spatial concentration of people, of consumers create the basis for a differentiated range of goods and the large-scale technological solutions to many supply problems. The city is the financial, cultural and social transaction central for societal life.

But it is not only a higher living standard that is the result of these technical and impersonally delivered supply systems. The illusion that city life can to a great extent be lived independent of other people is also there. The near and simultaneously forced supportive and collaborative relationships between people in what is often called the civil society that once was a dominating part of the everyday battle for survival has been watered down by the fact that each family can take care of the daily tasks itself using technical systems and mechanical aids.[4] But to a great extent the dependence on people remains, even if it is normally indirect and impersonal, not least through the unintended effects our actions have on other people's life conditions. This could be increased car use that leads to impaired public communications, noise, air pollution and accidents, or the growing trade in external centers resulting in fewer, more expensive shops near the residence to the detriment of those with few resources or lacking cars.

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[4]Hanssen, B. Familj, hushåll, släkt (Family, Household, Relations), 1978.

One of today's greatest environmental problems is that the effectiveness of the expanding urban traffic is being reduced through a gradual segues to private, motor-driven transport means. This traffic not only creates local and regional damage through accidents, barrier effects, poor air, poisonous emissions, noise and devastation of large areas. But its climate impact also places great stress on global resources.

Other serious environmental problems are linked as well to the urban lifestyle trends that are appearing. One such is the consumer mentality, often combined with a lack of awareness about and indifference in facing the connection between ones own actions and their environmental and social consequences. Another is the rapid, stressful life tempo, not infrequently linked to a compensatory consumption and a materialistic status seeking. Growing residence space, especially in detached villas, and growing facility space together tend to use up any efficiency gains in the heating systems. The end result is increased land use per capita and an urban sprawl with longer distances to travel. At the same time there is an increase in air-conditioning, floor-heating, mechanical ventilation systems and other comfort installations all drawing more energy. This high, accelerating consumption level creates a growing, poisonous mountain of waste and problems in closing the industrial and nutritional closed circle systems, both of which lead to shortages in strategic elements in agriculture, such as phosphorous and nitrogen.[5]

The large technological systems for energy and mobility that enabled a revolutionary increase in efficiency have not moved us towards a reduced resource use. Instead the per capita consumption tends to grow. The immense accessibilities these systems offer form a risk for the formation of expansive spirals where growth in one area forces growth in other areas as well, thus creating a resource withdrawal that is so large that the natural supply foundations are destroyed. Cheap and easily accessible energy leads to expansive transports that in turn promote sprawling localizations, increased transports and rising energy use. This easy accessibility and the payment systems contribute to undermining the restraining function of price mechanisms. The long-term growth in recreational travel by urban residents, often by air, forms yet another concern for efforts to limit resource use to such levels as are sustainable by nature over time.

There are basically two illusions that have cleared the stage for today's critical situation – one that urban life can be lived independent of nature and the other, that it can be carried on independent of other people.

1.2 Today and Perspectives Forwards

With its sprawl, spread, extension of large technical systems and growing populations, the current urban development generates a rising resource use per capita in both energy and land resulting in tangible threats to global, regional and local

[5]McNeill, J. Something new under the sun, 2000.

environmental values. These courses of events are in a way part and parcel of urban structure, institutions and the routines of the urban households. The large, potentially very effective systems for locality and residential supply, as well as for the movement of people, goods, energy, information and values are all imperfectly co-ordinated. In collaboration with the dominating user action patterns for maximizing comfort, the institutional arrangements under which these systems function form the basis for a growing resource utilization. Through the mutual alternation between the current change dynamic of the urban structure and the constantly repeated and modified choice for time use and consumption in its broadest sense, the current resource utilization patterns are preserved and reinforced in a way that is contrary to what the ecosystem can handle in the long term, especially in energy use.

The ecological importance and hazards of the cities and of city life are further accentuated by their scope and growing power. The cities and life in them has never been as important in human history as today. Half of all humans live in cities. This share is steadily increasing and is expected to reach 70% in but a few decades.[6] Conurbations are growing in number and in size. The countryside is increasingly influenced by urban ideals and an urban life style. The latter is indeed triumphing through a comprehensive immigration to the cities, as well as being accepted by growing numbers in the countryside. In the industrialized countries of the western world there is hardly any big difference between life in the countryside and that in the city. In this way people living in the countryside have also lost their contact with nature, tending therefore to the same degree as urbanites to lose proximity to natural resources and become increasingly dependent on the greatly internationalized markets for food and other necessities. People living outside the cities are highly dependent on cars and often have longer distances to work and service than do most city dwellers. Urban life styles have been generalized and spread to all types of social structures. Any attempt to solve urban environmental problems by breaking up or reducing the cities through a return to the countryside or small towns not only presupposed an improbable urban metamorphosis, but also an equally improbable deurbanization of the countryside.

There is a very tangible risk inherent in urban growth and the expansion of urban life styles, namely that of a constantly increasing resource use and environmental load far beyond what nature can manage. The desirable opposite is an ecologically sustainable city. In this study, we define such a city as one whose residents can live a materially good life in a way that prevents the devastation of the world's collective resources and leaves the world to coming generations without tangible changes for the worse. Sustainable urban development also presupposes that urban life styles remain socially acceptable and financially satisfactory. Still, the main emphasis in our understanding of a sustainable urban development is on household resource utilization and on how urban structure, institutions and life patterns can be brought to collaborate in order to keep resource use within acceptable limits.

[6]Christian, D. Maps of time, 2004, p. 453.

The resource and environmental effects of urban household actions are not localized to the urban area alone. Products the households consume are often imported from other parts of the world. At times the household members spend time outside their own city, thus impacting local and regional environments elsewhere. Even processes internal to the city, such as commuting between the residence and work, generate effects outside the city, including production of power and the emissions of greenhouse gases into the atmosphere.

Sustainable development can be described both as a future condition and as a contemporary process. As we see it the concept should and indeed must contain both these dimensions and then both in level and focus. Sustainable development is a process, or rather a complex of processes that taken together result in a reduced resource use and lessened environmental load. However, it is not enough to indicate direction. The changes need to be large enough that the levels attained to not exceed nature's capacity in the long term. Thus a future societal condition that satisfies this requirement is also a necessary part of the definition of sustainable development. Still, this cannot be a question of a static situational description as a society constantly changes, but a dynamic societal condition characterized by development mechanisms that ensure that resource use and environmental load stay within given boundaries.

Urban specific processes and general ones are both part of sustainable urban development. The creation of efficient motors, industrial processes and methods for insulating buildings all promote overall sustainable development without therefore being specifically linked to qualities in various cities or in various settlement types. Nor need some types of rule changes be tied to a specific town structure. Local sorting of waste and recycling is one such non-specific rule that even so might well be easier to follow in certain localities. The same is true of large parts of the households' non-durables consumption or time use, such as meat consumption and the time used for watching TV. But beyond these there is a long list of operations and activities that, due to the qualities of specific towns such as density, internal localization patterns and micro-environmental design, can be arranged or operated in various ways with different consequences for resource use. This goes for such segments as internal travel and transport, as well as the possibilities for reaching different availabilities in short times and proximate distances. Living without a car is comparably easier in the dense city and the conditions for public transport and heating supply are better in such density. In general the possibilities for public solutions increase thanks to the large and geographically concentrated situation in the city.

Though the disengagement of city life from an immediate dependence on nature obviously increases the risks for overdevelopment, it also opens possibilities. Thanks to that very concentration and collection of people and activities in the city, the basis for different types of large-scale, efficient solutions is created, as well as for public benefits such as an attractive urban setting. This potential urban advantage grows in importance as all types of communities are urbanized. At the same time, however, the continuing thinning and spread of the urban scene in a form of ruralization of the city called urban sprawl tends to reduce that advantage. A denser, more functionally mixed city increases the conditions needed for lower resource use and reduced energy utilization in the households, at the same time as that denser physical structure does not in itself lead to any overwhelming differences among them. The urban structure plays a meaningful, though limited role through its affect on the scope of travel and the opportunities for different types of traffic systems to function. Only through an interaction between the physical structure, the institutional conditions and the everyday action routines and tempi of the urban households can a sustainable development of the cities occur. Thus the great challenge is to find such institutional arrangements and methods that enable such interaction to develop and be strengthened, in spite of the fact that the overall development seems to be moving towards individualization and the short-term maximization of utility, status and comfort.

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Chapter 2
Limitations and Necessities

2.1 Backcasting

There are three basically different categories of future studies, each answering different types of questions. These are the Predictive (What will happen?), the Explorative (What could happen?) and the Normative (How can a certain goal be attained?).[1]

It is the last category that informs this book, the type of futures study that has specific goals to strive for. In some cases these goals can be fulfilled simply by making the right decision or if the existing development pattern continues on the road taken. In such situations it is perhaps suitable to use "preserving normative scenarios". They are preserving in the sense that they do not challenge the existing development trends and are empty of larger surprises. In other cases the picture may be considerably darker and only small indications exist suggesting that the goal will be reached at all. In such situations, it might be necessary to utilize "transforming normative scenarios". They are transforming in the sense that they look for or demand larger changes in order to attain the chosen goals.[2]

Transforming scenarios are also relevant when facing community problems of such type or size that it is difficult to see how they can be solved as they are so strongly tied by current conditions. When the purpose is to provide supportive information for developing more long-term, stable solutions to the problems, then new approaches are called for. These can in turn give birth to new ideas for solutions that surpass the frameworks set by today's conditions and trends. This book can be seen as a transforming normative scenario study with a focus on visualizing the shape of solutions for the stated problems and a subordination of the measures needed to reach solutions.

The question of sustainable development is of such character as to make it essential to develop thinking towards more long-term, stable solutions. Research in this area is based on the insight that if the economic growth on the current model

[1] Börjeson, L. et al. "Scenario types and techniques", 2006.

[2] Ibid.

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continues, there is a risk that the eco-system will be undermined and other resources depleted. Managing a global, social and economic development is no small task in itself. Then add to that the simultaneous necessity for preserving the production capacity of the eco-system while leaving the resources basically untouched for future generations and the task becomes much larger. Many of the current environmental measures only ameliorate the problems, creating some sort of sustaining defense, especially since they are isolated and usually lack relationship to the size of the change needed to attain a sustainable development.

One way to handle long-term questions such as sustainable development is to use the backcasting approach. As a transforming normative scenario, the backcasting approach asks that images of the future be developed that point to the attainment of a specific goal. Thus these images are already expressly normative in the problem formulation. Images of the future have a very prominent place in such studies. They illustrate how central parts of the field being studied can appear in some, rather remote future. The method is defined by an effort to liberate the design of the images of the future from today's mental straitjacket and dominating trends. At the same time they try to view significant parts of the ambient world as impressionable. When analyzing the possibilities for attaining a goal placed beyond trend-driven developments it is important not to fix external factors too tightly. Otherwise there is a danger that the developmental possibilities will not be revealed and observed.[3]

The backcasting approach has been used since the 1970s for several larger future energy studies, both in Sweden and in other countries, though it was not named until the 1980s.[4] During the 1990s it was mainly used to study sustainable development of various segments of society, such as the transport sector or urban areas.[5]

The most critical step in the backcasting approach is describing one or preferably more images of the future, each one illustrating ways to solve a larger societal problem. Naturally these will not present a complete picture of the future, but comprises a focused presentation of certain significant traits in the community of the future that are seen as especially relevant to the societal problem being studied.

There are several variants of backcasting. The one used here can be named target-oriented backcasting. It consists of four steps.[6]

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[3] Höjer, M. What is the point of IT? 2000a and Dreborg, K. H. Scenarios and structural uncertainty, 2004.

[4] Johansson, T. B. et al. "Sweden beyond oil: the efficient use of energy", 1983; Kaijser, A. et al. Changing direction: energy policy and new technology, 1991; Lönnroth, M. et al. Solar versus nuclear, 1980; Robinson, J. B. "Energy backcasting", 1982 and Steen, P. et al. Energi – till vad och hur mycket (Energy – for what and how much?), 1981.

[5] På väg mot ett miljöanpassat transportsystem (Towards an environmentally adapted transport system), 1996; Transport and environment, 1999; Steen, P. et al. Färder i framtiden (Journeys in the future), 1997; Åkerman, J. et al. Destination framtiden (Destination future), 2000; Metz et al. "Climate options for the long term", 2003; Åkerman, J. and Höjer, M. How much transport can the climate stand?, 2006.

[6] Similar versions of backcasting have been described in Dreborg (2004) and Höjer, M. and Mattsson, L. G. "Determinism and backcasting in futures studies", 2000.

The *first step* is to establish criteria and goals. In this study we choose criteria for sustainable resource use, as we mean that these are basic components in the sustainability concept and own a more absolute character than those criteria that can be formulated regarding social and economic development. This means that we accept as given such biophysical parameters as a finite world, complex ecologic interdependencies and the laws of thermodynamics. Rather we investigate how non-biophysical parameters such as technology, preferences, distribution systems and ways of living can be adapted to the frameworks established by complex biophysical systems that our societies are based on. What are accepted in our analyses are the physical, quantitatively defined, resource-based entities, as opposed to what we vary in our search for a sustainable city, namely the qualitative aspects of human activity such as housing related structures, institutional set-ups and household living patterns.[7] The criteria for sustainable resource use are easier to quantify than social and economic sustainability criteria. This means that clear requirements can be placed on a system, something that facilitates the search for creative solutions. What we are looking for are solutions that satisfy the resource criteria and also vital aspects of the social and economic dimensions of sustainability. As we develop the images of the future, we have taken the importance of these dimensions into consideration by varying the social and economic conditions between the images. In addition, the social and economic dimensions play an important role in the evaluation of our work. The goal is to develop images of the future that are as attractive as possible from a social and economic point of view, but under the condition that each of them must fulfill demands on ecological sustainability.

The *second step* is to investigate if the goals and criteria formulated are far from today's situation or rather simply those values that forecasts of the future development provide. Should the goal and the trend development agree, the discussion is not about some large, hard-to-handle societal problem and therefore the analysis work can be discontinued.

Should this not be the case, the *third step* begins, namely developing images of the future. This work is based on analysis of the most important factors or powers behind the development today, meaning those factors that have created the societal problem, as well as those factors that could promote future solutions. This then forms the basis for choosing themes for images of the future. The choice of characteristic qualities for these images is a critical moment in this work. The qualities we have seen as critical are directly linked to the resource use of urban residents and determined by a combination of the possibilities provided and choices made within or at the limits of available possibilities. This done, the images of the future can be described as solutions that either attain the established goals or satisfy the formulated criteria. This work takes into consideration the consequences of other aspects than those included in the criteria or goals. It is at least as important to judge the attractiveness of the images from social and economic perspectives.

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[7] See Daly, H. Beyond growth, 1996, for an in-depth argument for this perspective.

The results of this work are then presented for discussion by all parties concerned. Thus the relevance of the images can be tried and supportive comments received for use in the next step of the work with the images of the future.

In the *fourth step* the implementation paths to reach the images of the future are analyzed. By studying today through the images of the future, it is possible to determine the change needs and thus what choices can be important to make in the near future in order for a given image to be implemented. Identifying the trend breaks or reversals that are necessary and how to stimulate this is essential. The task is not to develop a plan for the future societal development. Rather the purpose here is to make it probable that a radically different society is possible.[8]

The images of the future are important for showing the possibilities in situations that easily can seem hopeless. It is premonitions that important goals will not be attained that justifies backcasting studies. In other scenario studies the effort is often to develop scenarios that are very different from each other. It is sometimes said that the aim is to span the credible range of possibilities, an expression that suggests a desire to cover all possible developmental bases. Backcasting, on the other hand, seeks to show how solutions to very difficult problems might look. Just this focus on difficult problems means that the differences between the various images of the future are seldom seen to be as large as the difference between the existing situation and the group of images. The reason is that the hard problems being focused on tend to place requirement on change in a certain direction, a change that then affects all images of the future.

2.2 Shared Traits and Differing Dimensions in the Images of the Future

As the discussion above has shown, the images of the future hold a central position in the backcasting work. Each presents a different way to satisfy the goals. Thus one important question is what is varied and what remains constant between the various alternatives.

We are not working here with assumptions for political or economic systemic changes. The differences we assume in these areas are not of such dignity that they affect the result in any significant ways. Our overall assumption is that the current world order will continue, though with certain tangible shifts in the economic activities and thus a resulting adjustment between the various continents. We see this development mainly as a continuation of current trends that have resulted in a concomitant adjustment over the most recent 4 decades, even though all parts of the

[8]The approach is discussed in Dreborg, K. H. "Essence of backcasting", 1996; Höjer, M. Telecommunicators in the multinuclear city, 2000b; Robinson, J. B. "Futures under glass", 1990; Quist, J. and Vergragt, P. Past and future of backcasting: The shift to stakeholder participation and a proposal for a methodological framework, 2006.

world have not been involved, most specifically Africa south of the Sahara. It is naturally possible and perhaps even probable in some ways that the economic and social turbulence during the last half century will have immense effect on human environmental actions and thus on the possibilities for realizing various types of images of the future. However, these are not major questions in this study.

All six images of the future share one facet, namely that they are localized in the Greater Stockholm area.[9] We have placed the images in the Stockholm geography and demography in order to gain a stronger coherence than would have been the case if they had been designed for non-specific cities, places and populations. Such coherence can obviously be driven too far making it difficult to draw any general conclusions. However, we do not feel that this danger is especially large. The images ought to be understandable and the report be studied with understanding by both those who have and those who lack knowledge of today's Stockholm.

The images of the future are prepared for year 2050, and are compared with statistics for Stockholm year 2000. The choice of temporal perspective represents a balance between two considerations, namely providing space for large changes on the one hand and the possibility for imagining and sensing the contours of the future society based on today's on the other. In most studies, 50 years is a long temporal perspective. It is even unusual for future oriented societal studies to look farther ahead than that. However, we believe that this longer time perspective is essential for studying lethargic complexes such as urban structures, as well as the action patterns and time use of households. A shorter perspective would not provide the freedom of thought that is a necessary condition for discussing larger changes.

Looking back some 50 years we can see that the mass use of cars had not yet begun in Europe. The conditions for the enormous spread of housing in and around our cities were not yet in sight. Suburban spread still depended on public, frequently track-bound transport means that kept the exploitation low. Half a century is the period in which a long, economic wave based on the car and the closely related single-family home could mature and reach saturation. It is also the temporal frame in which a new, restructured economic wave can grow and be accepted. It is possible that the changes between 1950 and 2000 seem exceptionally great, but in a book on Stockholm's environmental history it is shown that the differences were great between 1850 and 1900 and between 1900 and 1950 as well.[10] But 50 years is not a magic period. Much of what we are discussing can just as well happen in 40 or 75 years. A more rapid change would reduce the environmental damages and ensure that repairs need not be as comprehensive. The reverse is true if the transformation takes more time. But for our analysis there is no numeric magic in the number 2050.

The population growth or urbanization pace is one material characteristic and an important factor that must be integrated into the analyses of the sustainable city.

[9]Greater Stockholm comprises Stockholm County except for Norrtälje, Nynäshamn, Södertälje and Nykvarn municipalities.

[10]Pettersson, R. (ed). Bekvämlighetsrevolutionen (The convenience revolution), 2008.

A population growth carries with it challenges for satisfying the needs of the new residents when it comes to housing, facilities, transport and other infrastructure items. But it also brings opportunities both for utilizing the latest, environmentally most advance technologies, as well as supplementing and supporting existing settlement structures and traffic systems so as to attain a more efficient whole. However, the future population growth has not been varied between the different images of the future since we want to test the conditions for the various spatio-temporal solutions under constant conditions. In establishing future growth in the Greater Stockholm region we have utilized the forecasts the Stockholm County Council's Office of regional planning and urban transportation prepared within the framework of the regional development plan 2010.

The assumption regarding how many persons will live in Greater Stockholm in about 50 years is a central factor in formulating the urban housing information we face when shaping the images of a sustainable future city. Studies of urbanization sequences are unanimous in showing that urban growth varies over time and population growth fluctuates in both short and long-term perspectives. Thus it has proven difficult to forecast except in the rather near future and under stable development phases. Nor is our ambition here to predict the most likely development. Rather we seek to present a frame in which the images of the future are not unlikely and which at the same time holds challenges for the urban adventure in the nearest half-century. We have used the alternatives in the Regional development plan as points of departure.[11] In Base the average population growth is assumed to be 22% between 2005 and 2050, while in High it is assumed to be 48%, corresponding to a growth between 450 and 950 thousand inhabitants from year 2005. In this book we use a population increase for Greater Stockholm of 700,000, or 44% for the period 2000–2050.

The uncertainty is not as large when it comes to predicting the future median age, but over so long a period as to 2050 it too will increase. Even here we accept the assumptions in the Regional Plan. A varied growth rate means variations in age group distribution. If today's age-specific moving patterns hold, a greater immigration would mean a larger share of children and a concomitant shrinking in the share of older persons.

The future development of employment is another important parameter in urbanization and the shape of the future city, specifically through the construction and localization of work sites. The Regional development plan 2010 assumes that the employment rate will increase in the High alternative and decrease in the Low alternative. We use an alternative in between those, a slightly lower employment rate but with an increased population the number of work places still increases by 300,000 jobs.

While backcasting enables and encourages images of the future generation independent of current trends, it is not totally possible in practice. Each future study

[11] Office of Regional Planning and Urban Transportation, 2008, 2009.

is more or less consciously and explicitly a reflection of its time as to which factors may vary and which should be kept constant. Though the numbers of variations in images of the future are in principle infinite, it is hardly practically possible to vary more than a very limited number of factors in one study and still retain lucidity.

The factors we have chosen to vary can be linked to a spatial and a temporal dimension. Having chosen a household perspective, we focus on everyday actions and by emphasizing the importance of temporal and spatial structures, we indicate that the actions are dependent on an urban context.

The environmental load of urbanites is determined by a combination of the possibilities available and the choices made. The action frame is limited by such factors as the physical structures. The transport system and housing qualities play a vital role in deciding which alternatives city residents can choose from, including such factors as local trips and living space. These two account for a large share of the environmental impact of the households. For this reason, the spatial dimension of the urban structure, with the transport system and housing distribution as the most important components, has been chosen as one of the two dimensions forming the basis of the images of the future.

Three different urban structures appear in the images of the future. One, a polycentric structure, has a limited number of large cores growing outside the inner city and in competition with it. In another urban structure, based on the current Stockholm structure with subway and commuting trains, there is a reinforcing development of smaller centers and hubs. The third structure accepts the tendency to sprawl and is thus based on the development of low-rise, villa and single-family houses. We have named these three Urban Cores, Suburban Centers and Low-rise Settlements.

Other factors with decisive influence on the total environmental load are the scope and character of the household consumption. This use is in turn affected by both the economic conditions and the household time use. With strong growth greater consumption and greater investments are possible and thus in principle a larger environmental load. But the increased room provided by investments can also create possibilities for more efficient consumption in the sense that the consumed goods and services have lower energy content per monetary unit. Growth is linked to the size of the collective work effort – it is higher if the average annual work time is longer.[12] Shorter work hours also result in lower income, but at the same time more time for unpaid work. Thus the work time affects consumption both by affecting income and also by influencing activity patterns. We have chosen to let the temporal dimension vary in our images of the future. The variations are described as differences in tempo and contain variations in the work time scope, as well as the consumption room and activity patterns linked thereto.

We use two tempi in the images of the future, namely Fast and Slow. There is no apparent difference in the average annual work time between Fast and today, but

[12] Refer to Långtidsutredningen (The Swedish longitudinal survey) 1999/2000, 2000.

there has been a substantial economic growth. In Slow, the economic possibilities are as large as today, but the average annual work time is shorter.

2.3 Household Perspective

The resources utilized by a community and the environmental load caused by this utilization can either be noted at production or calculated during consumption. Logic shows that it is the same magnitudes. In order for the results to actually be the same, we must keep in mind the following:

1. that certain goods and services are consumed as inputs during production of other goods and services;
2. that a considerable share of the production of goods and services is consumed collectively; and
3. that production for investment on the consumer side appears as a gradual wear during the utilization of infrastructure and other investment goods.

Choosing thus, as we have done, to view urban sustainability from a household perspective does not mean that we feel that the households and their actions are the source of the resource use and environmental load caused by the collective production and consumption. The choices made by the households are important, but a number of institutional conditions outside the control of the households also hold decisive roles for the total environmental load, namely how corporate production, distribution and marketing is designed, as well as how external living conditions of the households are formed, such as traffic systems and housing structures.

There are several reasons for choosing the households as observation interface for the flow of natural resources to the cities. Not only are they the central unit for consumption, reproduction and free time, but they are also an organization where much production takes place. Many different activities are found in the households. All goods and service produced will sooner or later be used by the households, either directly and specifically, such as detergents, energy for lighting and child care, or indirectly and generally, such as the political system for bringing various interests together, the administrative system for handling common concerns (police, firefighters and the military), and the infrastructure (systems for transportation of people, goods, electricity, water and sewage). As we see it, the households are the end users of everything, meaning that they produce all final service. This final service is created using various resources. The individual's work is combined with greater or lesser use of machines and other equipment, as well as bartered, bought or publicly supplied goods and services.[13]

Previous historical experiences from the end of the nineteenth and the early twentieth century show that household decisions and actions have played a vital

[13] Gershuny, J. Social innovation and the division of labour, 1983.

role in social change with far-reaching consequences for societal development. The initiatives and efforts by the households have contributed to enabling some of the truly meaningful changes in the industrialized communities, including less illness and mortality, better nutritional standards, higher education levels and greater comfort at home. Their demand for goods and services that only in part were available in the marketplace ensured that these would to a great extent be produced within the households and some of the market demand was aimed at supplementary goods.[14] This role for the households is important in analyzing the sustainability of urban life, not least when pathways to a sustainable city are on the table.

With the household as the observation interface, the frequently ignored informal sector becomes visible and activity shifts between it and the formal sector can be handled, as can technological and social innovations. The decisions made in the households grow in importance as the share of the total consumption necessary for maintaining life shrinks. Thus the household use of possible choices gains in importance. Yet further reasons that a household-based perspective on urban sustainability is preferable to a producer centered one include the facts that the households have closer, more local links to the companies, are more strongly tied to the city, and that images of the future formulated with households and their functionality as a point of departure are easier to concretize and understand. Choosing households as focal point for analyzing resource flows and sustainable urban development stands in agreement with the thought that it is the lives that are to be lived in the city that should be and can be made sustainable, not the city itself.

Thus we can describe the nature resource utilization of urban households in a consequent manner if we take the final service they produce and that is produced for them by public consumption in the form of political, administrative and security services. This final consumption in the households satisfies a number of fundamental desires or needs. Since the households play an active role in satisfying these, it is possible to describe these as household services. The actions of the households and the effects of these on natural resource use will be mapped and discussed based on a separation of these functions into six categories, namely Personal, Residence, Food, Care, Common and Support. An operationalized description of how this has been interpreted in temporal and energy terms can be found in Appendices A and B.[15] These have been chosen since they are important to natural resource use by size and/or growth rate. They are also meaningful in the way people live in the city. They correspond to fundamental household needs, but also takes into consideration the fact that welfare is a function of other factors than just those that satisfy physical

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[14] De Vries, J. "The industrial revolution and the industrious revolution", 1994.

[15] Gershuny (1983), pp. 1f, 67ff divides the household service functions into ten categories: "Food, shelter, domestic services, entertainment, transport, medicine, education, and, more distantly, government services, 'law and order' and defense". These ten are taken from the European System of National Accounts. In the categories we have developed we have removed the transport segment, as this function most frequently serves as a means for satisfying other functions, allocating it instead to the other functions based on the purpose of the trip. The other Gershuny categories have in some cases been combined in order to facilitate the analysis. The Support category has been added.

needs, such as access to transport and mobility, as well as to the comforts of life and opportunities for recreation. This taxonomy is sufficiently flexible to embrace even such things as symbols of belonging or apartness, factors with great importance to individual identity and base in social fellowship.

1. *Personal* identifies a vital, varied category that includes such functions as night sleep, clothing, hygiene, recreation, entertainment, leisure trips and summer houses. It also includes a number of durable and semi-durable goods (TVs, computers, hi-fi systems, recordings, videos and DVDs, books and clothing), consumer goods (tobacco, alcoholic drinks, soap, make-up), and services (public cultural services and personal services). The consumption linked to free time has been growing for a long time, an increase that in all likelihood will continue into the future. Some of the activities are such as to affect the actions of households in the other categories. The goods and services may generate the need for space and travel. This category includes much of what serves as lifestyle indicators.
2. *Residence* plays a central role as an activity arena and gathering point for the household members. The resource consumption includes the residence and parts of its equipment. Residential services and heating/lighting are important components. Other parts are the furnishings (furniture, rugs and textiles) and household services, such as cleaning, maintenance and repairs. Housing expenses have been a heavy post in household budgets for a long time, but their share is beginning to show a long-term reduction. The size and function for the households are factors with high effect on household resource use.
3. *Food* is a category that can be satisfied in different ways, among them through preparation of items purchased using household equipment, through restaurants visits or through the use of a collective dining hall. The resource use comprises not only the actual consumer goods, but also the equipment needed for storage, purchase and preparation of foodstuff, as well as parts of the restaurant and café visits. In the longer term the share of household expenses attributable to food and drink has shrunk drastically. However, it is clear that food and drink have a fundamental role in the everyday life of the households and in societal organization with considerable consequences for the utilization of natural resources.
4. *Care* comprises mainly health care, schooling and various other care services. It deals with an important part of everyday household function, a segment that will most likely increase in importance. A growing share of household expenses and of the national budget will probably be assigned to education, health and other care services. In recent years there have been large-scale discussions of how these services should be organized, not least the role of the informal sector in this context. The temporal and spatial organization of these services can include possibilities for resource effectivization. In this there are large differences between various service types, including the possibilities for using new technology. Certain services can hardly be made more efficient in a conventional sense without losing quality, but in others there are excellent opportunities for keeping resource use at a low level, for example through new ways of using information technology.
5. *Common* includes public utilities such as the political system, defense, police, courts, central and local governmental authorities, as well as county and

municipal administrations. This category also includes participation in political parties, householder associations and neighborhood co-operation. The activities are mainly financed publicly and usually difficult to link directly to the households, even if they contain a service segment that calls for direct contact with the general public. Since this consumption is mainly collective, only a small part can be apportioned to individuals and households. However, these public services are essential as they satisfy a fundamental need for security and safety.

6. *Support* refers to the central function filled by the household members who in one way or another sell their labor in exchange for the means to consume goods and services. A relatively large share of household time is used for this purpose as time for salaried work, time for travel to and from the job, and time for changing jobs. However, in our household oriented perspective the resource used in working will not be booked on the household that contributes to the production through work, but on those households that eventually consume what is produced. Still, the household's own input for doing the work will take a special position. It can be a question of buying work clothes and tools, though such expenses are normally marginal. Instead, almost all resource use allocated to Support comes from commuting. This category is special in that it has a unique role in the design of the urban structure and for the households' time use. Work travel dominates during rush hour traffic and is thus a determining factor for traffic system dimensioning.

Since the point of departure is the needs and desires of the households, the category structure does not differentiate between private and public consumption. From a household perspective these two types of consumption are simply different ways of satisfying a need and in that way equivalent. Still it is obvious that the different ways to satisfy needs can have various consequences for the use of natural resources. Travel is not treated as a separate needs category since it is seen as a means for reaching a goal.

The point of departure for household activities is not only determined by an effort to describe the use of natural resources by the households in a thorough manner. It also provides excellent possibilities for discovering environmentally positive spirals that can generate desirable changes in other respects as well through changes either in some part of household activities for satisfying fundamental everyday needs or in technological or structural conditions or in both. Such spirals can initiate the development of social innovations, that is that the needs and desires sought by the households can be satisfied in new ways.[16] For example, changes in the inner structure of the residence and in the urban setting (communications and transport possibilities and functional integration) can make it possible to house additional activities in the home or its immediate proximity. The result can be reduced travel and a more efficient local use. Consistently applied this approach can

[16]Gershuny, J. och Miles, I. The new service economy, 1983, pp. 89ff.

also lead to simplified identification of any obstacles to change. Thus consideration can be taken to the degree of realism in conceivable changes.

2.4 Creating Images of the Future

A number of different phenomena have been described in the second part of this book and are intended to serve as documentation or building blocks for the construction of images of the future. Procedures and approaches may vary, in much as a result of dealing with dissimilar phenomena, such as urban structure, household activity patterns and technology, but where the differences are a consequence of the fact that the documentation has been developed by authors with varied subject competence. This diversity has been essential for including all the aspects that must be considered when urban sustainability and the possibilities for shaping urban life along the lines of the developmental requirements that are to be analyzed. However, there is a common element in the arrangement and focus of these chapters. Each one deals with the current situation, important trends and conceivable future alternatives. This provides the presentation with a measure of unity and grants the questions in three areas, namely urban structure, household handling patterns and technology, a similar treatment.

The main authors have received the task of co-ordinating the concurrent work. This has been done by examining the current situation, trends and future alternatives, seeking to determine if the images can handle the criteria established, as well as with consideration concerning the attractiveness and realism of the images from a social and economic perspective.

The images of the future have been developed in several steps and with a varying number of participants for each. In the first step we primarily focused on idea generation aimed at creating as broad a foundation as possible for shaping the future pictures. There occurred a certain agglomeration of ideas, meaning that the ideas were grouped in order to gain a convergence. Only persons who had worked or were working in the project or in some related project in one of the research groups were included in this step. The result of this introductory step was then worked over in three groups, one focused on technology, one on the design of urban structures and one on household action patterns (spatio-temporal dimensions in the images of the future). This done, a representative core group developed the ideas into a first, somewhat complete, draft version of the six images of the future. This draft was then the subject of a workshop that included project participants in order to identify problems in the images and find solutions to them. After a reworking, the images and paths to attain them were discussed in a workshop arranged by the Swedish research council Formas, with some 50 participants from the research programs *The City as a Life Environment* and the *The Sustainable City*. While this resulted in some adjustments to the images, the main results were ideas for deeper analysis discussions of the paths towards the images of the future.

The images of the future were also tested through qualitative interviews with a number of Stockholm residents. The starting point here was that urban residents have differing attitudes towards what would be the best way to solve the problems of environmental load. The method in this sequence was to confront the interview persons with certain central parts of the images exhibiting changed or unchanged everyday practices and asking them to discuss them. The traits offered were partly opportunities for better economy or more free time, partly new construction in a few, large centers or an urban sprawl in a larger number of smaller centers. In addition the persons were asked what their position was regarding measures for reducing energy use. Among the results of these interviews could be counted knowledge about the conditions households see as blocking them from altering everyday routines and what evaluation criteria they use when making their minds up about alternate images of the future.

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Chapter 3
Limits of Urban Sustainability

3.1 Sustainable Development

The concept sustainable development came into use when the World Commission for Sustainable Development used it as a central tenet in its analyses.[1] Since that time governments worldwide along with the UN have made sustainable development a political goal for society.[2] Though what is included in 'sustainable development' is not clearly defined, the most classical definition says that sustainable development is the ability to "meet the needs of the present without compromising the ability of future generations to meet their own needs".[3]

Sustainable development is a global, general concept. A more concrete definition might be arrived at by placing the emphasis on natural limitations. Ecologic economist Herman Daly has expressed it this way: 'The main principle is to limit the human scale to a level which, if not optimal, is at least within carrying capacity and therefore sustainable.'[4] The idea is that the scale of the economy is delimited by the ecosystem's capacity for functioning as a source for the economy's investment products and as a receptacle or receiver for human waste products.

Daly's thoughts form the point of departure for our images of the future. The goal is to maintain human activities and consumption within the limitations the earth's ecosystem sets and to remain at a level where the value of the natural resources is left undiminished for coming generations. Social and economic aspects of sustainable development are also frequently stressed. We include these as secondary conditions that may not be ignored, but ones for which it is unsuitable to formulate independent criteria. These aspects are primarily treated in the evaluations

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[1] World Commission on Environment and Development, Our common future, 1987.

[2] "We reaffirm that development is a central goal in itself and that sustainable development in its economic, social and environmental aspects constitutes a key element of the overarching framework of United Nations activities." From the 2005 United Nations World Summit Outcome, adopted by the General assembly.

[3] World Commission on Environment and Development, 1987, p. 43.

[4] Daly, H. "Elements of environmental macroeconomics", 1991, p. 44.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*,
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of the images of the future. The ecosystem's resistance to various changes sets how large societal emissions can be without depleting the natural environment and impoverishing human living conditions. One example of this is human release of carbon dioxide that has been found to affect the global climate with severe effects on both humans and the ecosystem. However, many claim that today's immense resource consumption and environmental degradation can be motivated by the fact that it contributes to the building up of a capital stock that even future generations will benefit from. Others would have it that each generation must be able to make its own choices, something that is hindered by today's huge consumption.[5] By embracing Daly's argument on natural capital, we are aligning ourselves with those who believe that the withdrawal of non-renewable natural resources can be motivated so long as all or parts of the net balance created by the reduction of these resources is used to build up another natural capital that can produce a substitute in the form of renewable resources.[6] Natural capital can be defined as a source provided by nature that can offer a flow of natural resources. These can include renewable flows, such as that ocean fish populations replenish themselves creating the opportunity for fishing or a forest that grows, thus enabling a certain amount of cutting. However, oil wells from which oil is taken are rather an example of a non-renewable natural capital – a finite resource that is not recreated.[7] It is also vital to understand that the environmental impact such a withdrawal causes must not lead to large damage to the ecosystem as is the case with oil.

The distribution of accessible resources among the earth's population is another important question to discuss as part of analyses of sustainable development. Consumption of natural resources differs strongly in various parts of the world. About two and a half billion persons (40% of world population) still live on less than two dollars a day. Together they account for 5% of global income. Meanwhile, the richest 20% of the earth's population account for 75% of world income.[8] The poverty causes starvation and suffering, as well as political tension and international threats in the form of wars and terrorism. Thus one central question for sustainable development is an equalization of resource utilization. This is already underway, in that a relatively large portion of the population in what earlier was called developing countries are now raising their living standards at a rather rapid rate and are in many ways copying the resource heavy action patterns of the western countries. Yet in spite of these rapid changes, the differences are still very large and as far as can be determined will remain so for a long time. In addition, certain parts of the world, such as Africa south of the Sahara, would seem to remain outside these growth processes. While it is clear that a problem of such gigantic proportions as the global distribution of resources cannot be seen as but one aspect of the efforts with sustainable development, in a criteria discussion it is necessary to take position

[5] Sachs, W. et al. Greening the north, 1998.

[6] Daly, H. "Operationalizing sustainable development by investing in natural capital", 1994, pp. 32f.

[7] Ibid., p. 30.

[8] Human Development Report 2007/2008, 2007.

on various distribution principles. One way to handle the question of a globally fair distribution is to count on an equal resource distribution within the current population as promoted in the 'Environmental Space' concept.[9]

Obviously there are other ways to handle the concept of fairness, including distribution according to need or merit.[10] These principles tie into the ethical positions written in the UN Charter, namely that everyone shall have the same rights and opportunities for development. However, principles of this kind are difficult to apply to the type of schematic calculations necessary for formulating criteria for sustainable development. Logical questions in this context include defining why Stockholm's population merits a higher resource consumption than the average global citizen, as well as what the needs are that would motivate this, other than that they have become used to the higher standard, comfort and consumption level than what the average person is able to. Nor can the usual argument that they need more energy to maintain a comfortable climate in their houses and locales during the winter half of the year suffice, as this must be balanced against the comparable need for people in hot climates to lower their indoor temperatures. It is also possible to formulate arguments that a fair distribution would mean an adjustment following the historical resource withdrawal, i.e. that non-industrialized countries should be able to release carbon dioxide about at the same level as today's industrialized countries did in the comparable phase of their development.

When natural resources are discussed, it is important to remember that for the most part these cannot be accessed without investment. Natural resources become accessible because someone makes them accessible and beneficial and to make that happen calls for knowledge and capital. In part what makes is possible for the richest fifth of the population to use 80% of the resources is the capacity developed in these countries. In addition, because of the technology and know-how in the rich countries, the yield per resource used is increased. Seen in this way it is not possible only to picture the resources as a cake baked for five children where one eats four fifths and the other four must share the rest. It is not enough to cut the cake more evenly. The possibilities and skills for making the resources accessible and effectively used must be distributed as well. Stable institutional and welfare promoting systems must also be shared in order to attain a more even living standard. In other words, an equal distribution of welfare is not necessarily attained through an equal distribution of natural resources.

Whether the energy resource is primarily used for an open fire or distributed through electrical or district heating networks, it creates quite different possibilities for the user. While it is true that a fire can warm both body and food, as well as provide some protection, the same amount of energy investment in a high-tech society provides considerably larger handling scope. Thus leveling the natural resource utilizations must be supplemented with an effort to level the yield from the same natural resources.

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[9]Miljöförbundet Jordens Vänner (Friends of the Earth), 1997.

[10]Caring for the Earth, 1991.

However, access to know-how and capital created by mankind will not nullify the fact that the earth is a finite heavenly body. This characteristic means that a constantly increasing resource withdrawal can finally lead to problems, either through the depletion of the resource base or through the emissions these withdrawals cause.

In this study equal distribution of energy use per capita spread over the global population will be used as a strongly schematized calculation principle. In other words, we do not take into consideration that different regions may have different needs and also varying conditions for accessing the resources. Nor do we include the fact that differences in energy utilization are currently large, both how annual use is perceived and how it has developed over the most recent 30 year period (see Fig. 3.1a, b). When it comes to globally accessible resources and environmental impact factors, it is possible in principle to imagine how a balanced distribution could work. Still, for more local resources this is hardly possible.

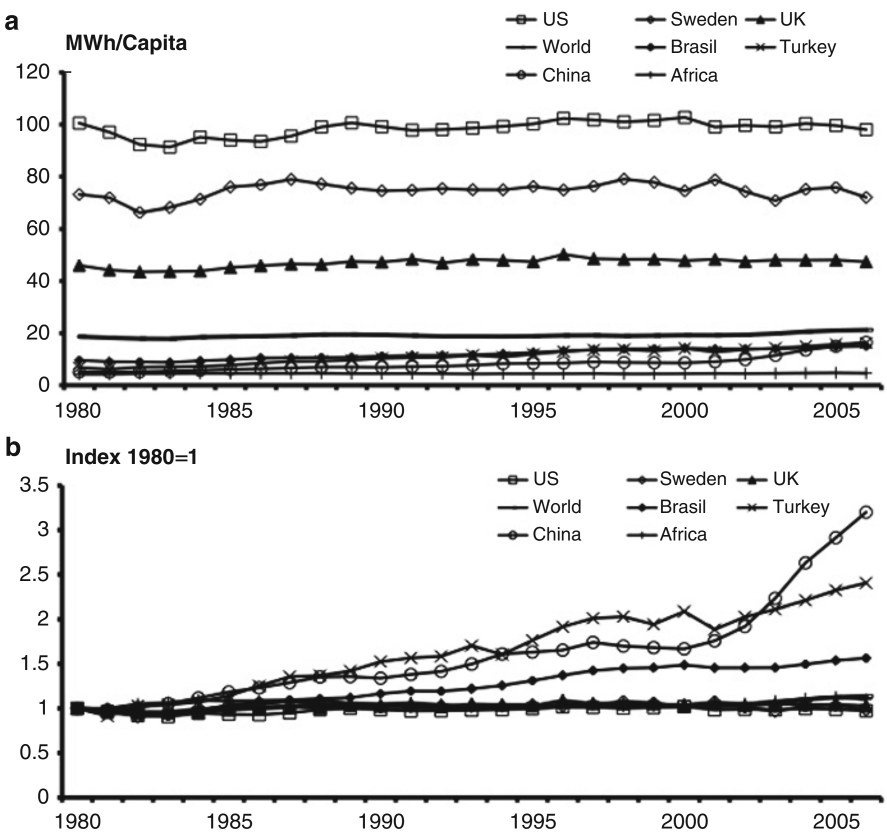

Fig. 3.1 (**a**) Total primary energy consumption per capita between 1980 and 2006 in MWh. (**b**) Total primary energy consumption per capita between 1980 and 2006. Index 1980 = 1. Source: International Energy Annual 2006, Department of Energy, US

3.2 What is a City and What are its System Boundaries?

It is part and parcel of a city that it cannot be self-supporting. With so large a density, an urban area is always dependent on a host of outside resources, such as food, energy and materials. The surrounding countryside will also take care of the city's waste products, such as nitrogen and sewage. Thus for any discussion of a sustainable city to be tenable, it must by necessity find ways to include the outer areas or fail. In other words, any definition of a sustainable city demands that the environmental impact of the city dwellers' consumption not only is considered inside the city limits, but also includes the consequences of production of that consumption. This means that the products prepared for city residents outside the city should be counted as part of the city's environmental impact.

If the global concept of sustainable development is to be used for conurbations, it must be operationalized so as to be applicable on a local level. The challenge of reaching a sustainable city lies in finding solutions that enables the city to satisfy the desires of its resident within the framework required by a sustainable development. This is essential since the city is dependent on both the influx of resources and on the availability of surrounding space to take care of its waste products. The very environment in the city is vital to the health and life quality of its residents. Thus criteria that describe a sustainable development can be formulated in terms of the resource influx to the city or rather to its population, the internal environmental qualities in the city and the outflow of waste products from the activities of urban citizens. These in and out criteria can be formulated so as to be general for all cities, while the urban environmental quality criteria are of a more qualitative and locally focused character.

The various problem types flagged by the criteria are often interconnected. Elements injected into the community often affect the local environment and are subsequently released into the surroundings in some form. One instructive example is the increased greenhouse effect that is the result of the fossil fuels inserted into the community and then released as carbon dioxide. Between the influx and the release, the city is also affected by various air pollution factors during combustion. In this case the problems can be remediated through measures taken at both ends of the process.

In this book we have chosen to concentrate on the global energy resource, as this captures many other aspects well. Energy is not only a central influx component, but also affects the local and regional environmental quality and outflows. Energy flows are also rather easy to calculate and determine, as opposed to many other flows and criteria.

The energy use by city residents is an influx criterion. In order for the sustainable development concept to be meaningful on a city level, we estimate the part of the globally available energy that benefits the city residents. Quality and release criteria are more local limitations, with the exception of emissions with global distribution, such as carbon dioxide. Thus the release of carbon dioxide forms a limiting factor when determining the energy influx that can be seen as compatible with a sustainable development. Other criteria than energy can be used, including material and land surface, both relevant from an environmental point of view. However, since theory formulation and measurement methods are less developed for both these factors, they are more difficult to work with. The situation is different in the energy segment where research has long been underway and where we have rather good knowledge of how the various development paths affect the community's energy consumption.

3.3 Today's Energy Utilization on Global and Local Levels

The energy use is distributed unevenly between the countries and populations of the world. The total world primary energy supply is app. 130 PWh.[11] In 2004, the world average was about 14 MWh/capita, with the Americans using about 4.5 times this, Swedes 2.5 and Africans about one third of that number.[12] Figure 3.2 illustrates this for several countries.

The numbers in Fig. 3.2 only show the energy use in each country distributed over its residents. They exaggerate the energy use of residents in countries with large exports of high-energy use goods. Since it is the energy use for consumption that we want to compare, the export surplus must be discarded. Our calculations in Chap. 27 of the energy use for Swedish consumption sets the figure at approx. 350 TWh, corresponding to 39 MWh per capita. On an aggregate, Stockholm

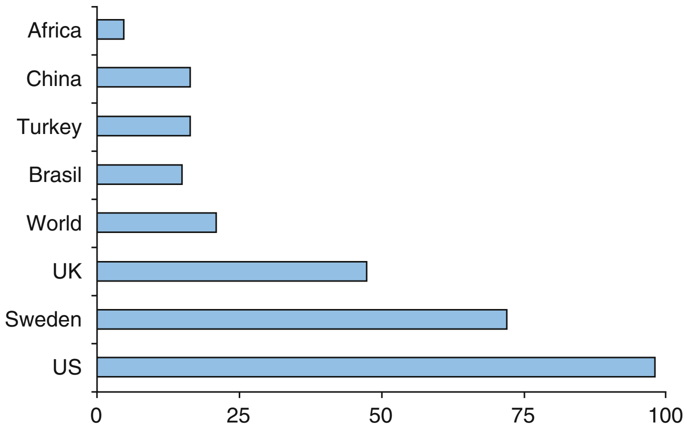

Fig. 3.2 Total primary energy consumption per capita for selected countries (Source: International Energy Annual 2006, Department of Energy, US)

[11] Energy in Sweden, Facts and figures, 2008.

[12] Energy in Sweden, Facts and figures, 2008.

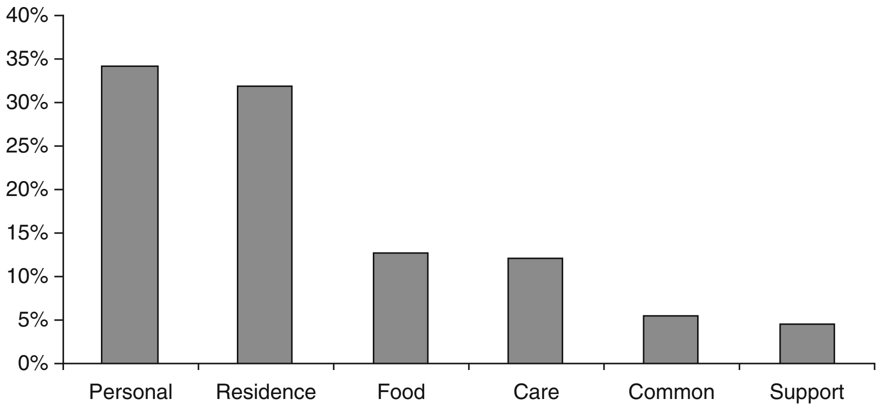

Fig. 3.3 Energy use by Stockholm residents distributed over function 2000 (Source: See Chap. 27)

residents do not seem to differ much from other Swedes when it comes to energy use.[13]

In Chap. 2 above we showed how the energy use of Stockholm residents can be described using six household functions. Figure 3.3 shows energy use by functions. Note that the numbers are for how Stockholm residents use energy, not what is consumed in the Stockholm metro area. A more detailed discussion of the numbers in question is found in the Chap. 27.

The figure shows that the private consumption answers for approx. 85% of the energy use, excepting Care and Common. The Personal function uses one third of all energy, half of which is from leisure trips. The largest part of the energy used for leisure trips is for trips by car (3/5), but travel by air is also significant (1/5). Our numbers suggest that energy used for air travel by Stockholm residents is significantly higher than for those living in the countryside. Next to transport the largest energy use is from bought electricity for such items as computers and TV, as well as for heating holiday cottages. The Residence function stands for one fourth of the energy used, mainly for heating. Of the energy consumed under the Food function, one half relates to the production and transport of the actual food and a third for bought electricity used to prepare and store the items.

In the Care and Common functions, the energy use is also mostly for heating and operations, in the first function for school, health and care facilities. The Common function is for such as authority facilities and the last function, that of Support, is entirely for commuting trips. As has been emphasized in Chap. 2, energy used at work is not considered part of the household that supplies labor to production, but rather on that or those households that finally consume the products.

[13]Energi 2050, 2003.

3.4 New Energy-Related Technology

Energy-related technology is rapidly developing. A big question is if new technology in this area can increase access to environmentally adapted energy so much that limitations in energy consumption will be unnecessary. Carbon capture and storing, CCS, is one example of a technology that might be able to change conditions for energy production. There are a number of possible technologies for CO_2 storage, including storage in old oil and gas wells, deep-sea storage or storage in discontinued mines. Calculations for large coal-fired power stations have shown that the coefficient of utilization may shrink by between 8% and 10% if CO_2 separation is introduced and that the extra costs will be about half the production price. A number of trials are underway round the world, though the techniques are not yet thought mature enough for large-scale use in the energy production system. The technology is also hampered by being difficult to use in small-scale production, as it is most suitable in large facilities. Thus CO_2 storage will not solve the problem of using fossil fuels in our cars.

It is very difficult to predict how large a potential CO_2 storage has and what the consequences for future energy supply will be. One problem is the uncertainty regarding how long the current reserves of oil, coal and gas will serve. Reliable experts believe that oil production will reach its maximum level in the near future and then begin to diminish. Gas and most certainly coal reserves will last considerably longer.[14]

Fusion energy is another energy technology long under discussion. Even here the research is broad, but most indicators suggest that a breakthrough that would make large-scale production possible is far into the future. A demonstration facility ought to be ready around 2035, but commercial facilities are not expected earlier than 2050.[15] Even if this optimistic scenario should be realized, the first fusion energy will not be ready in time to have a large impact during the time period we have chosen as our primary study parameter. Still, the year 2050 should be interpreted more as a point in time in the future, rather than a strict chronological endpoint. Indeed it does not seem reasonable to build attempts to attain sustainable development on highly unsure technological breakthroughs.

At this time the techniques exist for production methods such as solar cells, as well as wind, wave and tidal power. What is decisive for if these methods can have a significant influence on the current energy system is partly continued technical development and partly the average price on competing energy alternatives. If, as we have seen, we cannot count on technological breakthroughs to solve the global energy question, then the choice of energy as the criterion for a sustainable development would seem unassailable, if somewhat limited.

[14] Olja – tillgång och prisutveckling, 2002.

[15] Energi 2050, 2003.

3.5 Energy Access and Distribution in the Future

Energy in incoming solar radiation to the earth is de facto unlimited, but making it useful technically in such forms as electricity or liquid fuels requires large material and resource utilization. Thus the accessible energy for a sustainable society is limited.[16] While the energy utilization causes a number of environmental problems, the CO_2 emission is thought to be the greatest limiting factor.

There are many opinions about what a sustainable energy level is. The long-term EU goal is to stabilize greenhouse gases at 550 ppm (parts per million) carbon dioxide equivalents in the atmosphere corresponding to a concentration level of 450 ppm CO_2. For this goal to be realized, the CO_2 emissions must be reduced, though the reduction rate can vary. According to the mean alternative of IPCC's stabilization profiles, the global emissions of CO_2 ought to be reduced to 5 Gton carbon annually by 2050 and then continue to sink.[17]

Within these conditions, we have estimated the size of the potential for energy production using four global energy scenarios that all land at or near the indicated CO_2 emission level. The scenarios estimate the amount of energy that can be produced in the long term based on financial and environmental criteria. The four scenarios are the World Energy Council's *Global Energy Perspectives to 2050 and Beyond* [18]; the World Watch Institute's *Sustainable Energy for Tomorrow's World* [19]; *Renewable Energy – Sources for Fuels and Electricity* (RIGES)[20] and IPCC's Low-Emissions Supply System.[21]

These scenarios include a certain amount of technological development up to 2050. The IPCC states that the entire energy production system will be replaced at least twice during the coming 50–100 years. Thus there is reason to count on new, more efficient technology. One example is that the electricity production efficiency is expected to double from the current world average of app. 30% sometime between 2020 and 2050. Carbon separation from exhaust gases and fuels can reduce CO_2 emissions by more than 85%.[22] In its scenario, the World Watch Institute assumes that the efficiency of both energy production and use will double during the next 4–5 decades, primarily through technology development.[23] For the World Energy Council it is enough to state that a strong technological development

[16] Hunhammar, S. Exploring sustainable development with backcasting, 1998.

[17] IPCC, Climate change 2001, 2001. See also Åkerman, J. and Höjer, M., "How much transport can the climate stand?" 2006.

[18] Grübler, A., Nakicenovic, N. and Jeffersson, J. M. A summary of the joint IIASA and WEC study on long-term energy perspectives, 1995.

[19] Lenssen, N. and Flavin, C. "Sustainable energy for tomorrow's world", 1996.

[20] Johansson, T. B. et al. Renewable energy, 1993.

[21] Ishitani, H. and Johansson, T. B. "Energy supply mitigation options", 1996.

[22] IPCC, Climate change 1995, 1996a; IPCC, Technologies, policies and measures for mitigating climate change, 1996b.

[23] Lenssen, N and Flavin, C. Sustainable energy for tomorrow's world, 1996.

Table 3.1 Energy sources in four scenarios and year 2000, PWh

Scenario	WEC C1	WW1	RIGES	IPCC less	OECD/IEA 2000
Fuels					
Coal	18	1.4	17	17	33
Oil	31	8.4	18	21	41
Gas	44	66	30	34	27
Biomass	28	29	41	50	13[a]
Solar hydrogen	–	–	4	11	–
Electricity					
Nuclear[b]	1	–	<1	<1	2.6
Water	15	4.5	4.8	3.4	2.6
Wind		5.6	9.6	6.7	–
Solar energy		6.2			–
Solar cells		5.6			–
Geothermal		1.1	0.2	–	–
Totals	137	128	125	143	119
Renewable	43	52	60	71	18
CO_2 emissions (Gton C)	5	4	4.2	4.3	6.6

Source: See note 18–21 and *Energy Balances of OECD Countries 2000–2001, 2003*
[a] Including waste
[b] Nuclear power is presented without conversion losses

is essential for their scenario, without therefore specifying what that would be.[24] Table 3.1 describes that an energy access of approx. 130 PWh or just over 10% more than the current global energy use could be attained should the emissions be limited to a level corresponding to 5 Gtons annually up to 2050. Very large investments and much progress in renewable energy sources are essential in order for this to be realized. It is also important to remember that a continued reduction in CO_2 emissions is required even after 2050 if the IPCC principles are to be followed.

In order to calculate the energy available per capita we use a population forecast for 2050 from the US Bureau of the Census as base. This forecast suggests that the global population will be approx. 9.2 billion in 2050 as opposed to approx. 6.1 billion today or a 50% increase.[25] Should the sustainable energy volume of 130 PWh be distributed equally over the earth's estimated population in 2050, you would arrive at approx. 14 MWh (130 PWh/9.3 billion). This would mean an approximate reduction by 60% from the 2000 level in the Stockholm area.

Three suppositions that determine this change are equal distribution per capita, energy access and population growth. Of these, the first is the most important. Today Swedes use three times as much energy as the global average. However, population growth is also very important and would mean that per capita energy access for

[24] Grübler et al. 1995.

[25] US Bureau of the Census, 2004.

Swedes would shrink by a third. Even if energy access could increase by 10% over the same period, it is not enough to compensate for the other two factors.

Thus the long-term sustainable energy use seems to be in the vicinity of 14 MWh per capita and year or 40% of the current Stockholm level. This level is a strong reduction for the city's residents, but it is important to remember that it could provide every global resident with the same amount of energy without therefore leading to additional climate changes or other global environmental problems. For most individuals in the world this would be a large increase. Still we must point out that this level is not a forecast or a determination of what might be possible to attain. It is part of a backcasting analysis aimed at envisioning solutions to a large, structural community problem. The chosen criteria in this type of analysis are preferably challenging and, they should hold a solution of the problem in question.

Whether a so very low energy level as the one indicated above can be reached in as short a period as half a century can always be discussed. The postulate about equal distribution serves primarily as a way to demonstrate the possible consequences of a reasonable ethical principle. The envisioned global population seems much less controversial.

The stated preconditions sets the long-term sustainable level for energy use at 14 MWh per capita and it becomes the task of the analyses of the images of the future to establish the conditions necessary to attain the level indicated. If this cannot be realized within the time under discussion, the result will either be that the unequal resource distribution will remain and/or that an ecologically sustainable development will only be attained later, thus leading to greater environmental damage.

Reducing the energy use by 60% calls for large changes in Swedish cities. However, these urban areas own a large potential for managing the transformation to a sustainable community. Among the reasons are the large population and business concentration that makes large scale, efficient solutions possible and the opportunity conurbations provides for preserving large open areas for such uses as efficient agriculture and forestry enterprises, as well as for biological diversity. Material stored in the cities can be reused and/or recycled. In addition it is possible to utilize large scale, material and energy efficient infrasystems such as public transport, district heating and IT networks.

Through utilization of the advantages of the city, the varied individual desires and lifestyles can be combined with efficient use of natural resources. Today we can note a spread of an urban lifestyle to other regions bringing with it large demands for mobility, for new experiences and for the latest techniques and equipment. Such a development is hard to combine with ecological sustainability since these demands lead to strongly increased travel and resource withdrawal. Is it possible to combine the urban lifestyle clearly sought by many people with the hard requirements on resource efficiency necessary for sustainable development? The next chapter and later on in the third part of this book, we describe six different images of the future that each tries to satisfy the requirements for low energy use in ways that are principally different, one from the other.

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Chapter 4
Urban Tempo and Structure

The goods and services chosen by the households determine how large their environmental impact is. These choices are made within more or less coercive settings and restrictions. It is therefore possible to say that environmental impact of the urban households depends both on the choices they can make and those they actually make within these limitations. The urban physical structures or, if you will, the urban space comprising the organizational localization pattern and spread together with available transport means join to form the physical setting in which urban residents live their lives. On the whole this complex has decisive importance to the choices that can be made, while of course each urban structure offers very varied operational repertoire between different households. Even the city's temporal structure is very important, defined for this purpose as both the tempo and the distribution between different social processes and activities over the 24 h of a day. This then is the institutional setting in which urban residents live and which works with the physical setting to provide wide variations between the individual choices.

In Part III – Images of the future, we will present six images of the future sustainable city. All must satisfy the criteria for sustainable urban development formulated in the previous chapter. They accomplish this in varying ways, remembering that there is more than one way to attain a sustainable development in the form of a number of possible solutions to the formulated task. We have created these images of the future by combining the two dimensions suggested above, namely the city's and the urban residents' space and time. These two dimensions are the subjects of this chapter. Three partially different spatial urban structures will be combined with two urban temporal structures forming thus six unique combinations of spatial and temporal conditions for the everyday life of urban households. For each of the six alternatives, we will examine the requirements placed on the choices made by the households in order to remain within the constraints of sustainable development.

The images can be seen as six conceivable development directions for the city and urban life up around year 2050. We have chosen the Stockholm area as the backdrop and scene for the imagined changes, though the readers must transport the concepts to their own urban settings. This future construction starts with the current tendencies and trends in societal and urban development combined with the full

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utilization of the effectivization potential in known technologies and methods for long-term energy stewardship and environmental care. It is unavoidable that each image will appear as an image of the future, but we have avoided joining the mainstream of classic utopianism where the basic thesis is to change the social and political structure in order to create better, happier human beings. The three urban structures and two temporal structures are not especially unknown. One of their expressions is the varied ways of using work hours and free time. They can be seen today in housing and traffic systems on various locations, in the varied social group's life styles and living conditions and in technological innovations.

The various conceivable spatial products are a result of the fact that almost all renovations, new constructions and new establishments of activities during the coming half-century support the development of one or the other of the alternatives. The designs of the various urban temporal structures are based on differing average distributions of work and free time in the future. The large difference between the two alternatives derives from how urban residents choose to use the increased material resources. This leads to consequences for travel, household work, social relationships, leisure activities and the like.

4.1 Tempo

It can be assumed that the dominating tempo in a city affects the individual life rhythms. The possibilities for slowing personal daily rhythms increase if the institutional conditions and various practical arrangements in the city support a slower pace and if others have also chosen this way of living. The reverse is also true: the more live an intense life, the more people are drawn to that tempo. In highly industrialized service societies such as Sweden the time use of a majority has been marked by an increasingly high pace in both work and free time. People's different ways of managing their days can be revealed by studying how they use time for such activities as working, resting, exercising and entertainments. Each society can be described using the average time use pattern of its population. By expressing these patterns in terms of average work hours, number of vacation weeks, official holidays and shop hours, as well as the speed of train and car traffic, queue systems and time for everyday pleasures, an indication of significant cultural differences between societies can frequently be achieved. In reality time use is in many ways a simple, clear illustration of how both societies are organized and how people live their daily lives.

Once less time is reserved in the marketplace for work, greater possibilities for slowing the life tempo are created, thus attaining a good temporal welfare. More formal work time increases the possibilities for attaining this quality through the purchase of services and equipment that provide time effectivization and savings and allows for larger financial outputs offer.

We define two different time regimes in our images of the future and implement these by varying the hours worked in the future. In the *Fast* alternative the average pace of urban life remains high and a growing part of the needs satisfaction comes via the commercial market for goods and services, rather than within a system of informal exchange in the civil, private community. The normal work time is on the same level as today, leading to a considerably larger real income assuming that our current economic growth continues. In the other alternative, namely *Slow*, the social processes move somewhat more slowly, leaving extra time for informal activities and social contacts. One result is that a growing part of the needs satisfaction is transferred to the private society, to the family, friends and acquaintances, as well as other informal contexts. A reduction of normal work hours by about one fourth as compared to today creates the material foundation for this time regime and means that the economic growth is dampened and that on the whole real income remains on today's high levels.

The Fast alternative can be perceived as a reformed continuation on those tendencies that have ruled the societal development of the most recent decades and that display a continued high tempo and a continuing high time pressure in both work and private. Slow, on the other hand, picks up on a prolonged, though of in the same recent decades much slowed development towards shorter normal work time. If we look at the actual work time of the entire adult population, the trend towards a shorter average work time has continued since 1990 in the form of increasing early retirement, absence due to illness, unemployment and studies undertaken due to lack of job availability. One result of this is that the number of hours worked per capita has decreased since that year, though with considerable variations due to business cycles.[1]

In order to improve their temporal welfare in Fast, many more choose to pay for household and care work, including cleaning, cooking, baby-sitting, care of the elderly and other similar services than is done today. Most also eat one or more meals out or buy ready-to-eat food either on the spot or for the microwave. On average the residencies are smaller than today and well equipped technologically with traits of 'intelligent homes'.[2] In addition, purchases of energy efficient services related to education, competence development and personal well-being (body and soul, sports and trips) are more frequent, as are services related to culture, leisure time and goods consumption. The last item is more often in the form of life style goods combined with advice, tele-shopping and delivery. On a community level, institutional changes bring time-political measures that contribute to making time 'available' to most parts of the population, such as through flexible annual or lifetime work hours, longer hours for institutions and shops, as well as frequent and late hour public transport. Privately or more frequently joint owned or rented cars retain their attractiveness for certain errands and trips, while other travel is more often done using the improved, new public transport means or replaced by electronic communication linked to shorter trips and transports easily done with human power.

In the Slow alternative most salaried jobs have considerably shorter workdays than today. Here temporal welfare is achieved in the access to time – time for homelike, for being with one's own children, relations, friends and acquaintances and quite simply

[1]Statistics Sweden Statistik över arbetade timmar (Labor market studies of hours worked – Statistics Sweden), different years.

[2]Harper, R. (ed.) Inside the Smart Home, 2003; Rasmusson, L. Det intelligenta hemmet (The Intelligent Home), 2000 and Sandström, G. Smarta hem (Smart Homes), 2003.

time to be at peace. There is also more time to participate in different types of democratic processes, in all kinds of private activities and hobbies, for continuing education, for entertainment and for shopping. On the average, the residencies are somewhat larger than in Fast since more time is spent there. Time for cooking, working in the home, craftsmanship, repairs and cultivation enables a rise in consumption quality without a concomitant rise in expense. This can even be true for voluntary efforts in sports and co-operative associations or other forms of joint ownership, such as co-operatives, bartering groups and joint meals. Under the influence of slower tempo, public transport is favored and co-ordinated with bicycles and walking. Many more only use, borrow or rent a car for special situations when distance, accessibility, packing or load call for it. This has a strong effect on the energy use of urbanites.

4.2 Urban Structure

Cities and urban regions are very important when it comes to energy use and environmental impact. The reasons are to be found in what we call city or urban structure, namely in the localization and layout of housing, public and private organizations and the connecting supply and traffic systems – electricity, water and sewage systems, roads and tracks. Such changes in this structure as mixing the industrial and organizational localization, new land uses, new heating systems, road networks and transport means, conurban hierarchies and increased density comprise an unusually tempting and frequently suggested means for moving cities in a more sustainable direction. This would first and foremost be done by affecting travel modes, time use and temporal structure. So far, however, this has been done without it being possible to present especially many accepted conclusions concerning the importance of one or another structural measure as the basis for urban planning. Thus three different urban structures, all in their singularities described as far as is possible within the confines of sustainable development, have perforce been asked to represent the second dimension in the design of the six images of the future.

All three reflect both the tendencies in current urban development and the main strains in today's discussions about the cities of the future. In their most refined form the three are very different in that all new construction is placed and designed according to the three different principles. But they still share important common traits. In all three we accept that there will be a leveling in the inner city as to the distribution between work sites and residences, even if the nuances of this change differs between the alternatives. Today there is a large number who commute into the inner city, especially workers living in suburbs and even farther away. Since the long-term trend of moving work sites from the regional core can be expected to continue, at the same time as the more recently initiated process of increased central living goes forward, this greater balance can be achieved, one that makes shorter, more muscle-based business travel possible. In an urban development framework, this development will lead to the conversion of a large number of central work areas to residential districts.

Urban Cores or the polycentric city is recognized by a number, rather equal, competitive city or urban districts, all more of less directly interlinked, as well as by residential areas, work districts and centers of lower dignity in a more branched connecting network. The housing supplement and with it additional residences and work sites, is mostly concentrated to a small number of sites that include shopping centers, institutions, other work sites and residences at a safe distance from the old inner city. In that way these new centers gain a quality of new urban cores, city formations and mega cores. These are then interlinked via a new, high quality public traffic system and through the improvement of certain roads. Beyond that the new construction is placed at strategic or easy-to-access hubs along the road and track system, forming new, dense service and purchasing points, benefiting the immediate residential and work areas whose central facilities are in decline.

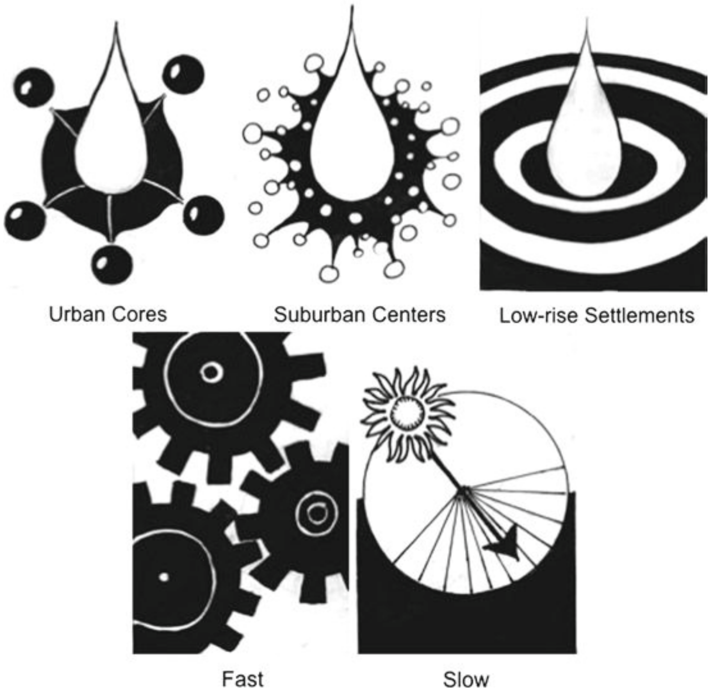
Suburban Centers or the monocentric city is recognized by the fact that the old urban core is still superior to other regional sites. The housing supplement in this alternative is found mainly in the reinforcement, supplement and filling out of existing residential, work and trade areas in a move to make them more balanced with urban district centers of a hub type located mainly along already existing radial and eventually improved track-bound public transport systems. These are supplemented by several new crosstown lines and small roads created to serve pedestrians and cyclists, all aimed at linking nearby hubs. Thus the areas are transformed into urban districts or, if desired, suburbs and satellite cities with both residencies and work sites along with more well-equipped centers. The existing urban structure is reinforced in this alternative.

Low-rise Settlements or the decentralized city is recognized by the fact that the supplemental housing, both for residencies and smaller companies, is built in the peripheral parts of the region and grouped around smaller, clearly defined low-rise areas. These are localized in unbuilt or lightly developed land near existing housing and transport routes or in sparsely built-up areas in the regional periphery. Additional larger institutions, work sites, shopping, service and entertainment centers are placed at current station locations on public transport route in order to support the outreach of public traffic and bus lines. Smaller commercial and municipal service concentrations have been developed on sites that are easily accessible from several low-rise areas. These small centers also serve as feeder bases for the strongly expanded public transport system using buses to bring passengers to the stations along the track bound public traffic system.

4.3 Two Times Three: A Formula for Images of the Future Sustainable City

When we become acquainted with life in the six alternative images of future cities in Part III – Images of the Future, it is important to remember that in many ways the situation we meet is not dramatically different from what we meet in today's urban areas. Even today there are many in the midst of or beside the metro noise who live a quiet life according to the pattern that will become more common should one of the Slow alternatives be realized. Attempts to attain a reasonable temporal welfare without having to reduce either tempo or ambitions occur in today's cities, as well, as people buy time-saving equipment and services, but would become more common in the various Fast alternatives.

Though there will be a lot of new construction in the region over the coming half century and thus grant completely different localizations and character in the different alternatives Urban Cores, Suburban Centers and Low-rise Settlements, most of the house mass is the same today as in the three variants. The differences between the alternatives are still larger than what is suggested in this narrative. One reason is that the renovations and supplemental construction will look different in the three cases and thus ensure that even the appearance and composition of the current building stock will develop differently over 50 years. The other is that the construction supplements of the three alternatives influence life in the existing areas differently.



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Part II
Building Blocks

The building blocks used to construct the images of the future are described and analyzed in this part. Factors linked to the urban structure and the household activity patterns are varied in the images. The environmental impact created by the city residents is determined by a combination of the physical structures in the city, primarily in the form of transport systems and housing distribution, as well as the choices made by the households within the limitations created mainly by those physical structures and the technology.

Chapter 5
Introduction: Urban Structure, Activity Patterns and Technology

This second part on building blocks includes this introductory chapter and then 14 chapters in 3 groups. Chapters 6–9 focus on *Urban Structures*. The dispersion of housing over the city's surface, localization of different activities in this cityscape and the design of the communications systems can collectively be called the urban structure. Together these factors have a decisive role in urban life, as well as for the environmental load and energy use this life carries with it. Through interaction with the institutional circumstances that regulate housing, activities and communications the urban structure shapes the outer conditions for the daily life of city residents.

In this way the configuration of the urban space can be identified as one of the most important factors in determining the development towards an ecologically sustainable city. However, the construct of the city and its transport facilities are not the only factors that affect the journey on the complicated path to sustainability. The relationship between the characteristics of the urban structure, such as density, and the environmental load is far from simple and unambiguous. Nor is it possible for the actual city structure to guarantee a sustainable development by itself. Established goals for a sustainable development can only be achieved if the urban structure is combined with a package of specially adapted household activity patterns.

Today western cities are known for extensive decentralization, sprawl and diffuse boundaries facing their surroundings. In these porous structures distances to various geographic goals tend to grow and the use of both housing and land surfaces per capita to increase. The individual car use increases at the expense of public and human-powered transports in direct proportion to urban spread and increasing income of the residents. The car has gradually become a norm for both household and urban structure. Still, there are counter trends. Exploitation in suburban areas is not even and lacking in contours, rather tending to concentrate to certain centers. At the same time, the downtown areas are seeing an upswing and the functionally divided ideal city is replaced by other models propagating for a living, dense, functionally mixed city served by public communications. Here and there the bicycle sees a renaissance, while in spite of significant setbacks public transport is in a period of new investment. There has been a turn-around in the long-term volume increase of heated and cooled facilities, in some cases to an opposite trend.

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DOI 10.1007/978-94-007-0653-8_5,

In addition, those ideals and rules that have unilaterally favored a geographic separation of function have been eased.

Chapter 6 provides a summary of western urban development over the last century. We move on to an identification of the trends still working out and examine the characteristic traits of the dominating visions in general urban planning in Chap. 7. A closer description of Greater Stockholm in Chap. 8 serves to make certain development facets more concrete. The interplay between localization of residences, work sites, retail and perishables shops, as well as communications systems is of special importance. Chapter 9 closes this part's focus on urban structure identifying and delimiting possible future changes in order to create a foundation for the images of the future.

Chapters 10–15 on *Household Activity Patterns* investigate the time use of the households and the interlinked consumption scope and character. Those choices made by the households regarding time use, as well as the consumption's scope and character are decisive for the total environmental load. The households combine many varied activities in their time use, while all goods and services that are produced are sooner or later used by the households. Historically their decisions and actions have played a vital role in social change with far-reaching consequences for community development, including better health and longer lifespan, improved nutritional standards and higher levels of education. This role is especially important in discussions of the various ways to achieve a sustainable city. The utilization of household options has gained in importance as the living standard rises. But exactly how these household options affect the environment is in turn influenced by a number of other circumstances, including the design of corporate production, distribution and marketing, as well as how the households' external living conditions such as traffic systems and housing structure are organized.

There is no doubt that today's consumption patterns and consumption scale are prime movers behind the environmental load and the feeling that life has become increasingly hectic and stressful. Too often have various temporary reductions in environmental load due to more efficient energy use been more than offset by continued consumption growth. The dominating pattern to date has been that this consumption growth is both material and energy intensive, even if the increase has not always been proportional to growth in income. The living area per capita has grown steadily, as has the number of cars, travel distances and especially air travel. At the same time the possession of capital goods grew apace and the expanding free time has tended to be much more goods oriented. One reason that consumption growth has been so difficult to stop is that it is part and parcel of everyday life and thus the activities that are decisive for living quality and for the picture of the good life.

The expanded consumption opportunities have been paralleled by changes in attitude towards time and time use. Increased financial well-being has not resulted in a quiet, harmonious life. Rather it seems that an increasing number have experienced an escalating time paucity as a result of the growth process and that there seems to be a link between this time shrinkage and an augmentation in goods consumption. Eventually this link can hold an opportunity for change in the direction of a new balance between material riches and a chronological one, a direction that could slow the tempo down and recreate more connected spaces for time use.

Chapter 10 discusses attitude to time and how these have changed over the most recent centuries, as well as certain aspects of time use. As differences in consumption patterns are vital characteristics of various time management schemes, we study the current situation, more long-term trends and possible alternatives in question from the most important aspects of household patterns seen from an energy point of view. These are residence (Chap. 11), food (Chap. 12), travel (Chap. 13) and durable goods (Chap. 14). The part on Household activity patterns closes with Chap. 15 that returns to the time dimension and maps the time use patterns of the households, trends in these and conceivable alternatives to the most prevalent patterns today.

Chapters 16–19 concern *Technology for Efficient Energy Use* and deal with the role technology can play to reduce energy use. This book seeks to give an account of how much energy is used today and to illustrate how it is allocated. In addition, we want to describe different ways for reducing that energy use and explain how great a potential these various ways might have. Keeping in mind that we proceed from a goal of reducing the energy use by 60% per capita (see Chap. 3 above), it is apparent that rather large changes are necessary. These changes vary in character and include such factors as new technology, new behaviors and new consumption patterns. With a household perspective as the point of departure, the previous discussion has been divided into six household functions. Investigations regarding how the consumption patterns could be turned in a more energy efficient direction have been carried out for each of those. In the following the focus is on the role that technological improvements can play in reducing energy use. The survey will concentrate on industrial production, vehicle efficiency and housing.

According to the official Swedish energy statistics industrial utilization is around 150 TWh per year.[1] In line with the systemic delimitations used in this book we will only discuss that energy that can be attributed to consumption by Swedish persons. As the estimate for this consumption made in Chap. 28 states, the net energy utilization for resident consumption of industrial goods accounts for approximately half of Swedish industry's energy use. While it is true that Sweden imports a large number of items, it seems even so that the energy content in the export goods is considerably greater than that in the imports. This is primarily an effect of the export of forest and mine products.

According to the Swedish Energy Agency energy used in Sweden for transport was 105 TWh in 2008.[2] To this should be added energy used by Swedes in the form of trips and goods transport abroad and the energy used by foreign nationals in Sweden should be subtracted. While the statistical base is not really open to such distinctions, the net result of such a calculation ought to be positive mainly because

[1] Swedish Energy Agency, Energy in Sweden 2009, (2009).

[2] Ibid.

the air travel of Swedish citizens is probably underestimated if the calculation only includes fuel taken on in Sweden. In the estimate done in Chap. 13 the energy use indicated for travel by Swedes is 75 TWh or an average of the 1999–2001 years. In Chap. 28 the energy use for goods transports is estimated at app. 25 TWh, meaning that the total energy used by Swedes for transport is around 100 TWh annually. In the chapter on housing (Chap. 18) we estimate the energy used for residences, summer houses and premises at around 140 TWh.

The potential for energy effectivizations we offer in the following chapters should not be seen as forecasts of technology development, but rather an indication of a potential. Some readers will surely feel that the potential we suggest is much too great and that the levels we use in our calculations are absurd. Other readers with a greater optimism of technological development may suggest that we are underestimating the strength in technological development. We base our discussion entirely on other studies, even if in certain cases we have been allowed to make some adjustments in the material. Chapter 19 is a summary of the technological chapters and the technological potential we use later in the description of energy utilization in the different images of the future presented in Chap. 28.

It is not necessary for the reader to accept each supposition on potential as either realistic or probable. Rather it is vital to weight the degree of realism against the transformations in household action patterns discussed in earlier chapters. A major point of this book is to place potential technological changes along side of other types of energy saving changes. A drastic reduction in energy utilization without concomitantly large welfare losses can only occur through a combination of powerful technology effectivization and behavioral change. By discussing both of these change types together, it is possible to construe the simplest way of reducing energy use. Those readers who are uninterested in technology or who do not wish study our suppositions about technological potential in depth, can skip Chaps. 16–19 without loosing the thread in this book.

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Chapter 6
Development of Urban Structures*

6.1 Introduction

The preindustrial city was known for diversity, proximity and density. These characteristics made it easily defensible within its walls and well suited as a transaction forum for both goods and ideas, but also a hotbed for epidemics and social unrest. Over time these characteristics have been transformed. Today's western city is characterized by a growing sprawl with greater distance between activities, an increasingly permeable urban structure and a thoroughly developed functional distribution, the latter slowed in recent years.[1] Several factors have contributed to this centrifugal transformation. For a long time now urban populations have been growing, as have consumption, building size and land use per capita; spatial friction has been reduced via improvements in traffic and organizational structures that have lowered the cost of moving both goods and persons dramatically. Nearly every business, activity or land use in the cities or metropolitan area is today strongly decentralized. Leaders in this have been the North American cities.[2]

However, until just after WW2 the cities retained their mono-centric character. The old city core defended its completely dominant position as financial center. The rapidly growing suburban areas with their traditionally relatively humble centers maintained strong ties to the core through radially constructed traffic systems and intense commuting. The urban center performed a strongly opposite, centripetal force in urban development. Once the peace economy had mostly stabilized in the late 1940s, however, the western city has seen a comprehensive transformation. The decentralization begun in the period between the wars continued and gradually came to include activities and urban elements earlier reserved for the urban

* Chapter written by Anders Gullberg.

[1] De Meyer, D. et al. The urban condition, 1999, p. 44, 46ff.

[2] The main sources for this chapter are Vance J. The continuing city, 1990; Anas, A., Arnott, R. and Small, K. "Urban spatial structure", 1998; De Meyer et al. 1999; and Hall, P. Cities in civilization, 2001.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*,
DOI 10.1007/978-94-007-0653-8_6, © Springer Science+Business Media B.V. 2011

center: office activities, including major companies, sales of capital goods and really large building complexes. The result over time especially in the US is that today's larger cities stretch over extremely vast and urban landscapes that are increasingly difficult to delimit. At the same time locally operative centripetal forces have created a number of centers in the suburban landscape. This has most often occurred in harmony with urban political and planning efforts. At first these centers of a more polycentric city were clearly subordinate to the old urban center and a hierarchic pattern of operational concentrations appeared. Even dense trade and office centers next to the large highways have played a heavy and growing role. This, however, has often occurred outside public planning, though more often in the US than in Western Europe. Starting in the 1980s and primarily in the US, this continued urban growth and changed localization conditions meant that the suburban centers increasingly became relatively independent units in a developing polycentric urban structure. In some cases, these highly specialized centers developed direct relationships with other metropolitan areas around the world without therefore the operations had passed through the local urban center.

Today a majority of the residents in the somewhat larger cities live in residential parts of suburban communities. With their suburban regions with at least a few suburban centers these residents have access to all the choice and activities needed for daily life.[3] The monocentric city has thus developed in a more multi-core direction with a mixed hierarchy and self-contained polycentrism.

While the relative importance of the old city center diminished radically, it did, however, manage to retain its position as the foremost financial and symbolic core.[4] In some ways the city core has even seen a partial renaissance of late, serving as a place for cultural activities and exclusive residences in previously rundown areas. Growth of urban related activities occur even outside the true urban area, including outside the suburban belt. This exurbanization is for the most part residential, but it too features a number of worksites, primarily for distance work.

Occurring partly outside the urban area, but primarily inside it and concentrated to the suburban centers, the continued decentralization is the result in part of development tendencies that arose in the interwar period and in part trends that gained influence later. In the interwar period large land areas were appropriated for residential construction, especially for detached housing aimed at the increasingly socially isolated nuclear family. This happened at the periphery of the conurbation and was closely tied to commuting by car, especially in the US. Later tendencies include moving offices and capital goods outlets from the center and collecting these at sites with good communications and available land. Moving industries from the center was also part of the picture. Behind these long-term tendencies for continued decentralization at an urban level and concentration at a district or area level, lay an unplanned combination of both routine and strategic decisions by

[3] Vance 1990, p. 502.

[4] Anas et al. 1998.

households and businesses, as well as the goal-oriented actions of the public sector. Especially in the US, economic growth, the development of household credit and an increasing family nuclearity caused an explosive increase in a suburban lifestyle that included single family homes and car commuting. This trend was supported by massive public support in the form of housing and highway construction. An expanding private real estate business and housing development created an immense range of detached single-family homes eagerly sought by the middle class.

Nearly all activities were decentralized and the various land uses tied to them spread over the entire urban area. However, the tempo and micro-geographic rate has varied depending on the activity in question: residences, work sites, manufacturing, retail sales, goods handling, entertainment and office activities. At the same time there has been a lively, far from harmonious debate on how the good city should be shaped. The efforts of the professionals, politicians and developers have only in part been realized. Many public plans and private development projects have been decided and then abandoned. Nor has it been unusual for those programs and projects that actually have been implemented to have been strongly revised and thus resulting in consequences that were neither foreseen nor desired.

6.2 Variations in Urban Development

Even if development has moved in the same direction throughout the Western World, there are significant variations between countries and regions with differing traditions and conditions. Seen from a general perspective, the development towards a new urban structure has occurred earlier, more rapidly and more thoroughly in the US than in western Europe, especially in cities with high car dependence. Canada and Australia hold a more middle position. After the war many of the European countries were occupied with reconstruction and the immense housing shortage meant that even less attractive apartments and surroundings were perforce accepted, a necessity that counteracted the social segregation that marked the North American cities. There the political and financial elite abandoned the center cities at the same time as foreign and domestic immigrants moved in. In addition it is important to remember that the European cities owned a larger stock of older, denser city construction and that mass use of cars did not become a question until the 1950s and 1960s or more than 3 decades later than in the States. Thus suburban construction in the US comprised larger volumes, was more focused on single-family housing and was more spread out than in Europe. The first postwar suburban developments in Europe were still not adapted to mass car usage. The suburbs rather offered good public transport and multifamily houses with several stories. In Southern Europe, as for that matter in Japan, the truly strong urban decentralization came first in the 1970s. European cities are as a group denser, less dependent on car transport and better supplied with public transport than their American counterparts. They are also more protective of their city cores. As opposed to the US, the lack of housing lasted much longer in Europe and the social segregation was much milder. Nor has the European elite abandoned the central city to the same extent as their American counterparts and they spend more of their time in public and semi-public settings, while US city livers have developed a more home-centered life style.

The development of the cityscape towards greater decentralized groupings and the spontaneous growth of relatively independent suburban regions is not yet finished. The future urbanization course is generally open when it comes to scale, strength and duration. Opposing tendencies to spread and concentration exist in varying geographic scales within the various activity spheres and everyday activities. There is a large mutual effect of both attracting and repelling types between private initiatives, public investments and household behavior that opens opportunities for new combinations and alliances. This is most certainly true in the urban transport segment where public and private systems influence each other and where large welfare gains can be made through a change in the distribution of responsibility between the individual and the collective levels. Doubts about future urban development and about the possibilities for influencing it are not reduced by uncertainty about the continued application of information technology to a number of fields with secondary effects on localization conditions for work sites, purchasing, entertainment and leisure activities. Public planning and the scope of urban political ambitions and focus are also uncertain factors for future urban development.

Will the New Urbanism that is so popular in the US and that takes its ideals from the old European city with its dreams of a swarming city life and an increased rail-bound public traffic gain influence in more than as architectural mannerisms in certain exclusive suburban developments and city planning attempts? Or will the reverse be true where the mainly market and car driven, large scale suburban investments that have characterized the US urban development during the last few decades eventually come to dominate the European scene as well?

6.2.1 Residences and Worksites

The first to be decentralized on a large scale were residences, even if certain industrial establishments at or outside the city limits had occurred earlier. Before electricity made energy easily transportable, industrial construction were controlled by local access to resources and left the dense conurbations due to lack of land availability and environmental regulations. These relocated industries later served as advance placements for the early residential decentralization. Once residential development began a more general process of filling out the suburban area, other businesses followed along, at first the house and household related job opportunities in everyday goods and public service. However, for a long time the central city remained the dominating worksite for the newly coined suburbanites. The possibilities for exploiting the urban perimeters were completely dependent on the creation of good, radial communications. The main railroad lines, suburban commuting lines, trolley rights of way and in some part even steamboat line contributed to a concentrated exploitation at the stations, stops and docks. In many cases towns that once were independent became part of the commuting sphere of a larger city. As private vehicles, such as the bicycle and the car, won ground, areas farther away from the stations and tracks could be expanded for residences. In the US the triumphal growth of car use as early as in the 1920s created a widely spread villa construction that gradually became the norm.

A new, even more rapid phase was seen after WW2 when the combined effect of extensive highway construction, comprehensive financial support for construction of private homes and drafting rules regarding minimum lot sizes created a widespread, decentralized residential development. It is possible to state that the public investments subsidized a decentralized urban development and that the below-cost pricing of urban transports simply encouraged already prominent decentralization tendencies. One-family houses were increasingly produced on an industrial scale. Earlier most construction companies had built one or a few houses at a time, but now the expanding companies increased production to include areas with hundreds or thousands of identical, prefabricated, slab-foundation houses all build at the same time.[5] This exploitation method contributed to the social homogeneity of the residential areas, but they differed one from the other. In this way residential segregation between the various middle class levels was strengthened. Age segregation also grew due to special developments, areas and districts for older persons and other areas that sought younger families. European cities, however, had more multi-family housing and public transport, resulting in a lesser dependence on cars.

It was not until a significant portion of the residential mass had been localized to the suburban area that a matching decentralization of worksites took off. During the first, rather slow phase saw the establishment of household related services, especially everyday goods and schools. In the beginning the commuting distances to and from the city core increased greatly. Later on when the worksites had followed the residences into the suburbs, the increase in average commuting time slowed down, though the portion of car usage increased. This meant that the worksites were still concentrated in the central urban areas than were the residences, though that by this time the worksite decentralization was occurring more rapidly than for housing. In other words, the jobs were following the housing to the suburbs and, seen in a regional perspective, tended to be as widely distributed. In the American metropolitan areas there are more jobs outside the city core and suburban centers than in them.[6]

City-based businesses have also moved to the areas just outside the real urban area, to rural areas and smaller towns outside the suburbs. Thus exurbia comes into use through the regular, repeated seasonal living by the upper and upper middle class. Certain professional groups such as authors, artists and intellectuals were pioneers in working at a distance, but retaining contact with the city. Greater

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[5] Vance 1990, p. 459.

[6] Anas et al. 1998.

numbers of city residents set up a second home in the country where they spent more and more time. Over time, work linked to the city was in time increasingly done in this second home. Large offices and other worksite localizations at the edge of the urban area also increased the possibilities for settling outside the suburbs. This general shift in focus towards the urban periphery has reinforced the rise of exurbia. In certain cases, older and smaller cities that happened to fall within the field of influence of an expanding urban area became suburban centers in this development.

6.2.2 Industrial Production

With the coming of the electrical age, the emigration and external localization of industrial operations increased. With the introduction of conveyor belt manufacturing, industry created a need for larger lots to build in one level. The need for increased parking for employees also grew. The factory surface per worker grew strongly. Decentralization also usually led to a motorized, primarily private job commute stimulated by free parking.

In the post-war period a growing trend towards industrial parks for light industry and warehousing took hold, a placement that was independent of railroad and ports. The truck became a significant localization factor as early as between the wars, releasing many operations from the necessity of being near the railroad. Thus manufacturing and warehousing could recruit a labor force from the surrounding rural areas, made available through the powerful rationalization of agriculture.

Especially heavy industry often moved not only to the periphery of the urban area, but to other parts of the country outside the traditional industrial districts and even abroad. Lower labor costs and greater work force stability were frequently decisive, as were falling transport costs.

6.2.3 Wholesaling and Goods Distribution

Trucks made it possible to spread goods handling as early as after WW1, especially goods to be distributed within the city. Previously this activity had been concentrated at ports and railroad stations. After 1945 the localization dynamics changed rapidly and comprehensively. New, motorized ways for handling goods were developed thanks to the loading pallet and the forklift. Immense single-story warehouses were built on cheap land, often near some highway at the city limits. The container reinforced the economy of scale and supported the tendencies to concentration within the goods transfer field. Trucks used smaller loading and reloading equipment, which meant that terminals could be spread out along larger highways. The sinking transport costs have enabled warehouses and reloading terminals to serve increasingly large geographic areas.

6.2.4 Office Localization

Not only did highways and other communication systems take the population to the suburbs, but they also prepared the way for office decentralization. This trend was further reinforced by the localization of airports in the urban outskirts. Still, as late as the 1960s an urban structure dominated that placed the most important financial functions in the middle of the traditional city center. Residential areas that once held high status, but by now were in part run down frequently surrounded the city cores. These were now expropriated for commercial activities and served as hotbeds for businesses and offices, in part due to good parking opportunities and attractive rental levels. High-rises spread to the suburbs and a general tendency to build larger volumes, regardless of height, called for the larger lots often available in the periphery, but difficult or expensive to find centrally. Successful companies sought the symbolic value of having their own, large complexes that also were located outside the old downtown areas for high car accessibility and excellent parking possibilities. These complexes were often built as solitaires, disdaining all contact with local settings and operations. Air conditioning and fluorescent lights were necessities for the windowless spread inside the thick building bodies. The office geography was changed and the back-office functions lacking customer contact, including bookkeeping, data handling and invoicing, were spread over large areas, sometimes even to other parts of the country. External office centers with a host of companies expanded and formed a strong incentive for the development of a clearly defined, polycentric urban structure.

6.2.5 Capital Goods Trade

Even the capital goods segment, the more exclusive, specialized trade that once was characteristic of the central city's business districts, expanded bit by bit into the new suburban centers as pure external establishments. Immediately after WW2 capital goods were mainly available downtown and family buying trips in American cities went there, especially as long as the woman in the family did not have access to a car. In some of these cities the flight of retail trade from downtown sections have turned the traditional shopping districts into office landscapes, often with slum districts dotting the area. Even in many European cities, including Stockholm, the turnover in suburban centers is far higher than in the traditional city center. In geographic terms trade came to be distributed in the same way as the population through the creation of shopping malls and suburban shopping centers.

However, on the micro-geographic level the new sales landscape, both in the US and in certain larger European cities, spread along the highways without contact with the residential housing. Especially in the US where the process has gone much further than in Europe, the exploitation process for these facilities was controlled by land speculators and developers who demanded high, rapid yield on their investments. In this way, shops with low turnover volumes and low profits were initially excluded. The profile of these shopping malls focused heavily on the availability of service, entertainment and events, something that still has not catch on in Sweden. Internationally then many of these malls gather a number of different functions under one roof and offer a wide range frequently specially chosen for different customer segments.

6.3 Cityscape Segmentation and Reinforcement of Relatively Independent Suburban Regions

As a result of the unprecedented spread and decentralization of the Western city after WW2 a distribution or, in some cases, an actual disintegration of the urban landscape has occurred, especially in the larger cities. Through this urban sprawl, large areas of the cityscape have been laid waste and lack real function or use. Such no-man's-lands are often found next to traffic facilities, large space-demanding highways and abandoned ports or railroad shunting yards. In addition there are abandoned factory areas and suburban land simply bypassed when the developers moved on in their search for even more peripheral, easily accessible areas.

At least since the mid-1970s, however, more of these surplus areas in the cityscape have been put to use. Abandoned or over-used land is filled and reused. Thus from the earlier monocentric structure a series suburban areas have grown, each one holding one or more strong housing concentrations. These are surrounded by a relatively sparse and porous areas with a well spread, but still sufficiently mixed land use that it enables most of the residents to live without external trips. This is true for Stockholm where the local trips in the various suburban areas represent more than a third of all trips in the region. Each area of this type comprises one or several regional trade and work sites that in part compete with the central urban area. The clear tendency in these areas to strive for a relatively independent activity level does not exclude that a smaller part of the city residents move over large parts of the urban region in their daily travels and thus represent a large share of the total commuting volume.

The first step in the development towards self-sufficient suburban areas was taken when the retail trade decentralized and with the expansion of local public service. This made the bare necessities of living available locally. Yet another step towards a relative local independence occurred when numerous jobs were created, including emigration of wholesale outlets, warehousing, manufacture and offices. In time functions and construction in these suburban areas were concentrated and regional centers formed. Over the last 30 years both the size and complexity of these centers have increased. Thus their ability to compete with the downtown area has grown at the same time as the older and smaller suburban centers have been depleted by the competition.

However, two important differences between the traditional city center and the regional ones remain. The latter show examples of a completely different morphology, with separate offices and shops as opposed to the inner city's dense block construction. They also serve only a segment of the urban region, including an external catchment area, while the city center still owns a position that relates to whole urban region. In order to attain a position as a true competitor to the traditional center, the regional centers need a customer potential that stretches beyond the suburban area. This can be done via access to communications that draw visitors from the more peripheral and even more distant areas. Common localizations include placement at regional interchanges on the radial highways, near stations for regional express trains and in areas close to airports. Through specializations these centers can also expand their catchment area to include suburban regions and perhaps even the city center. In some cases the area can stretch far beyond national borders. In recent years and especially in the US externally localized shopping centers have grown to such size that the usual one-story business building is not longer expedient due to the immense walking distances that exploitations of this type result in. Instead shopping malls with multi-story, air-conditioned buildings with unified settings and covered mall streets have multiplied in the US. The open storefronts provide the visitors with full exposure to the goods and the internal center differentiation structured by the mall administrator optimizes customer circulation and turnover.[7]

6.4 The Polycentric City

The appearance of a polycentric city structure is especially clear in the network of freeways surrounding American cities with edge cities at the most important interchanges. This is a conspicuously large change in no more than 25 years. The center formations in the suburban area have influenced the surrounding localization pattern for both residences and worksites. The sprawl that has been proceeding for a long time has thus been supplemented in part by a new, more concentrated form. Sometimes these centers are localized in corridors along old communication lines. Some are strongly specialized, while others are similar to the central business district in the breadth of their range and the varied make-up. Still, these regional centers have not succeeded in fully superseding the traditional urban center with its larger total employment, higher worksite density and most often a greater influence on the surrounding density and land prices.[8]

In Europe the same tendency can be discerned, but the star-shaped localization pattern is still strong and the closest to a polycentric urban structure to be found is in areas like Randstad and Ruhr in Germany. These comprise several old cities that through an ongoing urban expansion have come to enclose each other's field of influence.[9]

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[7] Vance 1990, pp. 505f.

[8] Anas et al. 1998.

[9] De Meyer et al. 1999, pp. 34f.

Not even in the US has a single suburban center challenged the old urban core for first place. However, taken together they are clearly larger than the urban core when it comes to office work places and retail trade turnover, especially in American metropolitan regions where a score of suburban centers can be identified in each important region.[10]

The changes in localization patterns towards accumulations in the suburban area can in part be explained by changes in relationship between and within companies. One, probably important factor is the network organizations with the advantage of economy of scale in the form of reduced average costs when several producers act in a limited geographic area. Positive technical and economic external effects between companies in geographic proximity can also be meaningful, such as for example through knowledge transferal between companies, access to a share, specialized labor pool and economies of scale when producing investment goods and services.

It is important to note that the ongoing development contains several, partly counteracting tendencies. Those interested in the traditional city core have not been passive facing the challenges presented by urban decentralization. The city cores have adapted to the enormous demand for goods and services, as well as seeking to stand up to the suburban competition. In several cases it has been possible to copy the suburban centers' building patterns as the city core was upgraded. However, during the most recent decades the traditional city physicality has become a widely spread and eagerly protected ideal. Centrally located port and industrial land have perforce given way to exploitations designed to lend new life to central city sections. The absolute, if not yet the relative retreat of the city core has been halted and replaced by its opposite. This inner city renaissance can be seen in many cities, in part because suburban growth contains other facets. One such is the heavy concentration of buildings and activities in the regional centers located in excellent communication positions. Another tendency is the exploitation of under- or unutilized spaces in the suburban landscape. This move can increase the density and supplement already completed areas with functions not yet present. A third development direction is continued decentralization and spread of the residential function, mainly through extensive villa construction in the residual areas of suburban geography, especially at its periphery. One last change with a rather small compass, but much attention in the urban political debate, is the phenomenon called regional expansion. Through rapid communications between cities located some 100 and 150 km apart an expanding commuter traffic is developed and the tendency to urbanization of the intermediate countryside is reinforced. While regional expansion can be considered a general decentralization tendency, it is based on the linking of existing agglomerations, not on the expansion of the suburban zone. In the long run this tendency can have a significant effect, not least because it is supported by large, public investments and tax deductions for travel expenses.

[10] Anas et al. 1998.

The development of the urban structures, meaning the localization and dimensioning of the overall support systems and those areas, facilities and functions they join, is characterized by four sequences. These are the reinforcement of the existing monocentric structure; the continued growth of a polycentric city with a new, higher density in new centers and nodes; and the continued, well dispersed decentralization with two variants, either as an intensification and expansion of the suburban area or as the linking of population centers at greater distances from each other. These tendencies are not mutually exclusive in that they are not unambiguously linked to a single urban structure. However, by confronting one with the other, they can contribute to defining alternative paths to the future.

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Chapter 7
Visions and Urban Structures*

During the last century shifting ideals and modes in urban planning have had a strong influence on western city development, even though the financial, technical and institutional conditions have decided what was finally built. Thus the unprecedented transformation and expansion of the Swedish cities starting in the mid-1900s was supported by ideals and visions that sought with minimal critical thinking to satisfy nearly all structural societal changes. "Accept", meaning accept societal development, was the name of the ambitious program for Swedish architects in 1931 and where the all-pervading theme was a new modernist architecture, in Sweden called functionalism, and the dissociation from the traditional city and its block and street pattern. The consequences for urban planning was even clearer at the influential international city planning conference in Athens 1933 where the Charter of Athens was promulgated. Its focus was the division and zoning of the city into separate areas for work, residence, recreation and central city functions. The future car society was welcomed by traffic separation, for instance regional highways and bypasses firmly separated from local streets. The urban structure presented was also the one that later was more or less implemented in the entire industrially developed part of the world, sometimes, and especially in Sweden, supplemented with ideas about *neighborhood units*, *New Towns* and *satellite towns*. The latter laid emphasis on social contexts, but at the same time contributed to the mono-centric and hierarchic order of the urban structure.

It would seem that functionalism's and modernism's city of the future was so well adapted to contemporary changes that the question if it existed any realistic alternatives seemed irrelevant. How would it for instance have been possible to integrate major industrial facilities in residential areas and the traditional perimeter block structure? How would an urgent housing production in the old, crowded city center have been able to compete with new prefabricated houses in residential sections near nature with new social services and other central facilities? Why not build the regional thoroughfares with their noise and emissions outside the local built-up areas?

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But there were alternatives early on, and more appeared as many ideals of modernism were implemented and the criticism against them grew. As societal conditions changed, new knowledge and supervening problems concerning segregation, poverty, shrinking public budgets, energy supply and environmental questions grew in strength, these alternative visions soon became a real concern for politicians and civil servants as well. Today all Swedish municipalities are involved in varied attempts to transform the expanded, sprawling and zoned car city inspired by modernism. From the early 1990s on nearly every municipality has developed its own Agenda 21 for sustainable development as a response to the international environmental programs' demand for reduced energy consumption and lessened environmental impact, an agenda that often has been made a part of their branded city profiles in competition with other places. Still, the urban visions claiming sustainability shaped by different organizations, researchers, critics and architects around the world are naturally quite different when it comes to architecture, housing patterns and city structure as a whole.[1] However, if we focus solely on the urban structure defined as the localization and dimensioning of overall support systems and the areas, facilities and functions they link, as well as the characteristics of the traffic systems and the hierarchy of centers and nodes, most visions converge mainly towards three solutions:

- decentralization through new, low-rise housing construction;
- supplementation and reinforcement of the existing, centralized mono-centric structure;
- concentration to regional centers and traffic nodes, resulting in a more polycentric structure.

7.1 The Decentralized Low-Rise City

The vision of a better life in small-scale communities has long been a permanent hit among urban and societal utopias. It corresponds to the conviction many have regarding the importance of place and local contexts, one that certain researchers feel is reinforced today. They aver confidently that the local area is vital or even the most important arena for beginning to turn development in a sustainable direction.[2] The first of the many contemporary visions and utopias of small-scale communities as political and religious alternatives to urban development appeared in the 1800s after the breakthrough of industrialism. The path away from congestion, dirt, low-salaried jobs, alienation and temptations promised self-sufficiency and

[1] For Swedish examples up to the end of the 1990s, see Bergman, B. Den svenska framtidsstaden (The Swedish city of the future), 1999.

[2] Falkheden, L. Lokalområdet som strategi för en hållbar stadsutveckling, 1999 (The local area as strategy for a sustainable urban development). pp. 23–26, 77–92.

self-government in a framework of a regulated social fellowship in new villages and facilities in the countryside.

In historical surveys the many settlements of religious sects are as well known as the projects of *utopian socialists* during the first half of 19th century, specifically those envisioned by Robert Owens and Charles Fourier.[3] In a philanthropic spirit, the former turned his factory and related residences into the small community of New Lanark. As described by an enthusiastic August Strindberg, Fourier's so-called Phalangstères, familiestères or 'phalanxes' were realized in the new main buildings for worker families in the company town of Guise. In some cases there was even some understanding of ecological recycling. This first came into print in proposals that linked these utopias to practical urban planning, namely those for *garden cities* by the English stenograph Ebenezer Howard published in 1898 and 1902 and frequently quoted in urban planning history.[4] He included all the typical and necessary activities of an independent town surrounded by an ample agricultural area and launched his garden city as an amalgam of town and country, mutually dependent for support, including beneficial waste products. Thus a local interchange was emphasized through which the urban dependence on external conditions and their footprint in the surrounding world could be reduced. Should a town grow beyond 30,000 inhabitants, a new one with its own green belt should be lay out.

No new, influential versions of the small, partly self-supporting urban community were offered during the breakthrough of the modern urban planning in the early twentieth century. This came as late as the 1960s, when energy and environmental questions were seriously raised in forming a new threat complex. Visions of a *low-energy society* were formulated by enthusiasts, researchers and activists in the broadly based environment movement, a society divided into *local communities*, though the label low-energy society came by analogy to be applied to the alternative society as a whole.[5] Both these smaller communities and the society as a whole comprised villages or towns sited in their own cultivation areas intended to ensure access to basic foods and energy with locally closed cycles as stabilizing factors. The degree of self-support was relative, necessitating specialized production of, for example, textiles, machines and tools in different towns. It was obviously also very positive that the local context responded well to the call of many contemporaneous radical movements for collectivism and local democracy.

A counter-reaction to these visions was not late in coming in most western countries, in Sweden not least after the national nuclear power vote. As early as in the early 1980s the 'green wave' of the previous decade was weakened by a criticism of the zoned modern city that emphasized diversity and openness of urban life. However, thanks to the gravity of the questions concerning the continued press on the environment and human health, the footprint discussion and the development of

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[3]Choay, F. The modern city, 1969.

[4]Howard, E. To-Morrow, 1898 and Howard, E. Garden cities of tomorrow, 1970 (original 1902).

[5]Alternativ Stad (1974).

research and new techniques, the ideas about the local community lived on in a host of variants. Furthermore, the argumentation was much improved by the ability and necessity of including defense of biologic diversity and utilization of information technology in every image of the future. Among the benefits of the latter was the possibility for distance work at home, countering the argument that all contemporary small-scale settlements might cause too much traveling.

The experimental *eco-villages* were launched as possible permanent settlements with societal support for change in nearly all household routines. However, it was presupposed that many of the residents worked elsewhere as well. In many ways the proposals for smaller, increasingly self-supportive cities and towns assumed the presence of sophisticated managements with the countryside surrounding each community divided into different areas for varying crops, energy cultivation, recycling and storage.[6] In spite of uncertainties in the supportive calculations, Folke Günther's radical version of a Sweden where high-energy food transports are drastically reduced through sufficient local food production is still a seductive reference. It would call for largely agricultural villages with 200 residents spread evenly around the country, something that would obviously spell a final adieu to the city.[7]

The fact that the above mentioned low-rise areas intended to realize far-reaching social, economic and ecologic objectives are interesting to study is clearly due to the widespread interest in living in detached and semi-detached houses that still forms an ideal for so many Swedes. In fact the critique of the post-war large-scale housing areas increased the demand for smaller houses, quite naturally placed in well-defined, smaller areas rather than rolled out like endless carpets. In the US, where the term 'community' is strongly linked to notions of local neighborhoods and social security, the segregation according to different building types and patterns has even gone so far that the term *gated community* has become an area description without any negative overtones.

In its entirety, this tradition of small-scale, multi-facetted communities support an urban structure that most certainly can be called decentralized. In relation to it, nature and its assets are as significant elements as any other. These environment and energy oriented visions mainly describe two functions for today's areas and communities, namely partly to safeguard biological diversity and partly to organize basic food production within local recycling systems. The distribution of specialized tasks and functions among villages, local communities, self-supported towns, or whatever one might call them, is either not considered as necessarily threatening the capacity and content of existing greenswards and waterways, but rather the reverse. However, the inexorable result is sprawling urban regions with concentrations of specialized, large-scale functions such as some industry, administration, education, retail centers and the like. In addition travel to and between these functions would be a large expense item.

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[6] Sverige 2009, 1994.

[7] Günther, F. "Stadens predikament" (The urban predicament), 1997.

When the historian of architecture Johan Rådberg tries to picture future housing his vision also falls within the above framework, in part as a result of his one-time crusade against houses with more than two or three stories.[8] His argument is that according to some studies the moderately sized Swedish town is the living environment that most Swedes prefer. Small, low and rather dense, urbanized communities are quite simply an attractive alternative for many, combining the possibilities inherent in manual crafts, small industries and high technology, but with a dependence on larger markets and centers. The strongest, most diverse support for such communities is obviously not tied in with a specific urban vision, but only linked to the desire of many to have a house of their own. This desire can even and has also been satisfied by spreads of low-rise carpets, even in a really large scale as in the American suburbs.

Keeping in mind that the Swedish small-town is for the most part rather well preserved, that the utopias and visions discussed above have proven vigorous and that many wish to live in their own house close to the ground, there is without a doubt a broad market for small-scale, well delimited urban and housing areas, and thus of a decentralized low-rise city.

One special facet of this discussion on the preference for small towns has developed under the name regional expansion. Here the advantages of smaller or medium sized population centers are combined with what is in no way a small-scale transport system, but intended to carry working commuters back and forth over distances that range up to 200 km. A house and habitat in small and medium sized towns should be compatible with a regional and metropolitan labor market and the reverse. Ideas of this kind appear now and then, such as some Swedish projects suggested in the 1960s. The thoughts have returned in strength over the most recent decades. For example in Denmark some planners use the concept H-city do describe a coherent country with one leg in Jutland and one in Zealand, with the two connected over Funen Island. The practical possibilities for implementing the concept have been improved with the large-scale construction of rail and road communications.[9] Still, such visions of regional expansion houses several, partly contradictory elements. On the one hand they promote the advantages of small local communities, while on the other tending to conjure up truly large-scale visions and benefits of urbanization.

7.2 The Reinforced Centralized Urban Structure

Even if Ebenezer Howard played a strong role in promoting small town utopias with a garden city architecture, image and name frequently reproduced in many contemporary housing areas, his central position in modern urban planning is more

[8]Rådberg, J. Drömmen om atlantångaren (The dream of the Atlantic steamer), 1998, p. 164–165.

[9]Nielsen, T. and Hemmersam, P. "Imagining the H-City – Denmark as an urban field", 2004.

linked to the regional urban structure. According to his proposal, urban growth should be accomplished via new garden city satellites that, like electrons round their nucleus, circled a larger city equipped with those functions they could not be expected to carry themselves. He called the resulting urban clusters *Social Cities*. This model for urban growth and establishment of a regional urban structure would take the lead in most western cities, adopting a logic that the spontaneous urban development already had began to adjust to since the early 1900s. Nor did the fact that Raymond Unwin, one of the first garden city architects in England, used Howard's atomic model in the early 1900s in order to describe the relationship between separate housing areas and the superior city center constitute a decisive deviation from Howard.[10] Right from the start his urban diagrams for the garden city also had consisted of a clear division into center, housing and work zones. In urban planning history subsequent intermediate and development steps must not go unmentioned, remembering thus the proposals by the Americans Clarence Perry and Clarence Stein in the late 1920s to divide the suburbs into *neighborhood units*, meaning housing areas with their own small centers. Then there were the proposals offered by their countryman Frederic Osborn for *Green-Belt Cities* presented in 1946[11] and London's regional plan from the end of WW2 with diversified *New Towns* as new regional colossi that included *community centers*. The latter was especially important to the Swedish post-war planning of *satellite towns*, which in Stockholm also were called ABC-towns, an acronym of the Swedish words for work-housing-center and an attempt to localize housing and work places near each other. Vällingby was the most famous example. Also medium-sized Swedish cities began to label their new, well-equipped suburban areas satellite towns.[12] Even in seemingly completely opposite proposals for a new urban structure it is possible to discover the hierarchy and zoning principles of the garden city and satellite town. Examples of this are the urban visions prepared in the 1920s by the pioneer in modern architecture Le Corbusier with high-rises and colossal buildings for housing in a park-scape traversed by elevated motorways.

However, when the criticism of suburban construction and city-center transformations during the "record" years in Sweden grew, it was not the hierarchic metropolitan/satellite structure with suburbs stretched like pearls along rail- and road-bound arteries that was the target, but the architecture and the functional zoning. Lacking work sites outside of the service fields, the new suburbs became dormitory towns, a concept rightly on the wane today, especially in larger cities, where most suburbs are surrounded and even penetrated by new, spontaneous establishments. Many of these concentrations neither sleep nor exist for sleeping alone. Even so, they are dominated by residential housing, a fact that leads many planners and politicians today to state that the areas ought to, or even must be supplemented

[10] This was done in Letchworth, England.

[11] Osborn, F. Green-belt cities, 1946.

[12] Åström, K. Svensk stadsplanering (Swedish urban planning), 1967.

with work sites. Many also propose that residences should be built in the industrial and office areas, where today most often no one lives.

During the 1960s and 1970s it was mostly new city residents from the countryside, immigrants and low-income earners from demolished downtown areas who were forced to chose the standardized, mass-produced flats in the new suburbs. This contributed to an increasing social segregation between whole areas, especially since these had been created as more or less isolated enclaves planned and separated from each other by green areas and thoroughfares. In spite of the fact that in the 1970s municipal finances were still only in the beginning of a downturn, more and more of these residential areas did not develop in accord with the planned, well-meant neighborhood ideal, but created problems with tenant turnover, badly maintained schools, unemployment and social maladjustment. The first protests, action groups and village councils acting against the demolition of the Swedish city cores were therefore quickly followed by similar actions in the suburbs, where the social workers' operations were either challenged or included in the movement for residential influence. Around 1970 democracy and participation in planning one's own residential area became an important, influential issue, among well-known architects such as Johannes Olivengren and Ralph Erskine as well. As ways to handle current social problems and sustainability questions, such initiatives confirmed and reinforced the importance of a local, popular involvement in the renewal of city districts, continuing strongly even today to serve as a goal of activists, associations, some civil servants and politicians. Inspiring examples include Lena Jarlöv's early pleading for allotments among the suburban high-rises[13] and almost the entire range of activities and initiatives in the Hyldesjaeldet area in Albertslund outside Copenhagen, the latter presented in a continuous research project.[14]

With the architecture, street network and city plans of the new housing areas in mind, the critical focus on social questions and democracy, as well as the absence of a varied selection of activities in suburban areas, was summarized as an absence of urbanity. If anything the scattered high-rise, prefabricated residence complexes were seen as the essence of suburbanism and a counterpart to the 'real and authentic' city downtown with its well-defined cityscape, streets lined with shops and offices, city blocks offering a business mix, interwoven street structure and more.

The criticism of the modernist, rational design, spatial ideals and urban planning grew during the 1970s all around the world. Among architects varied proposals for a new architecture were soon to be presented collectively as *postmodernism*.[15] From its spectrum mix, that articulated the previously defined contrast, a certain movement and perspective crystallized that could be labeled *the reconstruction of the European city*.[16] This became the most important point of departure for the urban

[13] Jarlöv, L. Hemfrid åt hyresgästerna! (Privacy for tenants), 1990.

[14] Falkheden, 1999.

[15] Jencks, C. Post-modern architecture, 1977.

[16] See specifically the texts of the Krier brothers: Krier, R. Urban space, 1979 and Krier, L. Drawings 1967–1980, 1980.

ideals still current today and whose influence in Sweden still does not seem to have peaked among politicians and civil servants. Emphasis is laid on the importance of the mix of urban functions, as well as on the scenography and spatial/building typologies of the traditional city with its well-defined streets, blocks, squares, sight lines, landmarks, and gates, including the differences between monumental and more anonymous buildings. The reaction to the uniformity and non site-related architecture of modernism made concepts as the identity, spirit and soul of place common as a basis for the evaluation of various urban settings and shaped a renewed place-oriented discourse inspired among others by the Norwegian phenomenologist Christian Norberg-Schultz.[17]

It was quite natural that this upgrading of the dense traditional city led to a nearly automatic rejection of the sparse, traffic generating suburbs and that the general spatial relationships of the traditional city came to support the demands for a sharper delineation between private and public, both in housing areas and the new indoor malls and arcades. Still, the overarching satellite town model and the hierarchic city structure were not seriously called into question. Since the primary goal was to transform partly central and peripheral city districts to more diverse, spatially well-ordered urban areas with their own character and identity, questions regarding the overall hierarchic urban structure focused merely on demands for better transit conditions and transverse connections.

Around 1980, the resurrection of the traditional city in the debate on urban planning in Sweden had practical consequences for Stockholm's suburban expansion in several new housing areas. In one of them, Skarpnäck, the grid-iron structure of streets and enclosed blocks even left a substantial part for offices and work sites. However, the new perspectives gained perhaps its greatest visibility in the 1990s exploitations around the South Station in Stockholm and in today's expansion of the inner city in different directions. Because of its integrated systems and arrangements for heating, water, waste and other functions, the Hammarby Sjöstad area became its showpiece ten years after the South Station, and now the Royal Seaport development is expected to fill that role the coming decades. In other parts of Sweden traditional city plans with street grids were also laid out as frames for new housing areas, including several large ones built in the late 1980s in middle-sized Örebro and the much smaller Staffanstorp. The trend included by now common variants of what we can call the concept city. In those the building patterns and styles became primarily a sales argument using references to past epochs. A prime example of this is the residential area called Jakriborg between Malmö and Lund in Skåne built as a pastiche on a German medieval city. However, nearly all such examples lack a direct contact both with the urban context being imitated and the surrounding city, as well as with other work sites, excepting perhaps schools and local services.

The orientation described above also had its international counterparts. In the US the comparable movement is called *New Urbanism* and boasts the erection of new residential areas with relatively small houses designed according to style and space ideals taken from the dense, older city and with some space left for small

[17] See such texts as Norberg-Schulz, C. Genius loci, 1980.

shops and service. Celebration in Florida is one of the movement's showpieces and there are also a number of gated communities that have been laid out along copies of the old, memorialized American main street. However, there are usually few links to sustainability in the presentation of these cities when it comes to the individual household economy and the city's own care. The car is presupposed to be everyone's transport means and larger work sites are simply elsewhere. Today there is a growing, varied collection of renewal projects under the label New Urbanism, including the transformation of pure car thoroughfares and American strips to highly varied boulevards for shopping and strolling.

Still, the international environmental programs in the early 1990s did bring attention to energy and environmental questions from a public finance point of view. Following their footsteps, Hans Bjur and Carl Johan Engström received support from the National Board of Housing, Building and Planning (Boverket) to write the study titled *The Future City* (1993) in which they brought the main issues of the international programs into a Swedish context.[18] This book contains a broad inventory of the city's environmental and energy questions and a systematic discussion of the more general, seemingly intractable guidelines for urban development applied to cities in three sizes. The nearly axiomatic position of the book is the creation of more dense and mixed urban areas, especially in the non-diverse, thinly built residential suburbia, though with still carefully chosen adjustments from case to case. In spite of the book's emphasis on the importance of cross-town roads and suggestions for new centers in semi-central locations, the arguments about infrastructure, traffic systems and city districts in urban regions mainly support a modification of the existing, centralized traffic grids, a process approximately corresponding to changing a stellar form to a spider's web.

In this context it is worth mentioning two proposals for solving Stockholm's housing problem made only a few years ago and met by attention in the media. While architect Anders Wilhelmsson suggested that narrow, standardized skyscrapers should be built on the small, vacant lots throughout the city, architect Lars Wretblad drew attention to all the unused land around the city's subway system with the same intention. Both suggestions look at land reserves that at least hypothetically would be able to hold a large part of the expected and necessary additions of housing. Nor did the practical problems seem insurmountable, even if many small green and open areas would disappear.

In *Agenda for the City* most of the threads leading back to the qualities of the traditional city and requiring only smaller changes in the overall city structure are gathered. The document in question was prepared for the Urban Environmental Council of the National Board of Housing, Building and Planning in.[19] The text legitimizes the large international environmental programs' proposals for urban densification and, as it is interpreted in Sweden, 'to build the city inwards', all in

[18] Bjur, H. and Engström, C. J. Framtidsstaden (The future city), 1993.

[19] Urban Environment Council (2003). See Plan 4/2002.

order to make denser concentrations support public transport investments and thus reduce the need to travel. Requirements such as 'the city or city district should be its own norm', 'suburban centers should be developed', 'all renewal should be based on the identity and history of the location', 'existing infrastructure should be used first of all' and 'a more closely integrated mix of various activities in different districts is needed' demonstrate emphatically that it is not only the existing city structure that is to be strengthened. As an architectural guideline for these changes the Agenda also stresses the importance of the traditional, older urban spatial typologies. Squares, streets and parks are the urban meeting places, not indoor centers, malls, arcades and terminals, though they too apparently have that function. Still, the expressed goal of relating to the existing construction in each city district does not seem to exclude other patterns and forms completely.

Wherever the external or partly external business and office developments, as well as road oriented working areas have become the focus of various municipal planning initiatives, a certain functional aspect is emphasized. As with the purely residential areas, this concerns the importance of mixed functions and uses where residences areas are frequently suggested as supplements to business areas.[20] Thus the Swedish concept *blandstad*, in translation meaning "city with mixed functions", but also used as a characterization of *mixed-use areas*, has become one of the key words for many who support an urbanism related to the forms and patterns of the traditional city.

To the extent that the new road-oriented agglomerations are noted for possible development and to the extent that transverse connections between the radiating motorways are slated for significant improvements, it is possible to perceive the growth of what urban theoreticians would call *the network city* as part of the transformation of the centralized urban structure.[21] Where exactly the ideas about urban networks belong in the current discussion depends, however, on the content, role, function and size of the network nodes, be they traffic crossroads, suburban centers, shopping malls, regional centers or business parks. It is also very important to study how the means by which the relationships between them are defined. The choices seem either a retention of a ranking and hierarchy similar to the structure of today, the encouragement of free competition between nodes or a support for the development of several centers of gravity with the dignity of the traditional urban center regarding certain central city-functions. Especially the last alternative represents the development of another urban structure than the one described above.

[20] City of Gothemburg (2003), and Kommunplan för Sollentuna 1998 (Sollentuna Municipal Plan 1998), updated and reapproved 2002, pp. 58–59.

[21] Siewerts, T. Zwischenstadt, 1998, and Brorman Jensen, B. Byen genopdaget, 2004 (The village rediscovered), pp. 229–230.

7.3 New Mega-Centers and City Nodes in a Polycentric City

The *polycentric* urban structure has long served as a counterpoise to a centralized, mono-centric urban structure with a hierarchy of satellite towns, neighborhood units, business parks and shopping malls. Here the term is used to describe a structure with several centers of almost similar dignity, strength, attractiveness and accessibility. However, the equivalent stature of various cores and centers may depend on different factors leading us to see at least two variants of a polycentric urban structure:

- one where all equivalent centers have in principle the same list of functions as in the German Ruhr area;
- one where the strength of the larger centers rests on a specialization regarding one or more central functions such as retail, entertainment, institutions of higher education or some type of business and office activities.

Concerning the latter it is possible to talk about a polycentric urban structure as *competitive* or *supplemental* in relation to the city core. Those in the former class will be more flexible when it comes to size, functions and relationships to their surroundings due to the special competition among them, as well as to alliances and to the overall, co-coordinative planning.

However, it should be sufficient to describe an urban region as polycentric if it is vitally dependent on several centers of regional importance that at least together counterbalance the influence of the largest one – almost always the older urban core – regarding several central city functions such as retail trade, entertainment and high tech branches. Today the breakup of the usual mono-centric, hierarchic urban structure and the appearance of new concentrations, technopoles and retail centers with even more than regional importance is a clear trend in most metropolitan areas. In many cases this has led to a regional planning focusing on a more or less polycentric structure as in Munich, Dublin and Stockholm.[22] However, in the cities mentioned polycentrism is still encouraged on the condition that the attraction of the traditional center is not affected negatively, meaning that the development does not yet in fact represent a qualitative break with the spontaneous, ongoing changes of the central structure in these regions.

Prior to the large, rapid expansions of urban regions in the postwar period no documented, recognized polycentric urban regions existed, other than the ones that had developed historically as an interweaving of proximate cities, as in the German Ruhr and the Dutch Randstad. Preindustrial urban clusters are not included here. But with the advent of widespread car usage, the increased pressure on the urban cores and the rapid urban expansion in the 1950s, alternative, parallel supplemental

[22] Office of Regional Planning and Urban Transportation, Flerkärnig regionplanering (Polycentric regional planning), 2003a.

centers were proposed, at times only for a few really heavy urban functions. One that actually was built was the gigantic finance and office city district La Défense in Paris. In Sweden the proposals were more moderate, but still comprised pleas for true *city annexes*, such as in Angered in Göteborg and Hansta in Stockholm. In the 1960s some Swedish investigators, researchers and critics meant that annexes of this type even were suitable for medium-sized cities with around 100,000 residents.[23] But the downturn in the economy a few years later denied the proposers their hopes. In spite of periods of comprehensive new developments of offices, retail trade and other activities in urban perimeters, they have not been able to find support for a renaissance of polycentrism in practical urban planning. Not until, that is, in such examples as the Regional Development Plan 2001 for the Stockholm region (RUFS).[24]

However, this did happen in the US where as early as 40 years ago the growth of car usage and the delayed, insufficient revitalization of the run-down urban cores led retail and office companies to begin to crowd together along the highways far from the urban core. At some interchanges larger agglomerations appeared and came to be called *edge cities*. These concentrations are well on the way towards becoming strong centers in a more or less polycentric urban structure.[25] In some places even the old core itself is transforming into a type of edge city, as in Detroit. Overall this development trend also seems to be the one that the financial and political power institutions are most eager to confirm.

In European countries, as well, many administrations are now focusing on strategic parts of the urban structure outside both the central urban cores and the planned, older suburban centers, all in order to promote new peripheral concentrations, new activity corridors and investments at such places as airports. Today there is an obvious shift in how the relationships between downtown, periphery and suburban landscapes are seen, not only regarding social segregation, traffic policies and the shape and content of the separate areas, but also when it comes to infrastructural demands. In Holland construction along urban roads and highways has led to a planned development of nodes (knooppunten), especially where the tangential highways and radial track-bound traffic meet or can be joined. These new concentrations and junctions quite naturally include offices, retail trade, housing and services, at the same time as their high-rise housing is meant to ensure accessibility and proximity for large groups of residents. Examples include Laagraven in Utrecht and Rotterdam Alexander. A new node named Parksstad with the same program is planned as part of a widely spread traffic area in Rotterdam's port district[26] and the internationally noted Dutch architects and their offices, such as OMA with Rem Koolhaas and MVRD, are involved in the design of new nodes in earlier urban peripheries. As a result of Copenhagen's latest expansion plan, a similar node called Örestad City has already been opened near the Kastrup Airport next to an intersection of railroad, subway and

[23] Vägplan 1970, 1969 (Road Plan).

[24] Office of Regional Planning and Urban Transportation (2002).

[25] Garreau, J. Edge city, 1991.

[26] Maandag, B. Rotterdam hoogbouwsrad, 2001.

a national highway. On the whole plans for and ideas about breaking up centralized urban structures using exceptionally dense concentrations at traffic junctions has been more and more common among planners and architects. The famous, ecologically oriented architect Richard Rogers has even suggested a compact, traffic-integrated concentration for some 80,000 residents in one of the East Asian megalopolises.[27]

This brings to the fore the question of the dimension and design of the new urban nodes, even if in principle it is not possible to say that the polycentric urban structure presupposes a specific housing pattern. However, it is worth noting that the nodes mentioned above have a design that has almost no connection with the 'reconstruction of the European city' nor with the 'New Urbanism' that has characterized so much of the city planning during the most recent decades. With some exceptions it is rare that proposals for these nodes today adjust to traditional urban patterns, even though many of the large expansions in port, industrial and station areas in central locations initiated some 15 years ago were in part clothed in more traditional forms. Rather most current attempts at transforming strategically located traffic nodes into new, strong urban centers in an emerging polycentric urban structure are done in the form of a radical, pragmatic modernism, where the design is a result of traffic flows, supply systems and distribution of functions, and not least by pre-chosen spatial patterns.[28] This trend, for instance, was also a clear result of the large competition concerning the design of the suburban landscape and its centers and clusters held some years ago in Denmark under the aegis of the Danish Ministry of Housing and Urban Affairs.[29]

The type of nodes found in most of the proposals above all share the utopian urban construction tendencies from the 1950s and 1960s, packing all urban functions into one and the same overall structure in order to ensure density, flexibility and traffic flow. Architecturally the result was often stacks, towers, silos, piers and similar structures. For some architects of the time, such as the Japanese metabolists and Paolo Soleri, the compact structure was an answer to the predicted population explosion or future environmental changes. Others saw it as a means to optimize accessibility and affirm mobility, individuality, democracy, relaxation or simply consumerism's throwaway culture.[30] The projects appeared mainly as utopias, experiments or contributions to the debate and were often designed as *mega-structures*, defined as robust foundational large-scale structures for long-term use, such as podiums, platforms, frames and towers, to which mobile, interchangeable and more short-term smaller units could be fixed, such as apartments, facilities and support systems. The 1964 proposal by the British architect group Archigram for a Plug-in-city was fully in accord with this.

Many of the nodes suggested today that contain a concentration or even a compression of urban functions and flows usually adopt the mega-structure principle.

[27] Rogers, R. Cities for a small planet, 1997.

[28] van Kuilenburg, J. W. "Trigger-happy urbanism", 2004.

[29] Den nye Forstad, 2001 (The new suburb).

[30] Banham, R. Megastructure, 1976.

A whole list of well-known urban elements have been tied to the basic constructions, ranging from defined house bodies, indoor streets and plazas to arcades, stages, terraces, pavilions and kiosks. At the same time most of the concrete proposals for new urban nodes are concentrations that connect to already existing junctions and built-up areas in strategic positions.

Hans Bjur and Bertil Malmström were probably the first in Sweden to propagate explicitly for a transformation of the hubs of offices and hypermarkets at the urban motorways into nodes supporting a sustainable urban development.[31] J. Söderlind was more concrete, but short-sighted in his book *Stadens renässans* (Renaissance of the City) when he questioned the structure and subdivision of satellite towns into neighborhood units.[32] In addition to bringing up the old idea of off-loading city annexes in medium sized cities, Söderlind pointed to the potential of the empty edge zones along urban motorways, ones that had been protected from exploitation and thereby forced retail, offices and hotels to unnecessarily peripheral locations, especially in the metropolitan areas. With regulated speed and built-up edge zones, these motorways should instead link isolated, proximate suburban divisions around new, shared centers, serving as alternatives to their own dying local centers. However, it is true that Söderlind brought the rather narrow view to the table that cities basically only consist of houses, blocks and streets, suggesting the transformation of motorways into city avenues, boulevards or esplanades, all three street types taken from the traditional city and the arsenal of New Urbanism. We must naturally see such solutions as possible alternatives, as does the architect Ola Andersson in his vision of transforming a traffic artery south of Stockholm into something similar to one of the well-known and populated inner-city streets that carry about the same amount of traffic. But there are many other alternatives, including the speed differentiated American strip, and if the proposed focus is to result in something that resembles new, multi-functional off-loading centers, urban nodes or city nodes with integrated solutions for both private car use and public transport, it is not fruitful to get stuck on the traditional elements of the inner city.

At this point no well-elaborated, concrete proposals for new urban, multi-functional nodes have been presented in Sweden, suggesting and relying rather on a development towards a polycentric urban structure. There are, however, single building projects with a stated goal of reinforcing each specific site as if it were an urban node. Of its genre the Regional Development Plans 2001 and 2010 for the Stockholm region (RUFS) are probably the most interesting in their proposal to concentrate urban settings and upgrade centers in seven regional agglomerations called *regional cores*, even if they also contain amorphous, sprawling areas.[33] Still, with only a proposed doubling of residents and work sites, there is a rather large risk that these cores will merely confirm an already existing level in the current

[31] Bjur, H. och Malmström, B. "Periferins gestalt" (The shape of the periphery), 1996.

[32] Söderlind, J. Stadens renässans (The city's renaissance), 1998.

[33] Office of Regional Planning and Urban Transportation Flera kärnor (More Nodes), 2003b, and Office of Regional Planning RUFS 2010, 2010.

center hierarchy. This is true even though it is assumed that they will remain different one from the other as to traffic systems and their functional composition with, for example, retail trade in one center and a hospital/university combination in another. Of course one or some of them may be especially favored by the future development. However, RUFS, with its increase of residences, activities and traffic functions in regional cores does not represent the regional drift in favor of the suburbs that could seriously challenge the dominance of the inner city.

7.4 Summary

To varying degrees most older cities are built on the basis of a few general, historically grounded plans and housing patterns, though there are many different visions, alternative models and solutions implemented at specific points in the form of new traffic systems, individual buildings and small areas. There are hardly any expectations that this will change, even if it is entirely possible that the energy and environmental questions on today's agenda will bring about a new overall pattern over time. However, all ideas, plans and initiatives for urban development today converge mainly towards the three perspectives sketched above:

- a decentralized, low-rise city;
- a reinforced, centralized urban structure;
- new mega-centers or urban cores in a polycentric city.

For sure they do not exclude other separate ideas or proposals that do not clearly agree with only one of the perspectives. The proponents of the low-rise city hold the small-scale house and proximity to the ground as their common denominator, but beyond that disagree rather much when it comes to building patterns, local co-operative forms, property management and economy. Many of those propagating for a reinforcement of the existing urban structure through a concentration and supplementation of built-up areas often use the traditional European city as a reference object, at times ostentatiously presented as nearly an urban grammar. Others do not see the development of more mixed-use areas around existing traffic arteries as being bound to a specific construction pattern. The weakest support is probably for ideas about stronger concentrations of persons and activities in the form of urban and regional cores or some type of mega-centers far from the inner city. They often offer spectacular proposals where the patterns of the traditional city have given way to indoor centers, multi-level traffic areas, high-rises and mega-structures, even if the congestion of people and work sites is not necessarily larger than in the original central core.

Obviously a reasonable and realistic future scenario is that urban growth will not happen in agreement with only one of the three perspectives and foci above. Even so, there is nothing to prevent us from imagining this, trying to sketch three scenarios and draw some conclusions from the supposition that development will in the main occur according to the shape of either the decentralized low-rise city, the reinforced, mono-centric city or the polycentric one.

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Chapter 8
Stockholm's Urban Development*

The population centers in the Stockholm region have followed the typical pattern for all building activity, namely growth in development waves interspersed with periods of much lower activity. These waves have been concentrated to certain parts of the cityscape and dominated by certain object types with special characteristics regarding size, building types and density. For the most part they have built on a certain type of traffic supply and promoted by specific investor constellations. The crests and durations of these wave movements are marked not only by favorable financial conditions, but also by the fact that the parties involved managed to establish relatively stable institutional relationships around the construction. Traffic system expansion has contributed strongly to the construction and is described in the next chapter.

The dense city with its closed blocks was a nearly exclusive built in the inner city prior to 1930. The first attempts to move this type of construction to the suburbs were not immediately imitated as the building type fell out of favor. To some extent the construction of Stockholm's suburbs was done as completely new communities outside the city limits, frequently along the main railroad line or through supplementary construction in much older towns on their way to being captured in the metropolitan area's gravitational field. However, the primary focus of the suburban construction was to build residential districts shaped to attract different population segments ranging from the most well to do and on to lower civil servants and trained workers. Certain of these garden suburbs were created by the Stockholm municipality only after their incorporation. The major part comprised multi-family housing, often with narrow buildings some three stories high that began to spread out into the most proximate suburban areas during the 1930s, but also into undeveloped districts of the inner city. However, many suburban developments were created through private initiatives. Both development types depended on traffic systems, meaning that communication to and from central Stockholm was essential.

*Chapter written by Per Lundin and Anders Gullberg.

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The development course of the Stockholm region displays many similarities to the general pattern described in the previous chapter, but a few differences are worth mentioning. The combination of city's location on a number islands where Lake Mälaren empties into the Saltsjö Bay, and the height of the land both to the north at the Brunkeberg ridge and the fault scarp along the entire northern edge of the Södermalm district has brought with it special and recurring communication problems. Other unique characteristics include large, early land purchases, construction of a subway system at an early time considering the size of the city and the establishment of a strong city building administration during the first decades after WW2. This administration mobilized powerful investments to seek a solution for the problems existing in the city and the region at the time. This resulted in strong communal control of residential construction up to the early 1970s and an increased intra-regional collaboration primarily aimed at creating a mutual public traffic company. A legacy of this subway era is that public transport in Stockholm still enjoys a larger market share than in comparable cities.

The suburban housing development up to the mid-1970s was done through increasingly large development projects that finally comprised whole city districts. The contrast grew greater between the less well thought out outer settings and the apartments' inner technical and spatial design. The regional forecasts for growth in population and living standard pointed steadily upwards, for which reason plans for traffic routes and building construction were laid for a doubled population in less than 50 years. This period saw a strong expansion into the suburbs, building on hitherto untouched land farther and farther from the regional center. These areas were served by a combination of public subways and commuting trains and to some extent, by buses on extended roadways and private transport in the form of private cars on the same roads. The acute housing shortage was solved, but many of the new high-rise areas earned the reputation of being badly sited and poorly designed. The apartments in these areas were found to be hard to rent out. The period carried with it a rapid, far-reaching expansion of Stockholm's metropolitan area under an official leadership that at first sought to establish suburban centers and work site concentration in good communication locations, mainly along track-bound lines. It was a strong decentralization with some concentration in centers and other centralities in the suburban area.

The city core or inner city has in much developed along the lines of international trends. Over a long period, it has lost its relative importance primarily as a place for industrial production, something that also was true for the whole metropolitan region, but also a site for trade and office activities. Its population dropped drastically as well, primarily because an increasingly spacious living style. However, over the most recent decades the inner city has experienced a renaissance, especially as a residential site. It is once again an attractive living setting without first turning into a slum as happened to many American cities. Today both young people and well-off, somewhat older persons are drawn to central addresses. Practically all inner city districts have risen in social status. A gentrification has occurred and accentuated during the 1990s through a comprehensive transformation of the inner city's rental properties being converted to building-society apartments or condominiums.

This gentrification has in part occurred on industrial and port land that has lost its earlier use. Areas just outside the inner city have also been drawn into this process and have been upgraded by new investments in track-bound communication. This has resulted in a loosening of the previously relatively sharply defined delimitation between inner city and its surrounding districts characterized by industries and terminals.

Craftsmen's workshops, medium and larger factories like Bolinders and Atlas, as well as activities like warehousing and goods handling at several sites in the old center have over the years left the inner city and moved either farther out or beyond the region's periphery. There is an increasing tendency for craftsmen and smaller industrial facilities that previously were integrated in the block construction of the inner city to collect in specially planned industry and trade areas in the suburbs.

Retail trade has grown into increasingly large units. The small shops for everyday consumables once found in each block of the old city center have been replaced by larger stores. The monopolistic position vis-à-vis capital goods previous held by the inner city has gradually weakened. The city is still the largest purchasing point in the region, but it is far from dominant. Early on trade began to follow residential construction into the periphery. The first step in this process was away from the central city to the business streets in the city's own periphery. This was followed by moves to the business streets in the early, dense suburban areas and when the large suburban developments along the new subway lines grew, trade expanded into the newly built shopping areas of varying sizes. The internationally discussed Vällingby district was an early example of this trend and the one at Täby even lie outside the city limits next to a planned, but not yet built subway line. These centers were planned variously through collaboration between municipal and private investors. While earlier suburban establishments and developments have mainly been placed along track-bound communications, such as main lines, local railroads, suburban trolley lines and subways, those in the most recent decades have found excellent communication locations along regional motorways. The latter, frequently promoted by private interests, usually lack good public communications, but are instead well supplied with parking places.

In a longer time perspective an important share of the city's utility transports have been transferred to mains networks, primarily then transport of water, liquid waste (including food waste, rinse water and human waste), energy in the form of gas, electricity and district heating, as well as personal messages and other information through telephony or radio and data communication. The centralized facilities for goods handling and wholesale, as well as terminals and warehouses have all been decentralized and, in many cases, resized to serve larger areas surrounding the metro region. As truck use grew dominant, the localizations along tracks lost their centralizing importance and the goods handling was oriented towards more advantageous locations along the road network. The truck has also enabled a smoother handling of the land transports within the city than was possible with exclusively muscle-powered transport. The corporate concentration in the foodstuff wholesale segment, as well as in other trades, to a greater presence of chains with their own distribution apparatus combined with low transport costs has contributed shaping larger warehousing and distribution terminals. The distances from warehouse to shop increases, while more frequent deliveries has become a competitive means for perishables. The movement of retail trade for both everyday and capital goods to peripheral shops with a large service area has meant that the customers have taken over part of the goods distribution that was previously handled by the local neighborhood store. Costs can be cut at the large peripherally located stores or easily accessed shops in suburban malls through the use of cheaper and simpler transport, more rational goods handling and the possibility for purchasing goods in larger consignments. When the depletion in the local residential areas has gone far enough space is created for small stores where customers usually must pay extra for the high accessibility.

There was a marked shift in the development of the Stockholm region in the early 1970s. This shift is very obvious if you compare what actually happened with the regional plans from the mid-1960s that had built on and accentuated the development trends of that time. The large-scale multi-family housing developments at increasing distances from the central city stopped as the financial business cycle turned and the population growth in the Stockholm region not only stagnated, but the region actually lost residents. This shift in the development pattern was true for the rest of the country as well.

Immense areas intended for major future construction remain undeveloped. New construction slowed and shifted to one-family and row houses, in part even in the periphery of the region. There were some multi-family housing projects in smaller scale, mainly to fill existing gaps in central districts of the already developed city structure, such as around the southern station area and others.

During the most recent 20 years through such steps as a discontinued housing policy tied to a dramatic change from generous subsidies to heavy taxation construction has slowed radically and been redirected to a more exclusive residential segment, frequently in the region's center. These manifest production problems that have brought about an increase in the average residential density in the region, something that is a clear break from the previously dominant tendency towards a more widely spaced living style. The production problems have also ensured the continuance and probable acceleration of the trend to rebuild summer houses for permanent residence and that the long-distance commuting has increased. The possibilities for travel between some town in the Lake Mälaren valley and a job in Metropolitan Stockholm and the reverse have grown thanks to investments in railroad traffic and expanded motorways. This phenomenon is often clothed in today's in-words, but regional expansion has been on going without any larger break since the mid-1800s. The traffic systems' key importance to the long-term decentralization of the traffic systems and the region's future development motivates the following, more in-depth discussion of regional roads, lines and traffic.

8.1 Focus on Transport in Urban Development

The transport systems play a key role in the urban decentralization process. Today's city is in much designed with the car as the dominant transport form, which is why car usage has in many ways become normative for both households and urban structure.

A sustainable city calls for a sustainable transport system, for which reason changes in today's transport systems are essential if we are to reach that goal. The purpose here is to use Metropolitan Stockholm as a start point for describing and analyzing current transport systems and their historical development and thus be able to identify conceivable paths to a sustainable city. For this to be accomplished our focus must be primarily on the structuring effect transport systems have on the building patterns.

8.1.1 A Historical Perspective

The revolution that the Stockholm city structure has endured over the last 150 years can be described by focusing on the connections between transport system changes and the spread of the suburbs.[1] Three phases can be identified, namely the pedestrian city, the trolley city and the car city.

The foundation for Stockholm's urban structure was laid in the 1850–1910 period, an era characterized by rapid urbanization, not only in Stockholm, but in the entire western world as well. The urbanization was facilitated by the introduction and expansion of new technical systems for transport, communications, energy, water and sewage. Railroads were built during this period and, together with steamboat traffic, had a structuring influence on the development of Stockholm's physical development. As many as seven railroad lines were opened for traffic during the period – the western main line to Göteborg (1860), the northern main line past Uppsala (1866), the Västerås line north of Lake Mälaren (1876), the Roslags line (1885) and the Lidingö line (1907) along the northeastern shore, as well as the Saltsjö line (1893) and the Nynäs line (1901) along the southeastern shore. Starting in the 1870s factory suburbs were built next to the tracks and around these shanty towns for the workers, primarily along the western, Västerås and northern main lines. The shore lines served to develop residential suburbs for the wealthier classes.

However, the housing development was not only affected by the developments in transport techniques. Land ownership was also an important factor. There were several larger tracts in the city itself that were owned by the state and thus not available for development. This forced the suburban exploitation relatively far out from city center. To the south the situation was different and the suburban development could spread rather unhindered and in close connection to the central parts of the city.

The new transport technologies were important to the development and suburban expansion in the outer city districts. But prior to this urban expansion, residences, work sites and trade facilities were mostly located in proximity to each other in a

[1]This part is based on Lundin, P. Städernas persontransportsystem (Urban transport systems), 2003 which in turn is based on Johansson, I. Storstockholms bebyggelsehistoria (History of construction in Greater Stockholm), 1987 and Gullberg, A. and Kaijser, A. "City building regimes in post-war Stockholm", 2004.

dense settlement structure Thus from a person transport perspective Stockholm of that period can be described as a *pedestrian city*.

During the 1870s public transport was initiated in the city in the form of horse-drawn, track-bound wagons. The first electrically driven trolley rolled out in 1901 and in 1905 the horses drew their last trolley. The trolley system was electrified and expanded during the 1910s and 1920s, strongly affecting the structuring of settlement patterns by clearing way for a development in hitherto undeveloped areas in the city's periphery. As the trolley lines were extended to the neighboring communities large land areas that up to that time had lain outside exploitation reach were developed. In 1909 a double-track line was opened northwards, as well as one to the south at Enskede. In the period 1911 to 1930 new lines were built to the south and in 1914 it was time for a line to the west that later was extended even farther out. The trolley lines filled out the network between the railroad lines and created the structure of Metropolitan Stockholm. Construction of residences, factories, offices and stores developed as suburbs along the new transport lines.

Bus traffic also started during the same period, but it was not until after the 1920s that the pace picked up. By 1923 as many as 25 regular bus lines were functioning. The 1930s saw the development of a comprehensive bus line network, confirming the regional structure that had been established by the railroads and trolley lines by filling out many of the empty spaces between their spheres of influence. If trolleys dominated the 1910s and 1920s, the 1930s were the golden age of busses. The period 1910–1950 can well be called the trolley city because of the structuring influence of that traffic means.

The Functionalist movement/International style during the 1930s established a new city planning philosophy. The improved communications opened new possibilities for city planners creating a light, spacious and hygienic city, in part by separating residences, factories, offices, department stores and entertainment centers. Traffic routes would link the different segments over the green, separating wedges. The new city planning ideal generated a strongly increased traffic flow since the residents would be forced to move between the various functions. During the post-war period the functionalistic city planning paradigm was fully implemented and the traffic system gained in importance, mainly in the form of a comprehensive commuting between home and work.

Cars and the subway were the primary transport techniques that helped shape that post-war city construction in the Stockholm region. The subway construction was decided in 1941 and begun in 1944. Subway suburbs were placed along the planned line. These were planned schematically with a subway station in the middle, next came dense, high-rise rental housing surrounded by a feeder street in a circle and outside this street lay low-rise housing. The first subway suburbs were built south of the central city during the 1940s and 1950s, followed later by others in the same area. The ABC town Vällingby was inaugurated in 1954 as a variant on the subway suburb theme and designed as a place where work (Arbete), living (Bostad) and center services (Centrum) were found in proximity. This was followed by several more in the northern suburbs during the 1960s. The subway confirmed the radial structure of the region in the shape the railroad and trolley lines had suggested.

The subway replaced the trolley lines in many cases – there was no longer space for the trolley lines in the planning of transport systems and suburban construction. When right-hand traffic was introduced in 1967, the trolley lines were simply closed. The new planning paradigm stated that the subway was to stand for most of the public transport and bus lines serve as feeder lines into the subway stations.

As the subway was built out, an infrastructure was created for the dramatically growing car usage. Prior to WW2 private car use was relatively undeveloped, only to explode during the 1950s (see Fig. 8.1). The governing city and traffic planning paradigm called for separating the transport systems. This was accomplished in a somewhat simplistic manner – one system was created for the pedestrian, bicycle, bus, commuting train and subway complex, while another was shaped for pedestrian and car complex. The two served different functions and were intended to work independent of each other. Thus co-ordination between the two was nonexistent. The separation was done to benefit car usage, with such techniques as over and underpasses. In this way the car became the normative transport means during the postwar period.

The growth of mass car usage and commuting traffic meant that suburban settlements could be established 20–30 km outside city limits. During the 1960s and 1970s this resulted in an immense growth of satellite cities and various suburban centers surrounding Stockholm. The postwar development process was also characterized by the sparse low-rise settlement pattern spread out over large areas

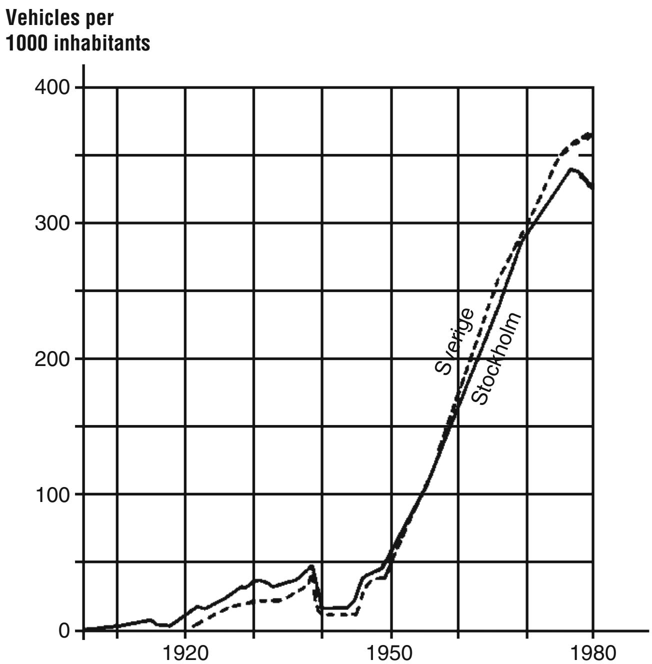

Fig. 8.1 Number of registered cars and busses in Stockholm and Sweden per 1,000 persons 1905–1980. No figures exist for the whole country prior to 1921 (Source: Dufwa, A. Trafik, broar, tunnelbanor, gator (Traffic, bridges, subways, streets), 1986, p. 77)

that later came to be called urban sprawl. Railroad traffic to the southwest and east was later called commuting traffic and 1983–1992 was dramatically extended. Double tracks were built both to the north and south of the city and new stations were built.[2] Though many of the new centers were linked to track-bound public traffic, they were planned and built with the car as the main transport means, as were the low-rise villa towns.

Being dependent on cars called for a well-developed road network. More roads were built and along them work sites and shopping malls were laid out so as to be accessible only for a driving public. More and more were persuaded to use cars. The postwar Metropolitan Stockholm quickly became a *car city* even if public transport still dominated commuting to and from the inner city. And as the car was made a part of everyday life, what originally was a free choice, became a necessity. Everyone had to have a car.

The car system expanded geographically (see Fig. 8.2). After 1960, city traffic stagnated while car use continued to grow in the region's periphery.

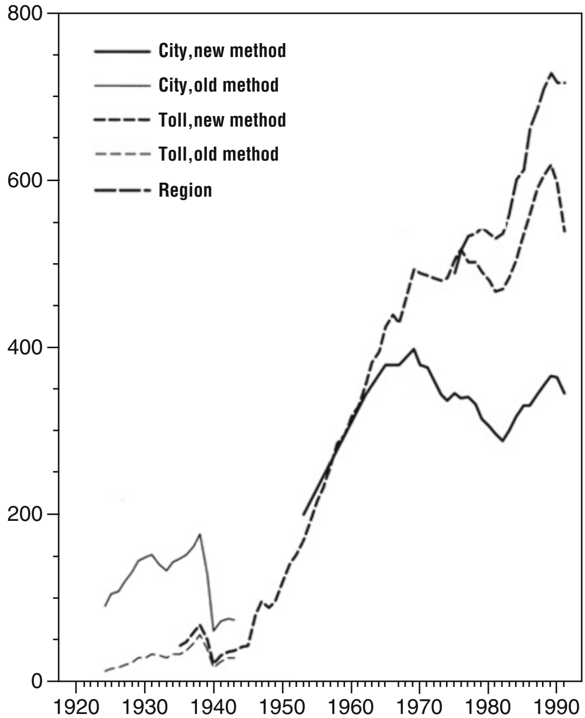

Fig. 8.2 The number of car transits at given geographic points in both directions during a weekday. City area – lower Norrmalm district; inner city; region, comprising Stockholm, Solna and Sundbyberg. The first two series are disrupted due to changed measurement methods (Source: Gullberg, A. City – drömmen om ett nytt hjärta (City – the dream of a new heart), 2001, s. 312)

[2]Fritz, S. 25 år med storlandstinget (25 yrs with the Greater County), 1996, p. 343.

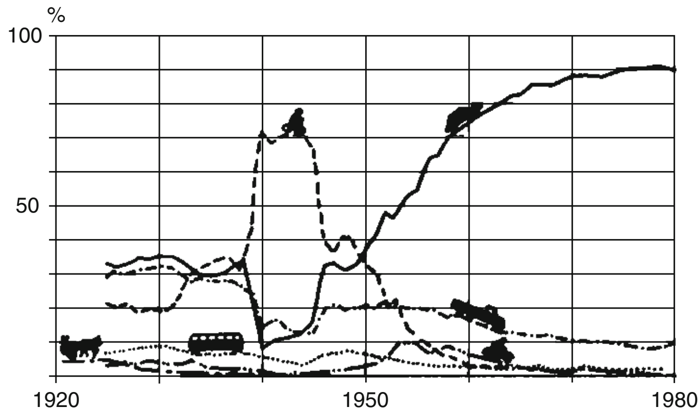

Fig. 8.3 Market share of different vehicles 1925–1980 counted at the end of October, as a percent (Source: Dufwa 1986, p. 78)

Changes in the transport system can be seen as in the main an unbroken expansion. Certain systems like horse transports, steamboat traffic and trolley line have stagnated and phased out, but looking at Stockholm's different person transport systems as *one system*, it has only expanded. The explanation lies mainly in the strong expansion of car usage. The car has become the dominant transport type in the postwar period (see Fig. 8.3). One way of expressing this is that the car system has pushed the bicycle aside and kept the public transport solutions' market share down.

A few words about the bicycle are needed. The bicycle was introduced in Sweden during the 1870s and the first bike paths in Stockholm were built as early as the 1890s. However, it would not be until the 1930s and 1940s that bike paths became part of traffic ways and approaches. In the early 1930s the bicycle traffic represented 30% of the transport means used, a ratio that remained unchanged until the outbreak of WW2 in 1939. During the war the share of bicycle use went up to 70%, but dropped rapidly – in 1950, 1960 and 1970 the bicycle share through inner city was 29%, 2.4% and 0.8% of the total traffic respectively. The car pushed alternative traffic systems out during the 1950s and 1960s, at the same time as a separation of motor and bicycle traffic on the motorways was sought.[3]

The development of Greater Stockholm demonstrates that transport systems are sluggish and have a structuring effect on construction. The radial structure that was established some 100 years ago with the introduction of the railroad continues to affect the transport system and settlement patterns, even if car usage has modified the picture. In this case it is possible to talk about a path dependency where once the development of a heavy infrastructure has attained headway, it is very difficult to stop it or to lead it into new paths.

[3]Dufwa, A. Trafik, broar, tunnelbanor, gator (Traffic, bridges, subways, streets), 1986, pp. 73ff.

Load factors can be used as an analytic tool to explain the expansion of traffic systems in Greater Stockholm. When the very expensive subway was built it was important to ensure that there was the passenger base was sufficient for profitability. This was done by co-ordinating the expansion with the establishment of new suburbs. The development of the trolley lines had followed a similar pattern. Proximate housing or factories were essential for making the trolley lines profitable and in certain cases the land developers financed the actual trolley line expansion.

One important conclusion of the historical survey is that the settlement pattern from the various historical eras was adapted to the transport systems and that each era remained normative on its original sphere of influence. Roughly then, the pedestrian city is still best for pedestrian traffic, the trolley city functions well for public transport and the car city is best suited for individual transport means. During the 1950s and 1960s there were strong efforts to make a car city of the pedestrian city, turning it into a gigantic parking place crossed by traffic corridors. These efforts were only partially successful. The different city types have consequences for travel choices in today's Stockholm.

8.2 Transport Systems in Today's Stockholm

A continually expanding transport system is perceived not only as a condition for welfare and for a good business climate, but also as growth engine. However, during the most recent 40-year period its negative sides have gained attention. Today's transport system is a threat to sustainable development. Car usage has expanded, causing congestion, accidents and environmental health damage. Thus there are good reasons for questioning the continued transport system expansion. In an attempt to nail down the complex relationship between transport systems, settlement structure and sustainable development, the relationship between urban structure on the one hand and travel choice and patterns in today's Stockholm on the other. The thought behind this strategy of identifying the critical problems inherent in today's transport systems is to be able to point out conceivable paths for a transition to a sustainable transport system and a sustainable city.

8.3 Urban Structure and Travel Patterns

One way to illustrate the travel pattern in today's Greater Stockholm is to divide the region in six outer traffic sectors plus two regional center areas and the inner city (see Fig. 8.4). By splitting the city at an imaginary, east-west line drawn from Lake Mälaren over the old city to the Saltsjö Bay, roughly comparative data can be developed.

Using this division as a point of departure, a rough geographic distribution of population and employment in the Stockholm region can be drawn (see Table 8.1). The numbers give an average employment frequency of 52%. Another way to

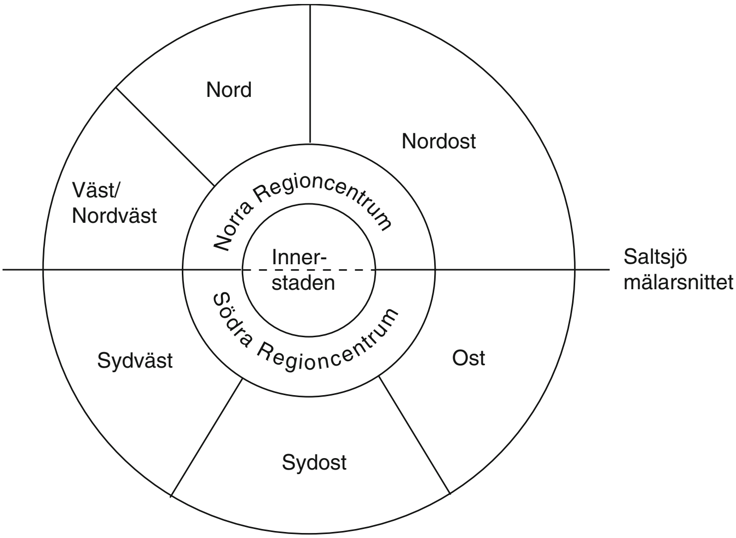

Fig. 8.4 The region divided into traffic sectors (Source: Trafikanalyser RUFS 2001 (2001), p. 16)

Table 8.1 Population and employment in thousands

Part of Stockholm region	Population	Employment	Employment ratio
Inner city	279	331	2.27
North center, ex. inner city	327	173	1.01
South center, ex. inner city	277	109	0.75
Other region: north	446	169	0.73
Other region: south	496	170	0.66
Total region	1,825	953	1

Source: Trafikanalyser RUFS 2001 (2001), p. 6.
The numbers suggest a geographic imbalance between population and employment, made even clearer using employment quotas – (S/B)*(Btot/Stot)

illustrate the relationship between residences and work sites is the ratio between the employment frequency and the average employment frequency. The ratios thus obtained show clearly that residences and work are not spread equally over the region. Most of the population is found outside the inner city, while the work sites are concentrated there and to a certain extent in the northern region center. The result is an intraregional imbalance manifested through a large share of commuting trips to and from the inner city. This is the result of thinning and fragmentation of residential construction in the wake of the last 150 year’s technical developments in communications.

The travel pattern does not only include travel related to work, but also school trips, service travel and leisure trips. Thus mobility is greater than the numbers above suggest, for which reason trips will be handled as a general category in what follows. Dividing the region into traffic sectors and regional centers enables a classification

Table 8.2 Traffic share for cars and public communications

Traffic sector	% share of trips	% public (of car and public)
Local inner city	11	68
To/from inner city	31	73
Local other areas	37	35
Transverse trips	14	35
Transit trips	6	61
Totals	100	52

Source: Trafikanalyser RUFS 2001 (2001), pp. 13f.

of the trips by type as shown in Table 8.2. Local other areas means trips within a traffic or regional center, but outside the inner city. Transverse trips means trips between sectors in the same half of the city, excluding the inner city. Transit trips means trips from a sector in one half to one in the other half, excluding the inner city. The percentage share of public transport of each type is shown in Table 8.2.

The dominating trip types are local ones and trips to and from the inner city. The big share of local trips is explained by the fact that 48% of all trips are for service and recreation, most of them locally.[4] In addition, trips related to work were often combined with service errands. Trips to and from the inner city are mainly the result of the previously mentioned intraregional imbalance between residences and mainly work sites, but also recreation and service. The public transport share of each travel type also illustrates that most of the local trips in the suburbs and the transverse trips use cars, while a majority of the trips to and from the inner city, locally in the same and transit trips use public means. The transport and settlement development is an important explanation of this distribution and then especially the historic heritage in the form of the track-bound transport system's radial structure. The public transport systems in the many subway suburbs were mainly planned for job commuting to the city center. It was expected that the local travel would be done by foot or bicycle, but as the housing spread, local travel became dominated by the car. The substandard transverse possibilities by public transport were a direct result of the radial structure.

A better measure of the load on the transport system than the number of trips is the transport work or product of the number of trips and their length, usually measured in person kilometers. The distribution of transport work during the maximum hour defined as the hour during the day when most trips are done, as well as the percentage distribution of public transport (Table 8.3) confirms the trend illustrated in Fig. 8.2. The share of car trips increases from the center to the regional periphery. Most of the transport work in the region occurs in the outer parts where the public transport system is least developed. In rough terms, the Stockholm inner city corresponds to the pedestrian city, the surrounding center city to the trolley city and the remaining region to the car city. Thus it is possible to say that the

[4]Office of Regional Planning and Urban Transportation, Årsstatistik 2002 för Stockholms län och landsting (Annual Statistics 2002 for Stockholm County and County Council), 2002, p. 200.

Table 8.3 Number of passenger kilometers in thousands during the maximum hour in different parts of the region using car or public transport. Includes trips outside the region

Traffic sectors	Car	Public	% public transport
Stockholm inner city	243	622	72
Rest of center	774	854	52
Rest of region	1,619	1,173	42
Totals	2,636	2,649	50

Source: Trafikanalyser RUFS 2001 (2001), pp. 15f.

Table 8.4 Percentage distribution of population 1997 as to transport means and distance classes in meters to the track-bound public transport system

Distances	0–300	300–600	600–1,200	1,200–	Totals
Subway	13	19	7	4	45
Commuting train	3	5	9	16	32
Local train/trolley	3	4	4	12	23
Totals	18	28	20	31	100

Source: Transport system in Stockholm County 2000, p. 14.

share of public transport in the region illustrates the attractiveness of public transport in the pedestrian, trolley and car city respectively.

One of the main problems with today's transport system from a sustainability perspective is the widespread car traffic and the vital necessity for reducing this share. One way to do this is to persuade traffic users to move over to public transport. However in today's urban structure, one of the large advantages cars have over public transport is its constant availability and its point-to-point transport capacity. For public transport to be attractive, it is essential that it can also offer such benefits. The geographic accessibility is vital, meaning proximity to public traffic connections. Such proximity can be illustrated by dividing housing into distance classes in relation to the track-bound public transport system (See Table C.1 in Appendix C for a detailed version of Table 8.4).

The inner city and the subway suburbs are well supplied with public transport in the form of subway lines and at least when it comes to radial trips. In this sense the subway stands as the most attractive track-bound public traffic system. Commuting trains and trolleys lack the same accessibility by far. The reason is not that the subway is superior as a technical system, even if the shorter distances between stations as compared to the trains is a factor. The answer must rather be sought in the surrounding settlement structure. The communities along the commuting lines are mostly satellite cities and center constructions with strong traits of the postwar sparse car city structure. This is most certainly obvious when compared to the garden city low-rise settlements along the trolley lines. These garden cities have a much higher accessibility than the sprawling car city structure along the commuting lines. The problem lies in the car city.

In addition to the geographic accessibility, travel time is also an important measure of the attractiveness of the public transport systems. The relationship between travel times using public transport as opposed to cars can be described

Table 8.5 Travel time ratios between public and car transport to the inner city and within certain geographic areas

From	To inner city	Within each municipality/area
Västerort (western district)	1.27	1.98
Söderort (southern district)	1.06	1.92
Österåker (northeast)	1.24	2.91
Ekerö (west, in Lake Mälaren)	1.25	2.75
Nacka (southeast)	1.01	2.29
Värmdö (east, near archipelago)	1.11	2.96
Huddinge (southwest)	1.14	2.24
Botkyrka (southwest)	1.12	2.19
Within the inner city	1.05	
Entire county	1.18	

Source: Transport system in Stockholm County 2000, p. 22.

using travel time ratios (see Table 8.5). The average travel time ratio for a trip to and from the inner city within the region is 1.18, meaning that public transport takes 18% more time than a car trip over the same distance.[5] However, the travel times are even longer when compared within each sector.

Today public traffic solutions work poorly for local traffic. They do, however, function better for trips along the track-bound transport system's radial structure. One weak point in today's person transport system is that the transport work is moved towards the periphery where the public traffic solutions are insufficient.

8.4 Transport System Loads

The travel pattern can be seen as a flow in time and space. From a technical system perspective infrastructures can be described as a network of links and nodes over which the flow moves.[6] Many systems require a carrier to move the flow. The network of links and nodes can be seen as the static components of the infrastructure, while the carriers can be viewed as the system's dynamic components.

It can be said in general that the urban person transport systems are in an expansion period as a result of continuing urbanization and increased mobility,[7] an expansion that is, for the most part, caused by growth in car usage. One result is an increased load on the person transport system, even to the point of creating

[5]Stockholm County Council, Transportsystemet i Stockholms län – Underlagsmaterial U:23, 2000, p. 20.

[6]Jonsson, D. "Sustainable infrasystem synergies", 2000.

[7]Steen, P. et al. Färder i framtiden (Travel in the future), 1997, pp. 84ff. There are exceptions of course. One example is the trolley systems that were discontinued during the 1960s, not so much because lack of users, but because they were seen as being an outdated technology with no place in the images of future cities prevalent at the time. Ekman, T. Kampen om gatan, 2000.

congestion in some parts of the system and at specific times. The aim of the analysis that follows is to identify when and where this congestion arises.

Two types of congestion problems can be identified. One way to define the difference between them is to apply the carrier concept. In the track-bound transport system the number of carriers is controlled and congestion cannot occur spontaneously for other reasons than accidents and other unforeseen events. However, the road system offers another problem picture since congestion here concerns the system's carrying capacity and is called top load. There is also congestion related to capacity that results when the number of persons traveling exceeds the number of seats available.

When it comes to overload congestion it is important to ascertain the flow concentration using a simple analytical separation to determine its time/space parameters. The person transport system's flow or load can be measured in a unified manner through the term transport work. Capacity problems can be handled either by tackling the system's static components, such as links and nodes, or its dynamic components, meaning the carriers. Capacity in the former can be increased, though often at a very high cost. The dynamic component is easier to affect, as it is easier to put more busses into the flow than to build a road link. An often-used way is to work for a more even load factor by spreading the overload. One way is through differentiated fees, either in time or space.

Information about the total number of trips distributed over a weekday is not especially interesting if the purpose is to characterize person transport system load. A better picture of the top load is achieved if the focus is shifted to the temporal concentration of traveling. An accepted measure is the number of trips during the maximum hour, that is the hour of a weekday when the largest number of trips are made. Of the total number of trips during the maximum hour, car traffic represents 166,000 and public traffic 181,000. The remainder is either by foot or on a bicycle and totals 80,000 or 20%.[8] The mean travel distance during the maximum hour is 11.3 km for cars and 13.4 km for public transport.[9] The system load is determined by how the actual transport work relates to the theoretically possible transport work. Are there occasions when the system is overloaded? By comparing the actual and theoretical transport work, an estimate of the system load or capacity can be drawn. Such estimates for the Stockholm region are shown in Table 8.6.[10]

The capacity utilization for cars is rather low with 1.4 passengers per car. When studying the numbers in Table 8.6 it is important to remember that the public traffic system reaches its top load during the maximum hour as early as at just over 50%, if the average capacity use in both directions is included in the documentation.

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[8]Office of Regional Planning and Urban Transportation, Trafikanalyser RUFS 2001, 2001.

[9]Ibid., p. 10.

[10]The transport work for bus lines is calculated using Table 8.3 where the total transport work for public transport is set at 2,649,000 person kilometers. If other public transport found in Table 8.6 is subtracted from that total, the number 1,049,000 passenger kilometers is arrived for bus traffic. The car traffic available in seat kilometers estimate is based on five seats per car. It should be noted that the numbers are for the average load during the maximum hour for both travel directions.

Table 8.6 Transport work (person km), theoretic of available capacity (seat km), and degree of use during the maximum hour

	Actual transport work	Theoretical capacity	Capacity utilization (%)
Subway	710,000	1,190,000	60
Trolley	90,000	190,000	42
Railroad	820,000	1,720,000	48
Bus	1,030,000	1,625,000	63
Public traffic total	2,650,000	4,725,000	53
Car	2,636,000	9,375,000	28

Source: Trafiken i Regionplan 2000 (2000), pp. 78, 84, 95.

The larger amount of the transport work during this period comprises commuting traffic along the radial corridors to the inner city. This means that the public traffic means run out towards the periphery with low capacity use in order to pick up travelers to the inner city.

A more correct comparison of the numbers in Table 8.6 would be attained by nearly doubling the use degree for the public transport types. The following hypothesis regarding the car system use degree and today's congestion problem can be of interest. If it were possible to double the average car utilization degree during the maximum hour from 1.4 to 2.8, this would by itself handle all transport work done by the public transport system today. This simplified, hypothetical argument regarding available car seats demonstrates that theoretically it is possible to solve the congestion problem without expanding a single traffic route.

The temporal flow concentration has been analyzed above. However, when both temporal and spatial concentration occurs, the risk for congestion is great. Thus the next task is to describe the spatial concentration. There are a number of bottlenecks in the road network around Stockholm, more specifically all roads through the inner city, as well as specific major commuting roads on both the north and south sides of the city.[11]

One measure of road network congestion is speed reduction. A reduction of more than 50% means that the traffic forms lines, thus creating what are called bottlenecks. A road network study of the number of lane kilometers that are forced into reductions of that scale indicates that the total number in the regional road system of 6,670 km thus affected is less than 1%.[12] In other words, it is only a very small part of the road network that can be seen as bottlenecks. However, these are strategically placed, as shown by the large number of passenger vehicles that pass through them (see Tables 8.7 and 8.8).

Since there are so few bottlenecks and they are relatively concentrated in time and space, there are many ways to eliminate them. Congestion problems are mainly found on the approaches to the inner city. This would suggest that the inner city as it is today has reached maximum capacity for car traffic. Thus expanding the traffic routes would serve little if the street network and parking capacity were not expanded equally. Still it is not self-evident that car commuting is the function that

[11]Office of Regional Planning and Urban Transportation, 2001, pp. 21f.

[12]Office of Regional Planning and Urban Transportation, Trafiken i regionplan 2000, 2000, p. 36.

Table 8.7 Share of lane kilometers after congestion measured through speed reduction (in %)

65–100% reduction	50–65% reduction	35–50% reduction	Total
0.2	0.7	1.9	2.8

Source: Trafikanalyser RUFS 2000 (2000), p. 21.

Table 8.8 Number of vehicular passengers on links with different speed reductions and comparison with total number of cars during maximum hour. A car can represent several persons

65–100% reduction	50–65% reduction	35–50% reduction	Number cars	Average share of cars passing any bottleneck
48,000	117,000	293,000	124,000	39%

Source: Trafiken i Regionplan 2000 (2000), p. 94.

Table 8.9 Number of travelers in public and car traffic over the central east-west axis during maximum hour. Some 25,000 vehicles pass the axis, of which just over 90% are cars. An average of 1.2 persons/car equals 28,000 travelers

Subway	40,000
Railroad	11,000
Trolley	1,000
Bus	6,000
Total public transport	58,000
Car	28,000

Source: Trafikanalyser RUFS 2000 (2000), pp. 25f.

should be given priority. There would seem to be a conflict about street space within the inner city concerning accessibility, transport comfort, car traffic, goods transport, public traffic and bicycle/pedestrian traffic, as well as between accidents, health, noise and environment.

The bottlenecks in the track-bound system are mainly in central Stockholm. The largest ones are from Stockholm Central station and south to the Älvsjö area. There are also limitations for commuting trains in the Södertälje harbor area and straight north in Märsta. The subway capacity is basically fully utilized.[13] But the capacity utilization in the public transport system is considerably higher than in the car system, as illustrated in the number of travelers over the central axis (see Table 8.9). Two-thirds of those crossing the central axis are public transport users, while the other third travel in cars. This means that a 10% reduction in car use moved over to public transport would only mean a 5% increase in the latter.

[13] Stockholm County Council, 2000, pp. 23ff.

8.4.1 Goods Transports

Goods transport and passenger traffic compete for space, firstly on the roads, but in Stockholm also along the so-called wasp-waist bottleneck over the central axis. Of the amount of goods moved about in the region the internal transfers amount to 55%, while the transit goods for 10%, including those that arrive or depart via ferries. Nearly all of the goods are carried on trucks. The remainder, that is transport into and out of the region, is to 50% by truck, 40% by boat and 10% by train.[14] This means that more than 80% of the total goods in the region is transported on the roads. However, goods transports are frequently poorly studied, something that is also true for the Stockholm region. One example is that the estimates of the truck traffic share of the total regional traffic work varies between 5% and 20%.[15]

Businesses, including the public sector, are responsible for most of the goods transports, while a smaller portion relates to the households. The total business related transports include a rather large portion of passenger traffic, mostly then business trips and use of private cars for business travel. The total traffic work on the streets and roads of the county during a weekday comprises 75% private, 5% business trips and 20% commercial trips and transports everything in vehicle kilometers. Cars, many of them used entirely for goods transports or combined transport, take up nearly half of the last 20% or 8.4% of the total, while light trucks are 5.6% and heavy ones 4.0%. Long-distance trucks, meaning those crossing county lines comprise some 2%. According to this calculation, trucks do around 10% of the total traffic work.[16]

Still, the number of vehicle kilometers is not a completely true description of the competition on the region's road network between passenger and goods traffic nor of how energy use and emissions are distributed. Trucks, and then especially the large ones take more space per vehicle kilometer than do passenger cars. The emissions and energy consumption is also considerably greater. At the same time it must be noted that truck traffic, especially the heavy trucks, is forbidden on parts of the region's local streets, specifically in the inner city.

During a study of road traffic on a dozen larger approaches and main streets during a weekday the share of light trucks was measured at 3%, the heavy ones at 5% and busses at 1%. Passenger cars dominated completely with a 91% share. Just less than half or 49% were business related trips, commuting trips were 25%, shopping trips 7% and other errands 18%. Of the business related trips a third were purely passenger transports. Taking in all vehicles in the study, about one fourth did some form of job related goods transport.[17] According to another estimate, the

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[14] Office of Regional Planning and Urban Transportation, Rörlighetens gränser (The limits of mobility), 1994a.

[15] Ibid., p. 40.

[16] SIKA, Näringslivets transporter i Stockholms län 1998 (Commercial transports in Stockholm County), 2000, p. 7.

[17] Office of Regional Planning and Urban Transportation, Godstransporter i Mälardalen 2020 (Goods transport in the Mälaren Valley), 1994b, pp. 33f.

business related traffic comprises just under 30% of the collective vehicular traffic work with around a third using passenger cars, light and heavy trucks respectively.[18] Truck traffic peaks at midday or between the morning and afternoon rush periods of passenger traffic, thus ameliorating road capacity competition. Business transports using passenger cars are in much used to deliver goods contribute a more significant share to the 2 weekday traffic peaks.[19]

The contribution to the total traffic flow by trucks and other goods traffic is noticeable. In certain areas and on specific traffic segments where there are traffic-generating activities, the share can be as high as 40%. In certain of the surrounding municipalities the share of business related goods transports is over 25% of the vehicle kilometer total.[20] Wherever the goods traffic uses roads in densely build settlements it is extremely disturbing.

If we rather compare the transported loads as expressed in number of tons/kilometer, the relationships are reversed and the heavy trucks dominate. In that calculation they carried out no less than 96% of the transport work in the county. For traffic crossing county boundaries there is only information for the heavy trucks showing that they account for just over 30% of the total number of vehicle kilometers driven within the county.[21]

The passenger traffic related to business activities is dominated by the property management industry with over half the number of vehicle kilometers. The main category is workers traveling to and from different reparation and installation sites, as well as smaller goods deliveries. The light truck traffic is dominated by the construction industry generating nearly half of all vehicle kilometers. More than 60% of the traffic work by heavy truck is done by the transport industry, including goods transports using leased vehicles or professional traffic.[22]

A significant part of all goods transports comprises bulk materials, mainly sand and gravel. The transported volumes are directly related to building cycles. As these transports are local, their share of the transport work is lower than their share of the goods carried. Of other goods that together comprise 55% of the transport work done, foodstuffs and trade account for more than half.[23]

Driving empty or without load accounts for a significant share or 40% of all business transports in Stockholm County. This is true for both passenger cars and trucks. For the heavy trucks these trips are for the construction and property management industries, as well as for the public sector. The latter has the highest share of empties at around 50%.

In a metropolitan region such as Stockholm the traffic distribution on local and intraregional traffic on the one hand and transit traffic on the other differs significantly from what is true in smaller and medium sized cities. Through its size, the

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[18] Ibid., p. 35.

[19] SIKA, 2000, p. 15.

[20] Ibid., pp. 18f.

[21] Ibid., p. 12.

[22] Ibid., p. 113.

[23] Office of Regional Planning and Urban Transportation, 1994a, p. 36.

activities and operations in Stockholm generate a very large share of the total traffic. In relation to the transit traffic, the local transports, as well as those that start or end in the region, are much larger than in other regions. Transit traffic has a considerably smaller role in the total traffic load, something that is also true of both passenger cars and goods transports. The latter category accounts around 10% of the goods transport work done by transit traffic including those trucks that arrive or depart on ferries.[24] Of the heavy vehicles that drive in over the county boundary, only 2% are going to a destination outside the county.[25]

It is difficult to make solid statements about the future development of goods transports in the Stockholm region due to the relatively weak information available. A forecast from 1993 calculated that the annual growth in transport volume for the period 1995–2020 would reach 1.7%.[26] This calculation has been criticized for seeming to presuppose a well-increased construction phase. This criticism assumes that the goods volume will not increase much, whereas the number of ton kilometers will, indicating an annual growth in transport work of 1.3%.[27] Even if the current (2006) construction activity is relatively high, trends suggest that the transport volume will not stagnate as development points towards more refined, higher value products with higher per kilo price. The future effect on transport distances depends to a high degree on corporate distribution strategies. These in turn affected by transport prices and the localization of the various operational facilities seen from a global perspective. Prohibition of heavy transports in the densest part of the urban area may also have an effect on future goods transports. On possible development is an increase in the amount of mixed loading at the terminals located in the periphery, thus reducing the total transport work. Another direction is that the number of central localizations near the customers will be reduced in favor of external sales facilities at greater distances from the customers.

8.5 Critical Problems in Today's Transport Systems Seen from a Sustainability Perspective

The description and analysis of today's transport system in the Stockholm region contains a number of problem areas. They constitute a threat to a development towards a sustainable transport system and sustainable city.

That, as a result of the spread of the transport system and the sprawl and fragmentation of the settlement structure, the transport system interacts over time with the settlement structure and the remove of transport work to the periphery has been

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[24] Office of Regional Planning and Urban Transportation, 1994b, p. 35.

[25] SIKA, 2000, p. 22.

[26] Banverket, Vägverket, VTI: Transportprognos år 2005 och 2020, as cited in Office of Regional Planning and Urban Transportation 1994b, p. 2.

[27] Office of Regional Planning and Urban Transportation 1994a, p. 11.

confirmed for the system in Stockholm as well. Especially after WW2, this uninterrupted expansion of the passenger transport systems is the result of the constantly expanding car system. Breaking this trend in order to bring the car system's expansion into a better balance between the various traffic systems is probably crucial for the achievement of a sustainable transport system.

Local trips and travel to and from the inner city are the dominating travel patterns in today's Greater Stockholm. The local trips outside the inner city are mostly done by car and are therefore the greatest threat to the development towards a sustainable transport system. Shifting these car trips to pedestrian, bicycle or public transport means is a conceivable solution to the sustainability problem. Trips to and from the inner city show a concentration in time and space and thus expose the transport systems for heavy loads. The risk for congestion at top loads is seen as the largest problem in today's transport system. Seen from a sustainability perspective, however, it is rather the proposed solutions that form a threat, since expanding the road system capacity will in all likelihood generate increased traffic. For this reason it is positive to demonstrate that a reallocation of traffic in time, space or transport type is a potential solution for today's congestion problems, as would be the possibilities for utilizing available load capacity for both goods and passenger conveyance.

One conclusion is that the urban structure affects travel patterns and choice. This means that these factors can be altered through changes in the urban structure. The interplay between the transport systems and settlement structure is important. Any changes made towards a sustainable transport system for the city are linked in part to the settlement structure and in part to the transport system. For the former it seems desirable to concentrate housing around the public transport nodes as this will provide a stronger public transport base for local trips, thus facilitating a transition from car to public transport. Another possible settlement structural change is a breakup of the function separation that has marked the postwar construction, seeking instead a reallocation of work sites and residences to that the number of the former is reduced in the inner city to give way for a comparable increase in residences. This would in all likelihood mean a certain reduction in commuting.

8.6 Conclusion

In spite of the fact that there occurred both a financial and demographic slow-down during the 1970s and a mainly financial one during the 1990s, the Greater Stockholm region has continued its geographic spread though at a variable pace, geographic foci and construction ideals. At the same time as certain interstices in the inner and half-central parts of the cityscape have been filled out, the communication systems have been instrumental in spreading the city area even more. This has usually occurred without the creation of large new construction areas, rather through the modification and supplementation of current land use, as well as through the incorporation of hitherto relatively independent towns under the direct influence of the metropolitan area. In this way new and large undeveloped or lightly developed areas have come to be included in what reasonably must be seen as part of the Stockholm region. In other words, at the same time as the concentration has recently increased in the central and half-central areas of the region, seen as a whole it has probably decreased through expansion in the periphery outside the prevalent city center limits.

The overall development during the postwar history of the Stockholm region has been marked by the long-term trend towards regional expansion. This has meant increasingly greater distance between travel goals and an increasingly porous cityscape with both thinned out and large, 'skipped' areas, as well as a higher land and housing utilization per capita. A massive decentralization has occurred. However, certain weaker countertrends have appeared. The inner city has moved towards a renaissance, especially as a place to live. In the last decade residential density has increased, mainly due to a low construction rate and high living costs. The long-term decentralization and spread to suburbia has not been evenly distributed, revealing instead strong concentrations to what can be called regional centers with large development potentials. A concentration has also occurred by filling out larger or smaller space in the suburban settlements, either with new, large-scale developments or minimal supplemental ones. The development in the periphery through single-family housing is in greater conformity with the trend that has long dominated and has been implemented either in the form of large projects by one owner or single building projects. Another part of this trend is the conversion of summer housing and country estates into semi-urban, permanent residences.

The development of the Stockholm region over the next 50 years is in many ways an open question. A combination of hard to influence macro-movements and the strength and focus of local initiatives will decide. During the most recent decades it has proven very difficult to form lasting coalitions between powerful interested parties – the failed, nationally funded, so-called Dennis development scheme is perhaps the clearest example.[28] However, other powerful coalitions can arise when the current paralysis has shown itself sufficiently inhibiting for development and collaborative solutions prove themselves financially attractive. Tendencies in this direction can already be seen in such projects as the ABC collaboration[29] between the municipalities along the Stockholm-Uppsala corridor northwards and the collaboration between Huddinge and Stockholm in the Kungens Kurva area to the southwest.

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[28] A parliamentary infrastructural development agreement to subsidize road and public transports in Stockholm County.

[29] An urban planning acronym comprising the Swedish words for Work, Residence and Center.

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Chapter 9
Future Cities – Possible Changes*

Over the last 50 years the physical structure of the urban regions in the west has undergone basic changes. This is especially true of the larger cities. They have continued to grow, not only through a comprehensive immigration, but also due to a strong increase in space use expressed both in terms of building utilization and land use per capita. In many cases the increase in space use reaches more than twice the original. Tendencies to sprawl, functional separation, segregation, thinning and population growth have led to comprehensive suburbanization. The sparsely built suburb has surpassed the traditional, dense city. As has been described in an earlier chapter, a new phenomenon has appeared after WW2 where the formerly financially dominant traditional city core has been reduced in importance, while a number of smaller, but still viable centers have grown in the suburban zone.

Today, nearly all somewhat larger cities can be described as polycentric, a situation that was improbable only 50 years ago. In spite of this tendency towards concentrated decentralization, the suburban regions as a whole have developed into an amorphous, thinly spread structure with sprawling villa and low-rise areas and a sparse, widely separated pattern for shopping and entertainment centers. The latter was equally true for work sites. Car dependence has increased dramatically leading to demands and comprehensive plans for additional road construction. At the same time the tendency towards a continued function separation has stopped. Urban planning discussions of resource use, stagnation and unhealthy comfort levels have increased, as has interest in both public transport and bicycle use. Even the value of urban settings and their protection from the most intrusive, disturbing traffic systems have been seen as an increasingly urgent task.

Through the decades, urban visions, actual construction and the action patterns of urban populations have shown tangible changes that tend to be concentrated in periods of comprehensive transformations separated by calmer periods. These chronological wave-like motions in urban construction will in all likelihood continue.

*Chapter written by Anders Gullberg and Per Lundin.

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One factor that characterizes this process is the capacity of those interested in urban development to find collective, stable solutions that can mobilize both capital and political legitimacy.[1]

It is clearly impossible to make any definite statement about the shape of urban development over the next 50 years, due in much to the inability to predict future power alliances, changes in visionary perspectives and shifts in life ideals. Only vague, open answers can be offered to queries as to whether today's development lines can continue into the future and which alternative development paths are conceivable. It is not possible to exclude development towards an increasingly sparse, regionally expanded city where car use, energy consumption and social separation increases, while sustainability is undermined. At the same time, however, it is clear that several basic changes are imaginable and to some extent possible to support and create. Among the changes that could have revolutionary effects for future urban development, the reunification of home and work after the immense, significant divorce stands out. We can easily imagine second and third level effects such that tele-commuting could cause strongly reduced commuting, especially at rush hour and even outside work itself. The utilization of local retail stores and other facilities close to home would likely increase as well, as would emigration to and beyond the urban region limits. As Peter Hall has said, it is possible to talk about a growing tele-sprawl by a minority.[2] In one sense, this partial return to working at home or its vicinity can be viewed as a continuation of another trend that carries with it that more activities happen at home, even including shopping using various equipment. Will the development continue if the home and proximate work relationship increases? Or will interest for leaving home grow during non-job hours if the workday is mostly spent at home?

In yet another way, the return of work to the home sphere or its proximity can also be seen as a continuation of an already strong trend. The decentralization of corporate and organizational routine and support work has been ongoing for some time now and in an extension of this tendency, these activities will sooner or later land at home or in local office hotels and call centers.

Another tendency that could have fundamental impact on urban construction is the dematerialization and miniaturization of components in household equipment that has been going on for a long time. To the extent that this development actually brings about smaller or fully dematerialized product, the pressure towards increasingly larger surfaces for living, playing and working would ease and a resultant reduced area actually mean increased greater human elbowroom.

Increased awareness of the seamier sides of an exaggerated comfort could possibly bring about an urban planning and life-style that promotes human powered transports. It is also possible that the steady increase in indoor temperatures can be turned around when more attention is paid to the health risks of involved.

Continued population growth points to an increased exploitation in the suburban zone, regardless of whether it occurs through concentration of the sparse construction

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[1] Gullberg, A. and Kaijser, A. "City building regimes in post-war Stockholm", 2004.

[2] Hall, P. *Cities in Civilization*, 2001.

structure or an expansion of the suburban belt through expansion of low-rise, single family housing. The tendencies towards an increased center formation outside the downtown area are strong and can be expected to continue, even if the most immediate characteristic of this process seems open and partly influenceable. One vital question is if movement in and around city centers will continue to increase and that the share of car trips will expand in the future, especially between suburbs. In the outer suburbs and in exurbia the car is for all intents and purposes supreme and a limitation of car dependency in these areas must be a key element of tomorrow's traffic strategy. There is cause to suggest that there has been no comprehensive innovation in urban traffic systems since 1900 and there is a great potential for sustainable development should a suitable one be implemented.

It is possible to define changes in urban socio-technical systems that can be possible in various time perspectives.[3] In a shorter perspective (1–10 years) institutional frames change, such as by implementing new financial rules or changing organizational structure to attain a stronger link between operations and expansion of the different traffic type, as well as of localization decisions and transport costs of various operators. The institutional framework for earning a living can also be modified to benefit work done close to home. The property management industry is under restructuring to further joint localization, joint use and flexible letting forms. In a medium perspective (11–20 years) the technical components in a system can be changed or replaced, such that a car park might be adapted to meet the demand on a sustainable, traffic safety development. Housing can be renovated, insulated and made more temperature efficient, as well as be adapted for shared use and partial rentals. Finally, in the long run (21–40 years) the structure of the entire system can change or completely new systems develop, such as new, track-bound public transport, new types of functionally mixed housing complexes and new energy systems.

The intimate interplay between the traffic apparatuses, especially the systems for human transport, and the housing spread and activity localization, is of decisive importance for dynamic urban development. What follows will begin with conceivable changes in urban transport systems and then move on to a section on the future design of housing construction and localization, as well as the connection between housing and the development of the transport apparatus. Using this information as a foundation, the chapter will close with a presentation of three conceivable development models for future cities.

9.1 Human Transportation

One possible future change is to turn public transport, including both foot and bicycle traffic, into the standard for shaping transport systems and housing structure, thus increasing its attractiveness. One result would be car usage on the unprotected

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[3] Kaijser, A. I fädrens spår (An inheritance), 1994, pp. 258ff.

traffic users' conditions and one question how the interface, that is getting on and off, between the various transport systems would be facilitated. Another important question is how well functioning, intermodal nodes can be created. Such a breakup of the current traffic segregation will bring the transport systems closer to each other and facilitate transfers. It will also be important to build sufficient parking for both cars and bicycles near the public transport nodes and not as currently in proximity to the node shopping malls.

Most trips are local occurring in the proximate area and to a great extent done by car. Wherever it is possible, the public transport system should be expanded. However, many suburban areas offer a building pattern that is too sparse to create the basis for infrastructure investments of that type. Thus it is easier to concentrate construction centrally and to facilitate foot and bicycle traffic in local areas. Only around 5% of all trips in Stockholm are done by bicycle, whereas in Uppsala and Umeå the figure is 25%, while Malmö and Västerås boast of 35%.[4] An objection raised here is that these are medium-sized cities and the distances are rather short. Still, Copenhagen is of the same size class as Stockholm and there some 35% of all work-related commuting trips use bicycles.[5] Therefore it cannot be seen as unreasonable to think it possible to increase the number of bicycle trips in an urban region like Stockholm. Nor is it necessary for the bicycle to replace another transport form, serving rather as a supplement to public transport. In addition to bicycle paths, it will be essential to build protected bicycle parking near public transport stations. One important characteristic of public transport is its high geographic accessibility. It is usual to calculate this as walking time to stations and stops. If instead the planners would get used to thinking in terms of bicycle distance and time, the geographic accessibility will be radically increased.

An intermodality or collaboration between different system links can also offer some potential. The combination with the largest potential is bicycles and public transport, where instead of parking the bicycle, you bring it with you. There are public transport systems that are specially designed for bicycle transport.[6] But even simpler solutions such as the combination bicycle and tram cars currently in use on Denmark's track-bound systems exist as well.

Peaks in the transport systems can be handled in different ways. One way is to increase the capacity at links and nodes, though such steps are capital heavy and are more than likely to increase traffic flow as well; another is to control the flow by redirecting it in time, space or over the transport system. For the moment, let us focus on the last alternative.

The flow can be controlled using differentiated tariffs as means. Today's discussion of congestion fees in the car system is in fact a discussion of time-differentiated tariffs. It is quite possible to broaden this discussion to include even

[4] Stockholm County Council, Transportsystemet i Stockholms län – Underlagsmaterial U:23, 2000, p. 15.

[5] Cykeltrafik i större städer (Bicycle traffic in larger cities), 1996.

[6] See for example, http://www.zeenergy.net/leantransit/.

the public transport systems, as they too have congestion problems and the fees in the car system will in all likelihood mean increased use of the public transport system. An example of a positive control method is to introduce free travel during the least trafficked times of the day. Space differentiated fees can also be used on the road system, enabling the transfer of traffic from the busiest links to less used stretches.

Yet another possibility is to increase the load level of the vehicles used. One effect of some form of organized car-pooling would be to reduce the load on the road network. The primary problem is to find attractive institutional forms for ensure wider use of this activity. It is also possible for an increased load level in goods traffic to lead to a reduced or at least an unchanged transport sector. One efficiency-promoting step would be to set up load transfer points in urban peripheries.

New technical systems are possible in the longer term. Most of the new transports systems currently being discussed and developed round the world fall into categories like monorails, light rails, track-bound taxi and the like. Other conceivable changes include cars using other fuels and increased links within and between different systems. Chief of these is the injection of IT into the traffic sector by developing such techniques such as automatic road directions, automatic driving, optimal distancing between vehicles on motorways and automatic, immediate payment for driving on (certain) roads at certain times.

9.2 Construction

Building localization and the distribution of activities over the building stock can move development towards sustainability in various ways through a general promotion of an energy efficient, minimal emission living style. In such a scenario generally reduced travel and an increased householding with building surfaces are not the smallest factors.

Should a building stock be designed for multi-function use on different levels, ranging from apartment, property and block to area and urban district, the opportunities for persons and households to satisfy their demands increase in spite of reduced travel. On a general level, multi-functional premises can also keep local specialization in check, resulting in a generally reduced building use. This would remove one of the driving forces behind the long-term trend towards an increasingly spread out urban region.

The efforts for benefiting foot and bicycle traffic should be reflected in more than just the traffic system's rules for handling bicycles in public transport. Building localization and design details should be arranged for and support this development. The possibilities for satisfying the desire for comfortable and purposeful communications present in the public transport system can be enhanced by the design and localization of the buildings themselves. A concentration to the station and stop areas, as well as a detail design that make contacts between the various public transport means simple and inviting, are also a possible future segments in urban construction.

Still, it is probable that the most meaningful changes will occur through an integration of the various traffic systems with each other and with the localization of activities and building use. This integration can be both physical and institutional. Such steps as a more efficient overall car usage through use coordination and/or car-pooling could be part of ensuring this integration. The introduction of a price mechanism, as well as physical and other rules to reduce car traffic and shift the travel to public transport, as well as foot and bicycle movement, are changes that could lead to comprehensive institutional reorganization in urban traffic. An institutional merging between the public and private traffic segments would be especially effective in opening completely new opportunities.

Many types of establishments in suburban centers generate positive external effects, including benefits to nearby activities. A single company such as an office or a shop that contributes to these values as part of a center, could not themselves gain from them alone. A developer who composes a whole center, however, can at least partially internalize these dividends, which in turn increase the chances for this type of establishment to occur. Public support for suburban centers, such as in the form good supply of infrastructure, regulation of exploitation and establishment or subsidy to developers and corporate localization, would also free up latent positive effects and achieve a more efficient spatial organization of an urban region. It may also be necessary to militate against the frequent traffic jams and the notoriously underpriced urban transports that both support an exaggerated decentralization of work sites.

The financial conditions created by agglomeration are equally decisive for urban concentration tendencies as for urban expansion trends. Thus those partnerships or other agreements that will be formed between public and private constellations will determine which tendencies will be implemented. These groupings will, in effect, decide who will be affected by all the heavy external effects caused by the urban transport activities, as well as who will benefit by the new exploitations. Since urban traffic systems seldom exist for their own sake, but is rather focused on accessing interesting goals, it is not a wholly utopian thought that a reduced mobility could lead to an equally good or even better living standard than would a continued spiral of sprawl and increased travel distances. This presupposes that the interesting goals are either concentrated in the core or are collected along the effective public transport corridors. The dynamics of urban development would truly change if a financial responsibility for the subsequent traffic expenses inherent in the various expansion and localization decision were included in those decisions. Such a structure would not only affect the decisions, but could also serve as an expedient financing source for a public transport sector that under so many years has needed tax subsidies to ensure that the city's public and private transport system would function.

9.3 Three Different Shapes of the Future City

We have named our three alternative urban structures *Urban Cores, Suburban Centers and Low-rise Settlements*, thus describing the different aspects of the ongoing development and various urban building ideals, while at the same time carrying partial breaks with other trends and visions. Our assumptions are that the urbanization of the larger cities will continue and that exurbia will continue to grow though not as a dominating trend. We even suppose that the city core will continue to retain its attractiveness for visits and living, while the work sites will continue to be decentralized. In addition, we foresee a continued decentralization to the suburbs of other functions as well.

This finds its expression in larger or smaller levels of local concentration. In the Urban Cores alternative, the concentration is strong and is implemented through new types of very dense building structures. In Suburban Centers the consolidation rather occurs through concentration and supplementation of already existing areas, while the Low-rise Settlements alternative continues to build on semi-detached and detached single family housing, though with the creation of some mini-centers and connections to all new low-rise cities via the already existing structure comprising cores and track-bound public traffic. Thus Low-rise Settlements is to a great extent a decentralization alternative, even if the larger low-rise areas will in all likelihood be relatively dense.

The dominance of the private car as a factor in commuting within and between the suburbs is seen as broken. Its market share is taken by a sharply expanding foot and bicycle traffic made possible by a strong growth in household acceptance, as well as an increased construction of transverse connections. The latter are the object of a widespread construction and the result of conscious suburban localization policies.

We have excluded a fourth aspect in the urban development and in today's urban political discussion, namely regional expansion. This is not part of our future images, not because this development is less likely, nor that it enjoys less support among influential decision makers. The reason is simply that a regional expansion cannot be reconciled with a sustainable development should long-distance commuting be more prevalent. Thus it was possible to exclude regional expansion as an alternative among future images.[7]

[7]Compare numbers on energy use for commuting between Stockholm and Eskilstuna in 2000 and 2050 in Åkerman, J. and Höjer, M. "How much transport can the climate stand?", 2006.

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Chapter 10
Time and Consumption*

10.1 Introduction

In this book we consider today's consumption pattern to be an important motive force for various types of environmental load. A societal development towards sustainability requires fundamental changes in consumption patterns towards a less resource depleting life style. It is, however, quite natural that changes of this type will meet with considerable opposition since they depart from established habits, values or traditions. In an attempt to find ways around such hinders, it might be possible to seek a new balance between riches in goods or material benefits and riches in time. This way the time factor is given an important role in concepts about a more sustainable way of living, primarily in such dimensions as tempo, pace and temporal fragmentation.[1]

This chapter will discuss several fundamental thoughts about attitudes towards time, primarily how these concepts have changed over the most recent centuries. Some basic categories that have been described in the literature about temporal perception and time use will be presented first. Following that, trends in rationalization will be discussed in three areas, namely work and temporal discipline, rationalizing household free time and the colonization of free time by time discipline. Next come three sections that are a sort of collection point for arguments hinted at in previous sections. One deals with tempo acceleration, the next with pluralization and the third takes up the question of growing time shortage and partial welfare. Lastly there are three sections discussing the changes in consumption patterns, the links between time and consumption and those between consumption and energy use.

*Chapter written by Ronny Pettersson, Paul Fuehrer and Mona Mårtensson.

[1]See Reisch, L. A. "Time and wealth", 2001, Røpke, I. "The dynamics of willingness to consume", 1999 and Fuehrer P. Om tidens värde (On the value of time), 2010.

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10.2 Fundamental Categories of Temporal Perception

In literature about time and time practice there are various notions about which trends and decisive breakpoints mark the last centuries. The overall patterns are often captured using dichotomies reminiscent of the traditional-modern conceptual pair. This done, historians tend to place the patterns these concepts seek to capture in specific temporal order and analyze the transition from one condition to the next. Sociologists, on the other hand, use the dichotomies to create order in a complex structure of simultaneously existing conceptualizations and practices. In the next three sections some of these dichotomies will be presented in order to provide the reader a rough understanding of some central elements in the time conceptualization and time practice analyses, namely cyclic versus linear time conception, female versus male time and organic versus artifact time. A small selection of dichotomies have been chosen from a larger number possible with the organizing conceptual pair being cyclic versus linear time perception. The three dichotomies chosen all are linked to themes that will be discussed in the rest of the book.

10.2.1 Cyclic Versus Linear Time Conception

Most researchers agree that a shift in time perception occurred during the 1700s and 1800s. The older, agrarian society was dominated by a cyclic time conception largely based on natural rhythms. The farmer's work was the primary time disposer in the community, but since this work was strongly dependent on natural rhythms, work year and nature year overlapped. Prior to the widespread use of clocks and industrial technology, time was perceived as a recurring alternation between light and dark, cold and heat, as well as various growth periods. The households lived in a cyclic pattern of alternations between periods of work and rest, planting and harvesting, and joys and sorrows. The links between the natural and the work years meant that time became rhythmic and repetitive, but not mechanical. The calendar was not nationally homogenous, as the temporal rhythms and delineations shifted between regions depending on the large differences in the natural and work year rhythms between different localities. Work intensity and character decided if time became long or short. A summer hour was never the same as a winter hour and the workday varied in length depending on the work to be done and the amount of daylight. The heterogeneous, work-dependent time accounting was synchronized with other time cycles that controlled country life. The church year and the administrative calendar became linked to the work year.[2]

The introduction and distribution of clocks played an important role in separating everyday time experiences from natural cycles. It introduced a differentiation

[2]Frykman, J. and Löfgren, O. Den kultiverade människan (The cultivated individual), 1979, pp. 22–26 and Daly, K. J. Families & time, 1996, pp. 5–6.

between time as a mechanical artifact, a line or band running into the future, and time as naturally recurring process of cyclic regeneration. Daily and seasonal rhythms continued to play an important part even after the transition to linear time conceptualization, but competed with the importunate clock culture that emphasized speed and efficiency. Clocks also introduced time precision in everyday life, departing from the previously rather imprecise division of time into periods for carrying out a certain task such as sowing or harvesting in favor of the industrial society's precise, standardized time units lacking variation from one season to the next. The full passage to clock time and its linear time conceptualization took a long time, starting in the Middle Ages and stretching over several centuries.[3]

The timeline of linear time conception comprised compartments and sections that required separation. Time became a unit that could be broken down into small, mechanical parts – units that were measurable and standardized. Thus the time system became rationalistic and strongly formalized. Punctuality became a virtue and time a scarce resource that could be saved or wasted. The view in the new time stewardship was always straight ahead. Linear temporal forms gained a permanent foothold with industrialism. During the 1800s, the new production technology placed other demands on time and time management than earlier production technologies had. Increased work separation and large-scale operations called for another type of temporal discipline than had been applied in the older, agrarian society. The lives and work of a large number of individuals now needed to be standardized and co-ordinated, not least using new temporal norms. Working life was organized on the principle that the worker sold his or her work time to the entrepreneur, who in turn bought time. A company's financial success depended on how efficiently it could use this time applying such processes as mechanization, as well as intensifying and structuring the work supplied by the employees. Corporate control over time increased and became a decisive factor for rational, economic operations and profitability. The need to set a uniform value on labor meant that time was more and more measured and controlled during the 1800s and thus made uniformly quantifiable.[4]

International trade and industrial mass production necessitated time system standardization over large geographic areas. This need grew first in shipping as that sector became increasingly globalized. Additional steps were taken later during the 1800s, as the railroads standardized their scheduling over large distances. As long as the transports were slow, the time differences between various places created few problems, but as the transport speed increased, the need for standardization grew. In the US during the 1800s the railroad companies were forced to handle the problem caused by the plethora of local time standards. Periodically the standardization and synchronization need was transformed into money, as when the director of an observatory discovered that accurate time measurements could be used to sell standardized

[3]Daly 1996, p. 6; Adam, B. Time, 2004, pp. 112–116.

[4]Levine, R. A. Geography of time, 1997, pp. 55ff; Zerubavel, W. "The language of time", 1987, pp. 343–356; and Mumford, L. The culture of cities, 1938, pp. 177f.

time signals sent by telegraph to railroad companies and industries in Pittsburgh. During the 1800s and 1900s the tendency towards globalization in such areas as economy, labor market, travel patterns and social relationships, ensured the spread of temporal standardization through such measures as the global division into time zones. It was consummated when in 1913 the first time signals were sent out worldwide from the Eiffel Tower. These wireless signals travelling at the speed of light replaced local time structures and created one time for everyone. Thus the material conditions had been created for a global communications network that transmitted information and transport.[5]

The linear time conception was tied to the precepts of progress. The link to progress and the future was obvious in the bourgeois culture, whose message about the lives of individuals was to make something of their lives quickly, to take advantage of possibilities, calculate, invest and expand. Life was viewed as an individual career ladder.[6] In the nineteenth century industrial society there was a clear link between temporal organization of everyday life based on the linear time conception and the idea of constant growth and progress in material life standard. This link was gradually expanded to include the workers as well, since the new temporal discipline promised continuous improvement in everyone's material welfare. A belief in development and progress grew in a very concentrated form, releasing the future from dependency on the past and based rather in the pulsating rhythm of city life and the constant change of the urban space.[7]

This link to the perceptual breakthrough of progress meant that the difference between experience and expectation tended to increase. In pre-modern society expectations were tied to the past. They received all nourishment from the experiences of their predecessors, making them the experiences of their successors as well. The changes that occurred were so slow and played out over so long a period that the gap between the previous experiences and the new expectations could not be especially large. However, from the end of the 1700s and onwards, expectations about the future were less and less based in a person's own experiences. Instead future expectations were separated from what the previous experiences had offered. The links between the space of experience and the horizon of expectation dissipated. The rule became that the future should be different from the past; more specifically, it should be better. The formula for the temporal structure in the modern world turned into the less experience, the greater the expectations.[8]

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[5]Levine 1997, p. 66; Zerubavel, E. "The standardization of time", 1982, pp. 1–23; and Adam 2004, pp. 117–119.

[6]Frykman and Löfgren 1979, pp. 34–36 and Daly 1996, p. 7.

[7]Mumford, L. The city in history, 1961, pp. 97ff.

[8]Koselleck, R. Futures past: on the semantics of historical time, 1985.

10.2.2 Female Versus Male Time

The female–male conceptual pair is a later categorization, but one that also has connections to the cyclic–linear conceptual pair. Even in modern society women tend to do more of the unpaid care-oriented work than men and to spend less time in paid work. The concepts female and male time are based on these gender differences in time use, with the former more cyclic and spiral, while the latter more linear.[9] The concepts describe ideal types that to a high degree characterize the current average time use of both women and men in Sweden.

According to this thesis female time is to a great extent informed by a care and responsibility rationality. One vital background factor for this characteristic trait is the traditional gender-based work division, namely women's reproductive work and gender typical socialization. The responsibility of caring for husband, children, old or ill relations forms a time use pattern where the cyclical repetition of routines is combined with change over a longer time span. Several activities that are carried out simultaneously or overlapping are part of the pattern. Female time is also highly relational – care activities and work demands adaptation to someone else's time use, calling for planning and co-ordination, but also flexibility in relation to other household members, as well as waiting. There is little space for personal time, ensuring that the free time is often connected with or disguised as some 'useful' activity.[10]

Male time, on the other hand, is seen as closely tied to salaried work, but also comprising prolonged time units that follow each other in a non-continuous way, similar to a line cut to pieces.[11] Many of the pieces are his own time, not relational contacts with other family or household members. There is a rather large possibility for time outs lacking demands for beneficial activities, such as looking at sports, sitting at the pub or visiting a café. Thus male time contains more personal time and time excursions linked to the superior male position in the gender order. As has already been said, other components of this order are that paid work is an important foundation for male identity and that the time-outs function to reinforce male identity, as a form of homosociality.[12]

In this approach, modern society combines cyclical and linear time for women.[13] Time use for working women with care responsibilities weaves male and female time into a jigsaw aimed at making everyday activities function. There is also a tendency for male time to invade female time.[14] One example is care occupations where paid work dominates in the administration of technological and financial rationality, meaning that costs should be minimized and work carried out in the

[9] See Nowotny, H. Eigenzeit, Entstehung und Strukturierung eines Zeitgefühls, 1993.

[10] Davies, K. Women and time, 1989, p. 107.

[11] In the agrarian society male time was also relational.

[12] Davies 1989, pp. 238, 245.

[13] The female activity field has also expanded through the addition of many more possible occupations.

[14] Davies 1989, pp. 100–109.

shortest possible time. The goal is an even, predictable production. Among physicians it is possible to see a scientific rationality that fits well into emergency care where results and growth are important. Unions are characterized by a salaried employee rationality, including demands regarding work hours, wages and job security. All these rationalities are perceived of as related to male time, as opposed to the care rationality primarily marking female time. Some claim to have found a tendency towards an increase in male time use for home care, but informal care is still primarily controlled by a care rationality.[15]

It is possible that the female-male time conceptual pair in reality actually should be described as unpaid care work versus paid work. The general tendency is that women have or accept a larger care responsibility and carry out more of the unpaid care work than men with differing consequences for their everyday life. If this work structure changed so that men and women who live together do paid work to the same degree, the concept of female-male time would most likely be less useful.

10.2.3 Organic Versus Artifact Time

The linear time conception and clock time have also been linked to a nature perspective and a natural resource stewardship that is thought to have contributed to the large environmental problems in our time. According to this way of thinking, nature is externalized and mankind is separated from nature. Mathematical description, quantification and standardization are facilitated. This externalization and its consequences have brought about a behavior that treats nature simply as a source of exploitable resources. One thought is that this process has created a marked differentiation between organic time and that of the artifact world, with environmental problems linked to this difference.[16]

According to this interpretation, organic time is recognized by rhythmic variation, synchronization and all-inclusive, complex and mutual relationships. Nature forms a field of co-ordinated rhythms of various speeds and intensities. The natural processes are also varied by context and a broad grouping of time spans co-exist. The artifact world owns totally different time characteristics. Here the artifacts are lifted out of context and thus abstracted, delimited and isolated. They own fixed characteristics as products, rather than processes, created as islands in a fluctuating ocean of continuous change. Artifacts, like machines and nuclear facilities, have been created with help from science, are rhythmically organized and carefully adjusted within each isolated system.[17]

The tension between organic and linear (artifact) time conceptions can be seen in many environmental problems. Many of these are marked by time delays, not only between cause and effect or between discovery and acknowledgement of a

[15] Ibid.

[16] Adam, B. Timewatch, 1995, pp. 130–131.

[17] Ibid., pp. 128–130.

problem, but also between problem identification, international acceptance and global agreements on remedial measures. Time delays are also found between the will to do something about the problem and actual, collective measures, between measures and effects and between corrective inputs and environmental recovery. These delays often mean that the links between cause and effect become invisible and that the relationships can no longer be described with scientific certainty and proven. The demand for secure proof in situations recognized by non-synchronized time frames, multiple time delays, unpredictability and insecurity can easily lead to political paralysis in environmental questions.[18]

It is possible to recognize environmental problems by the short or strongly limited action period – something must be done now or it is soon too late – at the same as the time scale for consideration needs to be well extended to cope with any unintended consequences of scientific progress. The socio-economic development moves towards an increasingly short time horizon and a rapidly expanding change pace, at the same time as any necessary action for correcting environmental problems must extend over truly long time horizons that frequently needs to take into account effects over hundreds of years. There is a strong need to move from practices that provide short-term benefits to ones that support the long-term systemic capacity for adaptation to the environmental changes the industrial society causes. However, in communities where time has become a commodity, speed has gained a financial value; the faster the goods move through the economy, the better. This speed increases the profit and raises the GNP.[19]

While the controlling economy functions over a short time span, ecologic consideration must perforce work in the long term. Most often the economy only considers short-term profitability without taking into account possible expenses for long-term effects. Such comparably shortsighted economic thinking is often seen as ecologically devastating.[20] The market economies as such tend towards sluggishness when it comes to controlling development in a more reasonable, ecologic direction. This sluggishness is often based on shortsighted awareness, thinking and action. Disregarding the expense of resource depletion or environmental damage in the longer perspective, short-term profitability is almost always prioritized over environmental and resource considerations now or a sustainable profitability later on.[21]

10.3 Trends in Time Rationalization

At the same time as the changes described above have taken place in time conceptions, there have been parallel changes in time use. During the 1800s and 1900s a rationalization has occurred in various areas of the industrial societies. The first clear indication of this process came in economic sectors and especially in labor

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[18] Ibid., p. 134.

[19] Ibid., p. 136.

[20] Hubendick, B. Människoekologi (Human ecology), 1985, p. 529.

[21] Ibid., pp. 531–532. See also von Weizsäcker, E. et al. Factor four, 1998, pp. 260–262.

organization. In time it also moved into the household utilization of its free time, that is the time not used for paid work. Finally a rationalization process affected even leisure time. The empiric base for the discussion of these processes is taken from various countries as they are more clearly illustrated in various contexts. The first case draws from the early industrialization experience in England, but also the discussion of work time in Sweden during the 1900s. The second case is based on Swedish developments before and after WW2, while a more mixed, empirical base is used in the third.

Those processes described below focus to a great extent on the economic treatment of time. Mutual to them is that time is seen as a commodity and therefore a limited economic resource. It is necessary to be economic with it in order to get the most out of it. This perspective on time as a unit that can be broken down into mechanical subunits, in turn capable of being measured, standardized and assigned an economic value, is described by Max Weber as one of the most important conditions for the growth of the capitalistic society and for rational industrial production. He coupled the Protestant work ethic to the view that time was a valuable resource one should deal with in a wise and economical manner. According to that ethical system, work was a duty and wasting time was considered one of the most deadly sins. The Puritans saw wasting time as morally reprehensible and included in that concept social intercourse, small talk, worldly pleasures or more sleep than what was needed for good health. According to Weber, the precept that time is money came into sharper focus in capitalism's industrial society where the labor force and work hours became a commodity. Clocks were used to measure the mass of products that could be manufactured by the labor force in the shortest possible time.[22] However, much time would pass before this perspective on time gained a strong or even dominant position. It was first achieved after much strife regarding both the nature of time and its value.[23]

10.3.1 Work and Time Discipline

The history of industrialization during the 1700s and 1800s provides many examples of how the efforts by early capitalists to make work time an object of economic calculations were met by considerable opposition from both farm and home workers. Weber viewed this drawn out opposition to an economic rational time discipline as one of the pre-capitalistic leitmotifs. According to him efforts to introduce piecework wages did not lead to an increase in the amount of work in a given time period, but rather the opposite – less work was performed. Indeed, workers would have preferred to work less, rather than to earn more and more money. Weber felt

[22] Weber, M. The protestant ethic and the spirit of capitalism, 1978 [1904–1905], pp. 48, 157–158.

[23] See Hohn, H.-W. Die Zerstörung der Zeit (The destruction of time), 1984 and Lundmark, L. Tidens gång och tidens värde (The passage of time and its value), 1989, pp. 25ff.

that the characteristic attitude of workers was wanting to live as they were used to and earn as much as was necessary to gain that goal. Thus it was natural for a certain amount of stubborn opposition to meet the attempts by modern capitalism to increase labor productivity by raising its intensity.[24]

The immense significance of time discipline in the growing factory system and industrial society played an important role in the analysis by Karl Marx as well. Through the factory system both the labor force and time itself became commodities. As time became objectively measurable, it could also be controlled in another way than as previously through power structures. Both Weber and Marx posited that a long discipline effort with the workers was necessary in order to break down their traditional perspective on work and work time. In Marx this was done in his interpretation via compulsory institutions such as work camps, correctional institutions, schools and, later on, factories. Gradually the workers lost control over when they should do their work, how long time they should spend and at what pace they should perform the tasks. The supervisors took control and shaped a rational work organization in order to control time use in the factories. This control was greatly automated via the machines. Thus work time and its content became abstract quantities that in the end were determined by the machines, as the external pace setters of the production process. Marx's conclusion was that time is the most fundamental and contested dimension of the capitalistic economy, since the time saved through the rationalization of the work process and work time can be used for differing aims, including material production on the one hand and intellectual activities on the other. Thus the battle over the length of the work day became a fundamental question and reflected the dispute between a more immediate, living labor and capitalism's "dead" work.[25]

As described by Weber and Marx, the promoters of the economically rational time discipline found that the task was not dominant, but the value of time as translated into money was. Time was indeed money and should not be used lightly, but be invested. However, those who opposed the concept of clock scheduled work supported a task-oriented time concept, an attitude that was seen as wasteful and indolent by those who felt that work should be structured by the clock. The task-orientation made work patterns irregular since no major co-ordination was needed. Within the need for a specific amount of work that needed to be done in 1 week or 2, say that a certain amount of cloth should be made, the workday could be longer or shorter. Everywhere that people could control their own work life, the pattern was characterized by intense working periods alternating with inactivity. The effort to gain greater co-ordination of the work, greater accuracy in time routines and the use of time measurement as a means for exploiting the labor force met with opposition.

The transition to a new order with strict time discipline was especially drawn out and conflicted in the first country to be industrialized, namely England. The battle

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[24] Weber 1978 [1904–1905], pp. 59–60.

[25] Marx, K. Grundrisse der Kritik der politischen Ökonomie (The basis for a critique of political economics), (1983 [1858]), pp. 89, 119f, 596, 716 and Marx, K. Das Kapital. Vol. 1, (1962 [1867]), p. 287.

was strongest in those industries where the new time discipline was the severest – in the textile factories and the mechanical workshops. Another reason the opposition was so strong was that there were no examples of improved living standards that in time could be attained using the new technology and work discipline. The time economizing must instead be enforced using time schedules, time inspectors, informers and fines. Schools were also used to indoctrinate people in the value of time management. Those for the poor were ordered to teach diligence, thrift, order, punctuality and regular habits.[26]

New work habits were shaped and a new time discipline was implemented to divide and monitor the work. The means were fines, alarm clocks and watches, stimulating rewards, preaching and teaching, as well as taking action against all types of pastimes and pleasures for ordinary people. The process could take a long time and was never fully successful. Irregular work habit lived on into the twentieth century. The propaganda aimed at the workers for economizing with time was gradually broadened as the ruling elite began to see the inactivity of the masses outside work as a problem. Since everything in a mature capitalistic society must be consumed, marketed and used, it was seen as reprehensible for the workers simply to waste their time when they were not working. This propaganda gained in effectiveness as the industrial revolution proceeded and as money for stimulation and broadened consumption possibilities gained in importance. These became tangible rewards for a productive time use and signs of a new attitude to that the future was in much predictable. As the wide-spread conflicts ebbed out, economizing with time and applying a clear separation between work and free time gradually became strongly established in all mature industrial societies.[27]

At first the new time discipline met opposition that defended the old, irregular work habits. In the stage that followed the forced acceptance of the new discipline, the workers began to fight about time rather than against it. In that battle some employers attempted to deprive the worker of all knowledge about time, but after a while the worker had accepted the company categories and learned to fight within them. In England committees were formed as part of an effort to shorten the work day – the so-called 10-h movement. Even later the workers demanded overtime remuneration, a clear sign that they had learned that time is money.[28]

The demands for a shorter work day and overtime remuneration illustrates that an increased time-based welfare played a central role in the early workers movement. However, all work time reduction was not the result of this specific battle. The early industrial society adopted and even extended the hours that were in force in the pre-industrial society. Still, the pre-industrial work patterns proved incompatible with the industrial society, which is why the employers shortened the work time in order to make the work more rational and thus increase production. Significant

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[26]Thompson, E. P. "Tid, arbetsdisciplin och industrikapitalism" (Time, work discipline and industrial capitalism), 1983 (1967), pp. 14–15, 26–28, 38–46 and Hohn 1984, pp. 138–144.

[27]Thompson 1983 (1967), pp. 51–57; Cross, G. Time and money, 1993; and Sanne, C. Arbetets tid (The time for labor), 1995, pp. 113–140.

[28]Thompson 1983 (1967), pp. 45–47.

shortening of work time was implemented in Sweden between 1850 and 1890, this in a period when the workers movement was weak.[29] Prior to 1900 the work time was generally reduced to 10 h as a result of contractual agreements between the labor market parties. The 8-h day became the major demand of the Swedish worker movement, as well as in other countries, but no legislation was passed. However, after WW1 the 8-h day or 48-h week were introduced by legislation or collective contracts in Western Europe, North America, Australia and New Zeeland. With a few exceptions, the work day length remained steady in industrialized countries up to WW2. The main reason for reducing work time was social. The shortened work day would provide the workers with increased free time. The risk for reduced production should be counteracted by improved technology and more efficient work.[30]

Calls for additional work time reduction continued up to the early 1930s, but without success. Instead the workers had to be satisfied with a somewhat longer vacation, this in spite of the fact the vacation demand played a small role during the 1920s and early 1930s. Vacation reforms were cheaper than work time reduction, both for the state and the employers.[31] In the postwar period the work time question was long subordinated to the overall goals of full employment and higher material living standards. While work time reduction was certainly desirable, the union position was that it should not be implemented at the expense of the workers' real wage standard and living standard. The demands for work time reduction were rather channeled to a vacation reform in the early 1950s. Even if the Swedish work week was first shortened to 45h (1957) and then to 40h (1970), work time reductions had relatively low priority in the postwar period. There was a general agreement that economic growth and the largest possible material welfare should be the central goals. When the demands for work time reduction grew, the solution was frequently yet another vacation reform.[32]

10.3.2 Rationalization of the Households' Free Time

Another area where the time discipline has become increasingly dominant is in ordering the free time households have at their disposal. Sweden between the wars offers one clear example where a trend appeared on different levels seeking to rationalize the unpaid work in domestic establishments. The effort of making housekeeping more efficient, not least by a rational use of time, was the focus of a 'domestic establishment' that included existing housewife organizations and the newly formed Association for Rational Housekeeping.[33] One of the reasons for

[29] Hellström, H. Kultur, arbete, tid (Culture, work, time), 1994, pp. 30–36.

[30] Ibid., pp. 37–62 and Sanne 1995, pp. 141–197.

[31] Hellström 1994, pp. 64–74.

[32] Ibid., pp. 74–90 and Sanne 1995.

[33] Hagberg, J.-E. Tekniken i kvinnornas händer (Technology in the hands of women), 1986, Chapter IV.

these efforts was that the access to capable servants was shrinking as young women showed preference for working in factories and shops, while others were the general modernization movement and future optimism.

The temporal modernization went hand in hand with spatial and technological efforts. The rationalization task included designing residences that were easier to take care of, promoting electrification, developing household machines and teaching housewives technology use and household effectivization. This focus became even more sharper during the 1930s and a ‘Tayloristic, scientific attitude towards work began to make inroads even among domestic experts’.[34] The idea was to simplify and reduce the household work done by women who worked at home and those with occupations. The transformation called for spatial changes as well, primarily in the residence. The Stockholm Exhibition 1930 presented apartments with small kitchens planned for reduced household work and the text talked persuasively about the new, work-saving household machines.[35] The influential Myrdal couple went even further with their visions for moving a number of functions out of the home and into joint laundry services, central kitchens and other collective solutions.[36]

In the late 1930s the household’s free time became the focus of the rationalization efforts. The 8-h day was legislated for and a 2 week vacation became obligatory. This provided time that should not be lazed away.[37] Rather the free time should be ‘a good servant to working time, a time to collect *joie de vivre* and a desire to work’.[38] Women’s lack of free time and vacation was also noted. That problem should be ameliorated through more rational household work where time saving would be a vital element. Advice was offered for such things as weekly planning in household work, simplified habits, work saving technology, dividing the work among the household members and collective arrangements. The housewives were encouraged to be their own time engineers and compare the time used for different working methods. ‘A time measurement series of that type is not complete until it is used as the basis for calculation that demonstrates time in relation to results as saved effort and cost’.[39] Towards the end of the 1930s attempts were made with so-called ‘housewife vacations’ that also were subjected to scheduled time use.

[34] Ibid., p. 91.

[35] Acceptera 1931. However, more technology did not result in less household work, see Nyberg, A. Tekniken – kvinnornas befriare? (Technology – Women’s liberator?), 1989.

[36] Myrdal, A. and Myrdal, G. Kris i befolkningsfrågan (Crisis in the population question), 1934.

[37] In Myrdal and Myrdal 1934, p. 312, there is a long list of women’s unwholesome leisure time activities. Stating that a whole book could be written about the confined triumph of women’s inventive capacity, they include such items as the many luxury tasks in household work, the petty bourgeois overburdened entertainment life, the overambitious housewife food and household interest and the desire for a narrow-minded social ostentation linked to it, as well as embroidery and knitting, sewing and crocheting, which they saw as merely filling walls and sofas, tables and bureau drawers. They also include the intense recreational reading among women, the exaggerated work-intensive shopping, sports and beauty care, protracted erotic, much of what was called free literature, artistic or scientific activities that would hardly bring in any money.

[38] Quote from a brochure for Ystad 1936 Exhibition in Hagberg 1986, p. 163.

[39] Quote from the Husmodersförbundets kommitté (Housewife Association Committee) in Hagberg 1986, p. 196.

The vacationing women could relax, but they were also expected to listen to lectures, participate in morning gymnastics, study visits and discussions.

Starting at the end of the 1930s interest in household work was also expressed in studies of energy use, as well as time and space use during household activities. The methods varied and included time diaries and test kitchens. This work continued during the 1940s, especially in the Hemmens Forskningsinstitut (The Home Research Institute) founded in 1944.[40]

One group of women suggested collective housing as a solution to the problem of household work and daycare for children in families where both adults worked. The first such house was built in 1935 and housed a nursery, central kitchen and dining hall.[41]

These efforts to facilitate household work via such steps as rationalizing time use appeared at a time when the housewife's role was the main one for a married woman, as was providing for the family the husband's. Actually the man's responsibility for bringing home the bacon was an ideal, one that was not reality at all levels of society and every household type. The deviation was largest in the lower level where the woman's income was essential, as well as in the highest when the woman chose to seek a career.[42]

The message that time is money and that it was essential to economize with time had a direct effect on the disposable household time. This was due to a direct monetarization of household time since an increasing share of this time had become paid time. The transition from an agrarian society to an industrial one meant that the share of women in the labor force, including on the farms, shrank to its lowest level in the 1940s and 1950s. In other words, that was the period when women double-worked least. After that the female share of the labor force grew apace, creating once again a situation where more and more women had two jobs.[43]

The growth was mainly in the paid work, increasing as it did from 11% in 1945 to 63% in 1978.[44] The greatest growth was for women with small children; women with children under seven comprised 28% of the labor force in 1967 and since early

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[40]Examples of changes achieved include that the average time for cleaning and washing was cut in half between 1937 and 1976. The reduction was not quite as large for meals and purchasing. See Åkerman, B. Familjen som växte ur sitt hem (The Family that became too large), 1941; Boalt, C. "Tid för hemarbete. Hur lång tid då?" (Time for work in the home. How much time?), 1983, pp. 59–62; Hagberg 1986 and Nyberg 1989.

[41]Rudberg, K. "Stäng in arkitekten i kokvrån. Kvinnorna och bostadsplaneringen" (Shut the architect in the kitchen. Women and residential planning), 1983; Woodward, A. et al. Den nya generationen kollektivhus (The new generation collective housing), 1989; Michelsen, W. Grounding time-use in microspace, 1993.

[42]The occupational activities of women during the first half of the twentieth century have been underestimated in official statistics. The reasons include the fact that women's unpaid work on the farms was not counted as earning a living. See Göransson, A. "Den könsliga arbetsdelningen och dess strategiska konsekvenser" (Gender-based work division and its strategic consequences), 1978; Nyberg 1989 and Axelsson, C. Hemmafrun som försvann (The housewife who disappeared), 1992.

[43]Nyberg 1989, p. 286.

[44]Ibid., p. 235.

1980s around 80%.[45] Married women comprised 15% of the total number of women in the labor force in 1940, 25% in 1950 and 49% in 1965.[46]

In Sweden, as in many other industrialized countries, when more women worked for a living, the share of men working shrank somewhat. Since the end of the 1980s, men and women have reached parity in the labor force.[47] Today the male support responsibility is hardly even an ideal and the society is dominated by families where both adults work and where one third of the Stockholm inhabitants live without a partner.[48] As the number of families with two working adults came to dominate, an increasing part of their time has become paid.[49] Thus it is possible to say the household time is increasingly monetarized. Taken together, the paid work combined with the unpaid household work means that women double-work to a greater extent than do men.[50]

Child care is a necessity for families where both adults work and care for small children is a task that for the most part has been moved out of the home and become an object for rational time planning. Thus the care work has been highly commercialized. Even the children's free time has become highly planned and its time regulated and many of their leisure activities are done in a commercialized setting. All of this has general consequences for the spatial use in households, where even in households with small children the residences are empty much of the weekdays.

The greater part of the responsibility for household work still lies with the women, including care activities and co-ordinating the activities and time use by the family and household members. Still, newer investigations in this area show that there may be a gradual change in favor of a reduced household work load for women and that men are increasing their share of the load. However, the double load is still more the norm for most married or cohabiting women than it is for men.[51]

10.3.3 Time Discipline Colonizes Even Free Time

The next step in the rationalization process is that not only the unpaid household work is so organized, but also that the free time, defined as the time that the individual has to do what he or she wants, is characterized by economic rationalization logic.

[45] Göransson 1978.

[46] Statistics Sweden, Historisk statistik för Sverige. Del 1. Befolkning (Historical statistics of Sweden. Part 1. Population), 1969, p. 83.

[47] Nermo, M. Structured by gender, 1999, pp. 29–58.

[48] Office of Regional Planning and Urban Transportation, Årsstatistik för Stockholms län och landsting, 2009, Table 14.1.

[49] That is the time of the day not used for personal needs, such as sleeping and eating.

[50] Statistics Sweden, Tid för vardagsliv (Time for normal living), 2003.

[51] Gershuny, J. and Fisher, K. "Leisure", 2000, pp. 623f.

Today's structured free time is the result of a multi-dimensional transformation of the perspective on free time. There are two prominent characteristics of this change. The first is that free time is transformed from having been personal time for recreation and rest to an increasing focus on consumption of goods and services. Thus free time becomes subordinated to demands for development and innovation. Secondly free time is increasingly made to reflect the work life organization where the greatest profit is sought through goal rational principles.[52] Weber's typically ideal-oriented description of the Protestant ethic and its links to the spirit of capitalism is one of the mechanisms behind this transformation.

In order to understand how we perceive free time and its meaning today we should probably go farther back to the beginning of modern time. In such a longer time perspective it is possible to state that the view of free time and the relationship between it and work has varied greatly. A historic survey of the various definitions of free time in western society reveals two clear and partially opposing viewpoints on free time as a social time arrangement. Both attitudes see the distinction between work and free time as the most basic categorization in the social temporal structure. However, they differ in how work and free time is valued in relation to each other. The extremes are on the one hand the ancient times of free time as an end unto itself and on the other the view of the growing capitalism that free time is a subordinated complement to work. In antiquity free time was only linked to free citizens, not slaves or working women. Work was seen as a necessary evil, perhaps even damaging to the personality, while free time was perceived as freedom from the compulsion to work with simple things.[53]

During the Reformation and the early capitalistic period the attitude that free time is 'time when you are not at work' dominated. Since then the dichotomy 'work versus free time' has been characterized by a lack of symmetry. Working for pay became the central category, while free time was considered an idle period intended to improve work performance, all in accord with the Protestant work ethic.[54] Weber pointed out that during the 1500s and 1600s the transformed perspective on work as a calling turned free time into a synonym for waste. It was downgraded to idleness and time became a commodity and a resource that should be handled rationally.[55] Working for pay continued to be seen as the central category in the modern society long after this perception of work as a calling had lost its hold and free time provided with new meaning. Whether free time was seen as the true kingdom of freedom beyond the compulsory mechanisms of material production or as an arena for collective reproduction of societal order, it was always seen as the negation of work.

In the later part of the 1800s free time was increasingly seen as an independent part of life owning value apart from work.[56] In that context the ambivalent nature of

[52] Hemingway, J. L. "Emancipating leisure", 1996, pp. 34f.

[53] Ibid., p. 27.

[54] Norling, I. and Gunnarsson, M. Fritid som socialt fenomen (Free time as a social phenomenon), 1994, pp. 102ff; compare with Hemingway 1996, pp. 31ff.

[55] Weber 1978, pp. 27ff.

[56] Two classics of free time research are Veblen, T. The theory of the leisure class, (1970 [1899]) and Lafargue, P. Le droit à la paresse, 1883.

free time was noted, pointing to its traits as both unbound free time and a binding status marker. In an analysis of the development of the industrial society, Lafargue focused on the image of free time as being unbound and counterpoised the destructive effects of paid work with the liberating potential of free time.[57] This thought was also a part of earlier time-political demands about more free time in the worker movement of the 1800s, demands that led to the battle for work time control and the 8-h day. Conspicuous free time consumption had long been a privilege of the upper classes and thus became an attractive symbol of social dominance for a climbing middle class. According to Veblen's analysis from around 1900 the enticement of free time lay in its positioning character rather than in the content of the activities that could be carried out.[58] Even if Lafargue and Veblen differed in how they viewed the function of free time, both defined it as disposable time without duties.

In the postwar period the importance of free time has grown steadily as weekly work time diminished, more vacation days were granted and the retirement age was lowered.[59] As work hours shrank, the research in the 1960s and 1970s called attention to the importance of free time as an indicator of social action in collaboration with other social systems and institutions, primarily then work, household and family. These interpretations did not see free time as a distinct, delimited activity area, but as determined by and woven into the shifting conditions of living. To a greater extent than earlier, its social dimensions were also closely associated with life's experiential dimension, since the free time was assigned greater meaning for individual development, as well as for testing personal identities and social roles.[60]

From the 1960s and on, the changes in the late capitalistic perspective on free time for the general public have been described as a return to antiquity's view on the subject.[61] Free time should no longer be seen as a temporal surplus informed by work and recreational needs, but rather as an independent life area. In this perspective, work and free time is seen as each other's opposites where many work forms are linked to alienation and compulsion, while free time is linked to freedom and possibilities for experiences and self-fulfillment. There are, however, some researchers who aver the opposite is true since fewer and fewer work in unqualified occupations. Thus the salaried work becomes exciting and interesting, even serving as a source of relaxation and recreation, while family life is seen as demanding and stressful. In this view, work is being transformed into free time and free time into work.[62]

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[57] Lafargue 1883.

[58] Veblen (1970 [1899]).

[59] Class differences had shrunk at the same time, most in the question of free time quantity. See Norling and Gunnarsson 1994, p. 104. See also Fritid 1976–1991 (Free time), 1993, p. 26; Gershuny, J. Changing times, 2000. And Gershuny, J. and Sullivan, O. "Time use, gender and public policy regimes", 2003, where time use data from various OECD countries is studied from 1960s up through the 1990s. They find that the variation when it comes to time allocated to different free time activities is considerably larger within countries than between them.

[60] See Kelly, J. R. Leisure, identities and interactions, 1983, pp. 14–24.

[61] Bardmann, T. Die mißverstandene Freizeit, 1986, pp. 25ff. See also Negt, O. Lebendige Arbeit, enteignete Zeit, 1984 and Olszewska, A. and Roberts, K. (eds), Leisure and life-style, 1989.

[62] Hochschild, A. The time bind, 1997 and Gershuny and Fisher 2000, pp. 620f.

Even if there may exist groups of wage earners who can be included in such a development, most indicators suggest a development in the opposite direction. This trend towards granting free time an increasingly higher status, is described as an area where it is possible to find oneself, seen as one's true ego.[63] Today there are many who try to co-ordinate a more or less demanding occupational life with a qualitatively high-value free time, an attempt that often ends in stress and disappointment.[64] Nor is a one-sided focus on work a realistic alternative for most people since this would also mean a social failure. Free time is developing into an increasingly important socio-cultural arena for identity work and for experiencing fellowship with family and others involved in free time activities, as well as those involved in civil society in such structures as associations. The growth in the socio-cultural redundancy where the importance of cultural traditions and normative lives shrinks, leads to an increase in choices between various identities, but also in the necessity of choosing, and that identity is always provisional and constantly transitional.[65] The identity formation has become a constant, reflexive action that calls for the individual to make many active choices and to take many positions, not least when it comes to free time activities and experiences.[66] This reflexive experience pressure where free time is controlled by the imperative "Experience your life now!" is also strongly related to the constantly increasing availability of activities and products.[67] At this point a successful free time experience is not only linked to many active choices that all need time, but also a high amount of goods and service consumption. But these consumer choices also mean that other alternatives are not chosen, which in certain cases such as in choosing free time activities for the children (soccer, tennis, piano, dancing, ceramics or …?), can lead to much insecurity as to whether the choice made really was the right one and if it fits the image one is trying to create. The risk is then strong that the final result is disappointment and stress in spite of the abundance of possibilities.[68]

Free time is also influenced by tempo increases. Work time and free time both tend to be lived and experienced as arenas for self-realization within the same rational development paradigm. Similar goals are set for the idealistic content of both work and leisure; they tend to be done and experienced at the same high pace. The individual is constantly caught in situations defined as personal challenges that s/he should be ready to accept. Thus life is seen as very full, but also very demanding since people hold the same pace at all times with only short periods of rest. The space available for recreation and contemplation shrinks and is subordinated to the

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[63] See for example Schulze, G. Die Erlebnisgesellschaft, 1992, pp. 52ff.

[64] For an American description of this dilemma, see Schor, J. The overworked American, 1991. Increasing, more intense work time tends to extend into evenings and weekends, and women's double work results in a reduction of her free time and greater stress.

[65] See Ziehe, T. and Stubenrauch, H. Plädoyer für ungewöhnliches Lernen, 1986.

[66] Giddens, A. Modernity and self-identity, 1991, pp. 38f. See also Sörbom, A. Vart tar politiken vägen? (Whither politics?), 2002, pp. 66ff.

[67] See Schulze 1992, pp. 58ff.

[68] Ibid., pp. 63ff.

demands of efficiency, at the same time as recreation has been more goods oriented and consumption controlled, even if it still takes 3 h to go to the opera.[69] The acceleration of free time is a general, western phenomenon. While it is still far from everyone whose weekdays are characterized by a high work and free time pace, the number of individuals who maintain a high pace in both has grown.

This accelerated time use and experiences of a shortage of time brings with it a vague feeling of concern that one is missing some meaningful experiences that can be located somewhere else or lie outside one's individual time rhythm. It even occurs that people worry that everything exciting happens when they are away or asleep. Keeping track of all interesting activities and events, as well as synchronizing one's own time use with these events is a demanding task in a 24-h society. This in itself creates stress. The TV-zapper is the prototype of the modern worry about missing something, of being out of synchronization with what's happening in time and space.[70]

However, this worry is far from a new phenomenon, but has grown over time as the modern society developed. As early as 1900, Georg Simmel described a modern, nervous restlessness that expressed itself in such symptoms as travel mania, quickly shifting preferences and flighty social contacts. According to Simmel, the main reason for this worry was not the external hurry in the modern society, but a lack of something steady in the center of their soul that expressed itself in a constant pursuit of new experiences and outer activities. This worry characterized the effect of the monetary economy on the social life, especially in the large cities.[71]

10.4 Acceleration

A faster tempo or acceleration appears throughout as a tendency in many areas of modern life and has already been discussed. A common interpretation is that the development of the modern society has brought with it a continuous tempo increase or acceleration in most sectors and on all societal levels.[72] Its practical expression is the same as has been given here. Technology development is a vital material basis for the increase as it in much reduces the importance of geographic distance. Globalization has been seen a special type of acceleration that leads to a displacement of the time-space axis.[73]

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[69] See Burenstam Linder, P. Den rastlösa välfärdsmänniskan (The restless welfare person), 1970, pp. 96ff.

[70] The zapper's nervous worry results in constant changes between TV channels in order not to miss the programs that are out of sight for the moment. This activity has even led to the development of a built-in technique where simultaneity is added to the TV allowing for screen splitting to show several channels at the same time. In Virilio, P. La Machine de Vision, 1991 there is a description of the zapper as a social type and zapping as at the same time an expression of restless searching and a sluggish, medialized culture.

[71] Simmel, G. Philosophie des Geldes, 1999 [1900], p. 675.

[72] Eriksen, T. H. Tyranny of the moment, 2001.

[73] Ibid.

Clock time equals money in the industrial society and speed has been given a considerable monetary value. The faster a product could be produced, the less monetary time was tied up in the production process in the form of machines, interest expense and labor costs. The faster the product could be moved through the production system to the end consumer, the greater the possible profit. This was and remains important for products with short working life, such as today's mobiles and computers. The increased speed or time compression was achieved in a number of ways:

– including increased activity in the same time interval using machines and greater work intensity;
– reorganization of production sequences and structuring activities à la Taylorism and Fordism;
– more efficient use of top and bottom cycles in the operation through increased flexibility; and
– elimination of all nonproductive time from the processes, such as with just-in-time systems for production, delivery and consumption.[74]

Behind the increased tempo lay innovations in the transport segment during the 1800s that dramatically increased the speed with which persons and products could be moved. The next century saw innovations that would result in changes in the relationship between time and movement, including the wireless telegraph, telephone, radio and later also data and satellite communications.[75]

However, the strongly positive valuation of rapidity is not only a modern phenomenon. Today's acceleration tendencies and the high value rating for speed are rather both variations on an old theme. Still, there are considerable discontinuities. One example is found in the time around 1900 when greater rapidity broke through in a number of areas and came to characterize societal development. Motorized transports, machine-based production, electricity and gas, film and electronic communication appeared in that period and affected how people experienced their world. In the midst of the quickness explosion, many felt that anything was possible. But the praise of speed was in many cases not tied to the monetary policies of the time, even if the change was founded there.[76] According to the Norwegian social anthropologist Thomas Hylland Eriksen yet another important step was taken as the information society developed, with the commercialization of the Internet in 1991 as an important milestone. He believes that the wave of information is in the process of filling all temporal interstices.[77]

Acceleration also includes an increased fragmentation of activities and information where time is chopped up into small pieces and processes are disjointed, as in the piling of smaller and smaller blocks on each other. Here an expressive example can be seen in news programs in radio and TV, where smaller and smaller time bites without analysis are repeated endlessly during the day.[78]

[74] Adam 2004, p. 128.

[75] Adam 2004, pp. 130–133 and Daly 1996, pp. 13–15, 34–39, 203–204, 221–223.

[76] Kern, S. The culture of time and space 1880–1919, 1983.

[77] Eriksen 2001.

[78] Bourdieu, P. Sur la télévision, 1996 and Eriksen 2001.

At first the acceleration affected mainly working life, but it has developed stronger ties to family life and free time. On the labor market and work places the growing acceleration and fragmentation have called for greater flexibility from workers as the border between work and free time is erased.[79] The individual's entire life is marked by acceleration in the form of shorter work episodes, continuing education, serial monogamy and greater impatience in love relationships.[80] In practice, the tempo increase in everyday activities involves periodicity (more frequent showering), tempo (faster cleaning), and time availability (less time for cleaning). There is a clear link to time shortage experiences. Activity fragmentation, broken sequences, too few or too many social rhythms contribute to the time shortage perception. Individual and household strategies for counteracting the time shortage include doing less, doing it more rapidly, doing many things in parallel, planning sequences and changing time use with technology.[81]

It is true that some consequences of acceleration are seen as positive by many, but research about the importance of acceleration for human and social life concentrates mostly on the negative effects. Speed has been characterized as addictive and infectious. It sets up assembly line effects and leads to simplifications, loss of precision and demands for even more speed. It has also been pointed out that what you win one day you can loose the next and that technology can have unpredictable side effects.[82] Acceleration has been found to make it hard to gain a larger view of consequences, such as activity sequences, with consequent time shortage experiences. Even temporal synchronization between persons becomes a problem when face-to- face contacts are fewer due to greater geographic mobility, more individual decisions, fewer fixed time routines and flexible work hours.[83]

Fragmenting and piling in the form of increasingly small information pieces makes chains of events incomprehensible. Context, overview and understanding are more difficult leading to feelings of insecurity. Thus it is possible for this tendency to cause faulty notions of cause and effect. Interestingly enough, when compared to fragmentization, the concept of linear time has been positively received as a base for a logical, cumulative process for such activities as writing a book where the thought sequence is developed from the first page to the last.[84]

The increased tempo in modern society is a general phenomenon that has concerned many Europeans since the early 1900s. In Sweden, time pressure is most certainly noted in working life, but temporal demands on the job have also led to increased tension between family and working life. Statistics for reporting in sick and investigations of self-diagnoses of poor health illustrate the negative effects of

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[79] Sennett, R. The corrosion of character, 1998 and Eriksen 2001, p. 143.

[80] Eriksen 2001.

[81] Southerton, D. Shove, E. and Warde, A. "Harried and hurried": time shortage and the coordination of everyday life, 2001.

[82] Eriksen 2001.

[83] Southerton, Shove and Warde 2001.

[84] Eriksen 2001.

time pressure for both physical and mental health.[85] Psychologists have pointed out that general tendencies in society will increase the strain on individuals and families through such things as increased tempo, short-term thinking, focus on risks, stimulus overflow and information.[86] There is much that suggests that it is women who suffer from the double demands from work and family. One example is that as opposed to men's, even when they come home from work women's stress hormones remain high.[87]

As opposed to money, time can neither be saved for future use or yield interest. Even so many people plan carefully and rush as effectively as possibly through their days, both at work and at home. The need is to juggle many balls at the same time, doing many things simultaneously or one right after the other, choosing rapid transit to arrive in time at quick, productive meetings and to plan time use carefully. In this pursuit of sometimes rather minute time gains people use time-saving products, services and technological systems, only to discover that they must work even harder in order afford these aids.[88] The rapid temporal growth means that increasingly faster time is used in order save even more time at an even faster pace. This means that it is never possible to save enough. Far from creating more disposable time, the increased possibilities for time savings have rather had the opposite effect, in part because the savings move hand in hand with the rapidly advancing tempo increase in the society.

10.5 Pluralization

The changes discussed in previous sections have varied in their effect depending on the area. Thus different time use combinations and time attitudes can exist in parallel and simultaneously. It is even possible to talk about a tendency to pluralization. Actually, temporal pluralization can be found on several societal levels, not least in an individual sphere, but also in households and local communities. Temporal pluralization and problems with time co-ordination between individuals are linked to structural changes in other areas. Time is intimately connected with space; time use and time conceptions are linked to possibilities of and hinders to geographic and virtual mobility.[89] Social institutions or artifacts with decisive influence on social time and tempo supply information between time and space on different levels. Examples of such 'conductors' include the public transport

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[85] Paoli, P. and Merllié, D. D. Third European survey on working conditions 2000, 2001.

[86] Piltz, K. G. and Gústavsdóttir, K. Par- och familjeterapi vid stress och utmattning (Couple and family therapy during stress and exhaustion), 2003.

[87] Davies 1989, p. 236.

[88] The description by economist Burenstam-Linder (1970) of the mechanisms behind this phenomenon is discussed in greater detail later in this chapter. He calls it the time saver's dilemma.

[89] Giddens 1991, pp. 96, 101.

schedules, length of the work day, the hours of shops and daycare centers, as well as financial transaction forms.

The late modern relationship between time and space is strongly affected by globalization. One important factor behind today's tempo-spatial structure is the increasing pace of transport means. Another, even more important condition for global synchronicity is found in communications technology, not least in that single technical systems have been joined into larger systems. One example is the telecommunication system whose existence not only enables synchronicity, but even raises it to a necessity for both global financial transactions, but also for ordinary work and personal communication. The global spread of stress and time pressure is a phenomenon partly impelled by global 'conductors'. Global synchronicity goes hand in hand with striving for more personal time and the space for individual temporal experiences has increased proportionately to the development of an increasingly global time simultaneity in trade and communication. Helped by technology, individual time experiences have been facilitated and to some extent idealized since the early 1900s, driven forward by such phenomena as mass media, private transport means, cameras and film devices.[90]

In many areas there is a noticeable tendency to diversity in temporal attitudes. At the same time as the share of paid work has diminished and of free time grown in the 1900s, at least for salaried workers, societal demands for social synchronization has shrunk. One example is that there are no longer standard norms for how the work free Sunday or weekend should be spent and the activities available on weekends and vacations, as well as in the evenings have grown apace. This creates possibilities for individual time rhythms. The search for individual time experiences and time indicators has found expression in such activities as the non-stop community's 24-h day, varied choices and plans for important celebrations and the increased importance that many ascribe to vacations and vacation trips.[91]

On a household level pluralization and synchronization have always existed between household members. However, as their time use has become more diverse, synchronization has in all likelihood become a harder, more time demanding task. One difference here is that more women work now – during the housewife era the co-ordination lay in her hands. Now more of the household members share responsibility for the task. Family almanacs with space for each member's weekly schedule and shared web almanacs are contemporary aids for synchronizing the household's time use.

The increased diversity in time use and perceptions is seen on the local level as well. One way this is seen is in a renaissance of urban and district festivals. Another in municipal projects for identifying and strengthening local time perceptions and time use patterns.[92] Yet another is the introduction of new holidays in some Swedish schools intended to provide non-Christian children improved possibilities for expressing their faith.[93]

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[90] Nowotny 1993, pp. 23f; Castells, M. The rise of the network society, 1997, pp. 124f; Castells, M. End of millenium, 1998, pp. 350f; and even Rifkin, J. Time wars, 1987.

[91] Nowotny 1993; Lundmark 1989, p. 150.

[92] Mückenberger, U. (red.) Zeiten der Stadt, 2000 (Urban time), pp. 175ff.

[93] Göteborgs-Posten (newspaper) 14/6 2004.

Time pluralization also includes standards for when a product, service or know-how can be accepted as out-of-date. The link between production or innovation pace and the standards for aging has weakened, or at least become more differentiated and context dependent. Thus they are more frequently formed keeping factors of the specific artifact or service in mind, such as its area of use and the user's social position and surroundings. These standards have a tendency to change at the same pace as innovations pop up, something that has happened at a considerable acceleration for certain artifacts, especially when it comes to electronic devices. Computers, programs and knowledge in the computer segment only a few years old are already outdated. Many feel that last year's mobile is too old in spite of the fact it offers the same functions as the new models. Other areas, however, do not have this throw-away tendency. In such cases it is rather the product or service function that forms the basis for when it is not longer useable and there are differences between individuals and groups as well. For some people a product is attractive just because of its ability to age slowly and remain independent of fashion trends, a quality often labeled timeless.[94]

It is possible to discern a development towards a clearer coexistence of linear and cyclic temporal conceptions. In addition, individual time experiences and time markers are increasingly valued. Finally, there has also been a growing variation in temporal standards for artifacts, services and knowledge.

10.6 Growing Time Shortage and Partial Prosperity

As incomes rise in the prosperous countries, one prominent trait in modern societies with economic growth is increased goods consumption. The demand for material improvements remains large, in spite of the fact that this reduces the benefit from increased earnings. Economic development tends to be seen as a goal unto itself and not a means to create the conditions for a satisfactory use of free time.

Another important trait is that the attitude to time is strongly affected by an experience of far-reaching time shortage. Personal time administration has become a much desired skill and punctuality an important characteristic. Waiting is seen as an irritating waste of time. Every day is dominated by clock awareness.

The relationship between the growing time shortage and the growing goods consumption is emphasized by Staffan Burenstam Linder in his book *The Restless Welfare Person*.[95] He points out that economic growth increases the yield from work time; productivity rises and the goods shortage shrinks. However, he also notes that time shrinks as well. In a growth society time is seen as a scarce resource that needs to be spread over various activities to ensure that it provides as large a yield in all areas of use. With rising productivity comes an increased income level, which in turn has repercussions on the time allocation. Greater yield from salaried work

[94] Hörning, K. H. et al. "Do technologies have time?", 1999, pp. 293–308.

[95] Burenstam Linder 1970, pp. 136–137.

causes the individuals to try to raise the yield from time in all other activities so that it is level with the yield on work time. Thus economic growth does carry with it a general growth in time shortage. This means that the yield on time in consumption must be raised and one way to do this is to raise the number of actual consumption commodities per unit of consumption time.[96]

Growth and income increase leads to increased good consumption, but the time used for consumption is affected. Enjoying the items bought most often requires time, making that time as important to the consumption process as the items themselves. When the goods are cheaper in relation to time, people find it suitable to make the goods consumption more intense. This means that the consumption time per commodity will change. In as much as items become cheaper in relation to time, it will be profitable to use more of them. Through this increase in goods intensity, the individuals will push the yield per time unit in consumption up, which is necessary to maintain equality when incomes have grown. Time per unit will diminish to the extent that it is possible to replace time with goods. Acceleration will occur in consumption as the time spent with each separate item shrinks, an acceleration that takes various forms. A more expensive version of a commodity can be used for as long as an earlier, cheaper one. Simultaneous consumption is another way to accelerate consumption, meaning that the consumer tries to enjoy more than one consumption item at the same time. Yet another form is successive consumption where the consumer enjoys a shorter use of one item at a time.[97]

Burenstam Linder also points to other consequences of the growing scarcity of time. A rising tempo risks a reduction in time use efficiency. A stoppage effect can occur when you try to press as much as possible in the available time frame. If your program is overstuffed, you can find yourself hopping from one task to the other and accomplish less than what should be possible. There is also a danger that the capacity for enjoying material benefits shrinks when a person uses a stressful tempo to increase the yield of the time available. Since productivity in the service sector increases more slowly than in the goods production, it is also possible that the maintenance time shrinks. This comparable time is rather put into highly productive work that provides the income needed to replace the items that should need maintenance. Thus growth is tied to a reduction in service quality, even if the service quantity may have increased.[98]

The tendency towards increased commodity intensity will not be the same for all activities. Rather a rise in intensity will increase the yield on time to varying degrees for different activities. Burenstam Linder believes it probable that less time will be spent on traditional pleasures of bed and table. Those activities that call for skill, discipline and patience to provide pleasure will also be reduced. Attempts to save time in such areas will make the pleasures uninteresting. Rather consumption activities where it is easy to raise the goods intensity per time unit will be given

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[96] Ibid., pp. 9–22.

[97] Ibid., pp. 85–88.

[98] Ibid., pp. 32, 48–52, 54–67.

increased amounts of time as incomes rise. This is primarily so for activities built up around using things. The total time used to utilize these things will increase, at the same time as the average time spent on each one of the items will shrink.[99]

According to Burenstam Linder the prosperity created by economic growth will only be partial, since the access to time is limited and the demand on that time increases. Rather the prosperity takes the form of a plethora of goods. Such goods centered consumption means that raises provide the possibilities to increase the yield on temporal resources through an intensification of consumption. The question is if the internal conflicts in a rising consumption volume will affect the evaluation of the result of the growth efforts. One scenario might be that the time shortage will in time create such problems for people to further raise their consumption level that they will look for new purposes. In such a situation the individuals might wish to spend time in a way that does not call for a goods centered consumption. It then is replaced by other goals where growth is not the focus, giving way to such foci as concentration and refinement. The economic growth would then be seen as a means that can release the individuals from the financial process and even allow time waste. The individuals would quickly reach their financial goals and thereafter spend time on non-economic contemplations. In this scenario the profits of productivity could be taken out in the form of longer free time periods, time that could be spent on intercourse with family, friends and relations and/or on community involvement, continuing education or immersion in nature. Such a transformation would lend progress a new content.[100]

10.7 Changes in Consumption Patterns

10.7.1 Temporal Perception and Consumption

The linear time perception grew and won a stronger impact at the same time as the idea of progress gained ground and improvements in material living standards became noticeable. It was the bourgeois culture, with its perception of life as an individual career ladder that first made a direct connection between an everyday practice shaped in accord with the linear time perception and the idea of constant growth and progress in material living standards. After a while this connection came to be valid for workers as well and the possibility of an improved material standard weakened the opposition to the new time discipline. Broadened consumption possibilities became a tangible reward for productive time use and has remained so.

Starting in the late 1800s the broadened consumption possibilities have been revolutionary in effect. Today the average Swedish income is about 25 times as high

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[99] Ibid., pp. 88–100, 101–116.

[100] Ibid., pp. 33–35, 137, 148–152; Easterlin, R. A. Tillväxtens tidevarv (The era of growth), 2001, pp. 222–224, 232.

as at the end of the 1870s. The purchasing power per resident is actually higher than that, possibly reaching as high as 50 times as large due to a qualitative development in most product areas. In spite of the immense growth in consumption, the productivity growth has been enough to shorten the average work time from around 3,000 h per year to half of that. Together with the trend to a longer life expectancy, this development has meant that a shrinking share of the total lifetime is spent working. Calculations suggest that in the near future the share of the total lifetime spent working will be somewhat less than the time spent on meals.[101] The immense technological changes have made it possible to satisfy the basic needs for food, clothing, housing and other necessities with far less work than was necessary earlier.[102]

The consumption pattern broadened during the 1900s with the higher living standard. In the early parts of the century large shares of the household expenses went for the bare necessities. The share for food and clothing sank by 50% as the incomes rose, while the share for housing, leisure activities, health and contacts with the surrounding world doubled.[103] In the 1950s and 1960s between a fourth and a third of the consumption expenses were for food, around 10% for drinks and tobacco, between 10% and 18% each for housing and clothing. Even if the stability of these statistics was considerate, certain changes occurred. The cost share for food and clothing continued to shrink, while those for household equipment, trips (including buying new vehicles) and recreation increased. The relatively high share for housing during the prewar period segued into a considerably lower share on the regulated postwar market. The largest increase in the latter period was for trips, household equipment and recreation. The equipment category includes items that are linked to household modernization, primarily the electrical devices in the homes. It was during the 1950s that white ware experienced a real breakthrough, primarily then the electrical stove, washing machine and refrigerator. The travel category includes the changes brought by the car to living conditions, including being able to live farther apart, commuting to work and enjoying free time in other ways than earlier. The share of passenger transports carried out using private cars increased from just over 30% in 1950 to more than 80% in 1970. Together the car and the new household technology created the conditions for a different, more flexible household life. They also contributed to increasing the demand for new, modern housing.[104]

Starting in the 1960s and up to the mid-1990s the consumption change pattern was characterized by the fact that most goods and services that provide for basic needs in

[101] Andersson, Å. and Sylwan, P. Framtidens arbete and liv (Future work and living), 2000, pp. 17–18. This calculation suggests that in 2010 8.4% if the total lifetime is used for meals and 8.0 for work. See also Fogel, R. The Fourth Revival and the Future of Egalitarianism, 2000.

[102] Fogel 2000. In order for the average American household to satisfy its annual need for food only 20% of the number of working hours needed in the 1880s. (260 hours versus 1405 hours).

[103] Fogel 2000 and Andersson and Sylwan 2000, pp. 22–23.

[104] Dahlman, C.J. and Klevmarken, A. Den privata konsumtionen (Private consumption), 1979, pp. 13–14 and Schön, L. En modern svensk ekonomihistoria (A modern Swedish economic history), 2000, pp. 388–400.

food and the like increased very little in cost, while the consumption of dispensable items such as trips and leisure articles increased comparably much. Furthermore durable goods increased more than non-durables and services. The second half of the 1970s was an exception in that private consumption stagnated. When the high business cycle began around 1984, the previous pattern returned.[105]

Since the early 1960s food has accounted for around 20% of the private consumption with a slight volume increase thereafter. The primary cause ought to be that food consumption is relatively insensitive to income changes. In the mid-1990s clothing and shoes accounted for around 5% of the private consumption. Clothing has increased somewhat more than the total consumption during the most recent decades, which is also true for shoe consumption. Part of this can be explained by looking at the price development mostly as a result of low-price imports. Another factor is that clothes and the like have received an increased role in personal identity creation and the need for social recognition. The old need for protecting the body against wind and weather has diminished in the face-off with non-material needs.

Consumption related to housing accounted for around 30% of the total private consumption in Sweden in the mid-1990s, a ratio that in much has followed the development of housing construction. As summer houses have grown in importance, they show the greatest cost change. Between 1963 and 1970 consumption grew annually by almost 12% and by 4% between 1970 and 1985. The rapid growth in the 1960s was related to strongly increasing income, shorter work time and greater car ownership.

Furniture, household utensils and related items accounted for around 6% of the private consumption. The strong, annual three percent growth between 1963 and 1975 fell off to the mid-1980s, only to expand again in the latter half of the 1980s. The growth stopped in 1990. The changes are linked to alterations in household structure and housing construction. This particular category is also extremely sensitive to changes in income.

In the mid-1990s health and medical care accounted for around 2% of the private consumption. At app. 15% the publically financed portion of this category is considerably larger and private costs represent only a smaller part of the total expenses.

Transports accounted for approximately 15% of the total private consumption and is a category that has grown faster than the total private consumption. Air and water transports are the primary cause of this change.

In a longer perspective goods and services related to leisure or free time have increased rather strongly. In the mid-1990s the category accounted for around 10% of the total. One example is that the sub-category TV, radio and phonographs has increased by around 10% annually between 1963 and 1990, while cultural services such as books and newspapers have had a considerably slower growth rate.

Trips abroad and related expenses there have also grown rapidly. The category grew in volume by an average of 10% annually between 1963 and 1972, only to become irregular thereafter. The expansion in the 1960s was linked to the

[105] This description of the changes in consumption patterns is based on Sandelin, B. Den svenska ekonomin (The Swedish economy), 1997, pp. 66–71.

breakthrough of charter trips that made it much easier for the average Swede to vacation abroad.

The household consumption comprises more than just goods and services bought in the marketplace, including also a number of services sought through the public sector. In a longer perspective the public consumption share of total consumption has increased at the expense of the private. The latter has diminished from over 90% around 1900 to less than 70% in the three most recent decades. Public consumption comprises collectively consumed services from national and local authorities, including the judicial system, police and defense, as well as publically financed services offered to individuals in such areas as public health care and education. Part of the reason for the increased public share can be traced to a rapidly expanding municipal consumption, while the national share has been stable since the 1950s. The heaviest items in public consumption are social safety, education and university research, as well as health and medical services. Together they account for more than half of all public consumption.[106]

The long-term changes in consumption patterns are in part a result of changes in lifestyle based on rising purchasing power. But this is only part of the answer. Better education has also affected values and outlook on life and therefore purchasing patterns. Just better education has increased consumption of goods and services linked to social contacts, travel abroad, voluntary education, child care, gifts, housing (especially ownership), literature, toys and health care. On the other hand, consumption of some kinds of entertainment, such as lotteries, betting and dance, as well as tobacco, TV and radio, alcohol, clothing and domestic travel has diminished as a result of the rising education level. During the most recent decades these links have remained the same as the disposable real income per person has grown somewhat, the educational level has gone up, family size gone down a bit and the average Swede has become somewhat older and shortened his/her working life. Thus the strongest growth in consumption has been in restaurant and hotel services, travel (especially abroad), other communications and contacts, cultural and information products, as well as free time equipment and housing. As to residential pattern, a shift has occurred towards residential ownership. The budget share for food, tobacco and alcohol has shrunk. Tendencies showing that more and more consumption occurs outside the home have caused a growth in the share of transport and communications expenses.[107]

10.7.2 Time Scarcity and Consumption

Even if there has been a shift in the consumption pattern away from simply satisfying material needs and towards non-material ones including participation, emotional relationships and understanding, this has not reduced material consumption.

[106] Sandelin 1997, pp. 64–65, 73–75.

[107] Andersson and Sylwan 2000, pp. 24–25. Also pp. 26–27, and Andersson, Å. E. Kreativitet Storstadens framtid (Creativity is the future of the metropolis), 1985, pp. 262–289.

Satisfaction in the latter category of needs has brought with it more use of material artifacts. Examples of this are the rapidly growing recreational activities that, if nothing else, call for a lot of travel. The immense productivity of modern economic growth has not reduced the pressure of material needs. The pursuit of material assets is as intense as before, in spite of a never previously seen prosperity. Each step on the stairway of economic development creates new economic needs. Rising real incomes are deflated by rising material needs and for all intents and purposes the subjective well-being tends to remain constant. Even if a part of the profits of higher profits has been cashed in the form of longer free time, this time has tended to be more commodity oriented. The quiet, harmonious life often expected as a result of economic well-being has not been realized. In its place more and more persons experience a growing time scarcity as the yield of growth.[108]

The increased free time has not reduced the time pressure. The time for recuperation and contemplation tends to shrink and be subordinated to the demands of efficiency. Thus free time has also become more goods oriented and consumption controlled. Even in free time, the experience of time shortage has been reinforced by a constantly growing range of activities and products. Many time draining choices are combined with high consumption of goods and services. Nor has an increased use of time-saving devices in the households led to comparable reduction in time shortage. Mechanical aids demand time for service, as well as work time to earn money for purchases, making it easy to exaggerate the time-saving effects of the machines. As demands on the equipment have grown, the effects have been counteractive. Even so, household productivity has probably increased as a result of the household devices and machines. However, this does not mean that the time shortage has been reduced. While time may have been saved, it will be spent on different areas making the overall yield the same. In fact, the time shortage rises as household productivity rises. Thus increased household productivity cause a rise in total income and an increase in demand for time.[109]

In a situation with increasing time scarcity, the maintenance of consumption goods tends to worsen. If the productivity increase is higher in goods production than in service production, maintenance will be more and more expensive in relation to the commodities. In this position the consumers will reduce maintenance per product and apply the time to high productivity work. The income from this work will be used to replace items that would need maintenance. On the one hand the products can be made so simple and cheap that they can be thrown before they need maintenance. On the other it is possible to make high quality products that for that reason are not in need of maintenance. In both cases the households will economize with the maintenance time. In many areas there has appeared a growing reliance on goods and a comparable indifference to each separate item due to a low use degree and rapid replacement.[110]

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[108] Easterlin 2001, pp. 222–224, 231–232.

[109] Burenstam Linder 1970, pp. 51–52.

[110] Ibid., pp. 48–50, 64, 87, 151.

10.7.3 Consumption and Energy Use

The fact that the material demands have risen and that non-material needs increasingly tend to be satisfied using material artifacts, means that the link between needs satisfaction and energy use remains strong. Household activity patterns are closely tied to a community's energy system. This in turn provides basic conditions for the activity patterns in the homes, at work and within the urban structures, affecting therewith the designs and rhythms of everyday life. These conditions become self-evident once they are established. The system contributes to shaping household expectations and suppositions about what is possible and normal, such conceptions of how fast and far it is possible to travel in 1 day, how much work can be done in a given time, and which tools and equipment is available for everyday tasks. In a world where the car is the transport means, it is natural to travel at a comparably high speed to complete certain tasks. But if a step is taken back to the time when the railroads were new, the speeds are rather moderate, but were seen as revolutionary at the time.[111]

Today's high-energy society grew in the early twentieth century and was based on the introduction of electricity, oil and natural gas. These energy sources were added to the earlier system dominated by steam and coal. Prior to that time the energy system used bio fuels, muscle power, wind and water. Modern societies are dependent on large withdrawals from energy stores and are quickly emptying finite assets of fossil fuels. By using these energy resources, societies have developed that use energy at an entirely different rate than before.[112]

The increase in energy use has far exceeded the population growth. As opposed to earlier experiences, the total energy utilization per capita has increased around 12 times during the most recent 150 years. For centuries or even millennia the per capita energy use changed only marginally. It was the same in even the most developed regions. The increased access to energy has enabled a strong growth in global foodstuffs production. It has served as the foundation for the industrialization process that has shaped modern societies. Add to that the development of mass transport and telecommunications that have contributed to the appearance of a global civilization.[113] However, the growth in the absolute energy use with higher economic development levels hides an important, relative downturn, namely that mature economies tend to have a lower energy intensity. They use smaller amounts of fossil fuel per monetary unit. This fact reflects a combination of factors:

– reduced importance of added energy-intensive factors;
– improved efficiency in energy utilization; and
– a rising share of energy use for the service sector.

[111] Nye, D. E. Consuming power, 1998, pp. 7–8, 10–11.

[112] Smil, V. Energy in world history, 1994, pp. 157–158 and Wrigley, E. A. Continuity, chance and change, 1990, pp. 68–132.

[113] Smil 1994, pp. 187–188 and Simmons, I. G. Changing the face of the earth, 1990, pp. 212–215.

This relative downturn started early on. In England the energy use per monetary unit reached its highest value around 1850, in the US around 1920 and in Japan around 1970.[114]

The Swedish energy use is in much in accord with the general pattern described. The use changed only slightly up to the close of the 1800s, at which point an exponential growth began that continued until 1970, the war years excepted. After 1970 the energy use stabilized. Counted per capita the energy use increased from 13 MWh per year in the beginning of the 1800s to 14 MWh in 1900. By 1970 the use had reached 50 MWh per capita, only to shrink somewhat to 46 MWh in 2000.[115] The energy intensity, seen as the relationship between the aggregate energy use and GNP, increased in Sweden between 1950 and 1970, only to shrink again by the end of the 1980s.[116]

One of the most striking uses of energy from fossil fuels has been to support an unprecedented urbanization. While there certainly have existed large cities in the past in the most developed parts of the world, the share of world's population living in cities as late as 1800 was less than 10%. The exceptions were Holland and England. Traditional societies could not support more than a small number of larger cities since food and fuel for population concentrations had to be harvested in the form of biomass from a large, surrounding area. A city that received its energy from coal and oil needed only an insignificant surface for the actual energy production.[117]

The cities in a traditional economy need to support themselves by concentrating spread-out energy flows. However, with cities based on fossil fuels as an energy source, the concentrated energy can be spread out over a growing number of cities of an entirely different size than before. Therefore the number of larger cities increased rapidly during the 1800s. In that century and the following the number of cities with 125,000 residents increased five times and those with more than 500,000 residents eight times. In 1900 nine of the ten largest cities in the world were dependent on fossil fuels, with Tokyo the only exception. That city was in an economy that to a great extent was still based on bio fuels for energy. Around the year 1900 some 10% of the world population lived in cities, though the urban share was much larger in cities with large coal production. The share was over 70% in Great Britain, nearly 50% in Germany and almost 40% in the USA. In the twentieth century the number of large cities grew apace. Today half of the world's population lives in cities and this share is expected to grow to 75% by 2050. In 2005 there were 450 city regions with more than a million inhabitants, and 20 megacities with a population above 10 million. By 1990 there were 300 cities with more than a million residents as compared with 13 in 1900 and one in 1800. However, the large cities

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[114] Smil 1994, pp. 205–207.

[115] Kander, A. Economic growth, energy consumption and CO_2 emissions in Sweden 1800–2000, 2002, pp. 58–60, 223–228.

[116] Ibid., pp. 65–70.

[117] Smil 1994, pp. 208, 220–22 and Berry, B. J. L. "Urbanization", 1990, pp. 103–105 regarding cities in general; Clark, R. P. The global imperative, 1997, p. 55 and Hughes, J. D. Pan's Travail, 1994, pp. 74, 80, 83 regarding Rome.

were long dependent on old energy sources for internal transports, even after the railroads had taken over the long-distance transports. The changeover to internal transport systems based on fossil fuels and the sinking energy prices until 1973 meant that the cities could be far larger surface wise than what they once had been.[118]

Through industrialization and urbanization the growing energy use has had large effects on living standards. The first signs of improvement were the slowly increasing consumption of household articles and those for personal use such as utensils, clothing and furniture. Time saw the development of mass consumption with its many physical comforts and demonstrative use of goods. Some other changes included longer educational periods, higher personal mobility and growing expenses for free time and health. The development sequence was followed by a rising, average energy use per capita.[119] The high-energy society touched every aspect of daily life, especially for the urban households. It promised larger residences, cheaper food, quicker travel and increased access to social services, such as health and medical care and education. During the 1900s large changes occurred in all these areas, especially in the postwar period.

10.8 Conclusions

In recent discussions of temporal welfare, emphasis has been placed on the value of free time independent of earning a living. One reason for this is that time for reflection and contemplation in a non-stop society is seen as having become a scarcity even in off-work hours. Time for reflection has even been called the new luxury item of our time.[120] An extrapolation from this thought is the idea that, with the exception for certain luxury and identity items, material goods are not longer seen as especially scarce. This means that their importance for an individual's experienced life quality has been reduced. As opposed to material goods, free time or time for reflection cannot yet be bought or only purchased to a limited extent, further raising their attractiveness. This idea finds support in the fact that the demand for services that enable the person to increase free time grow apace with rising income.[121]

In this discussion, the concept of temporal welfare has been filled with varied content by different researchers. They have noted the quantitative aspects of time and time use to varying degrees, referring rather to how much free time, how much time in paid/unpaid work and similar factors. Several authors have even sketched

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[118] Smil 1994, pp. 132, 208–210; Berry 1990, pp. 107–113; Simmons 1990, pp. 233–234. Soja, E. and Kanai, M. The urbanization of the world. In: Burdett, R. and Sudjic, D. (eds), The endless city, 2007.

[119] Smil 1994, pp. 210–213.

[120] Enzensberger, H. M. "Reminiszenzen an den Überfluß", 1996.

[121] Reisch, L. A. "Ist das Thema Zeitwohlstand theoriefähig?", 2002, p. 38.

out strategies for optimizing the temporal welfare of a society and thus formulated a draft for a time policy.[122] Reisch summarizes the new time policies thusly:

1. There should be enough time for social reproduction process, such as creating and maintaining social networks, and natural reproduction process, such as utilizing renewable natural resources in ways that make it possible to replenish them.
2. The society should provide temporal space for individual time rhythms and time use patterns in several areas, including economy, ecology, politics and the lifeworld.
3. There should exist space for a cultural diversity of time attitudes and logics who can serve as a counterpoise to the monolithic, linear logic where time is money.
4. There should be place for long-term perspectives in politics. In that way society can minimize the risk of gradually accumulating faulty decisions, meaning decisions that in the short term do not seem to have especially large effects (such as CO_2 emissions), but that can have very serious effects in the long term.

According to these thoughts social time institutions should be reinforced. Not only does this require the introduction of institutionalized time arrangements, as well as a conscious preservation of old, inherited time institutions, such as the work-free Sunday, or various local festivals, such as carnivals. These institutions have even been called temporal commons and are an important societal glue. What they share is that they leave space for a counterpart to the dominance of monetary time logic.[123]

In recent years, the insight that time has a central importance for the general welfare has found expression in various political time projects promoted by rather different organizations and actors. Societal level and degree of local support also varies, ranging from international and national social movements against time shortage, Città slow cities and municipal time offices through visions of a change in the traditional work week with five work days, a weekend and activities in smaller groups, to self-help literature. Time alternatives even offer alternative spatial organization where time and space are seen as interlinked. Yet another shared theme is that a reduced time shortage would improve health.

Perceptions of time have changed over the centuries and have varied between individuals and groups. In this book we have chosen two different, but plausible developments. One is tied to the linear time conception and to the fragmentation and tempo increase that belong to it. The other has stronger elements of the cyclic time conception and relates to a slowing down of the tempo and the re-creation of a less fragmented time use. As has been presented above, increased time pressure tends to lead to increased consumption. Thus differences in consumption patterns are important characteristics of the different time regimes.

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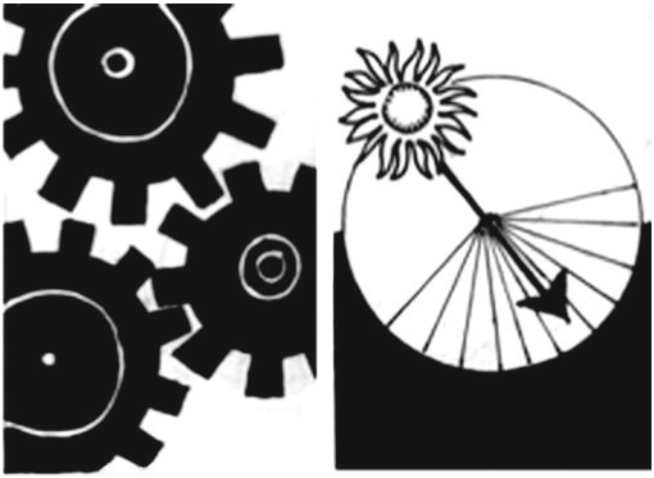
[122] Reich 2001; Scherhorn, G. "Güterwohlstand versus Zeitwohlstand", as quoted in Biervert, B. and Held, M. Zeit in der Ökonomik, 1999, pp. 147–168; Müller, M. "Öko-soziale Zeitpolitik", 1998, pp. 219–237 and Reheis, F. Die Kreativität der Langsamkeit, 1998.

[123] Reisch 2002, pp. 50f.

The following chapters will describe how things are today, some long-term trends and possible alternatives to analyze in relation to residence, food, travel and durable goods. In a closing chapter we will return to the time dimension more explicitly, mapping the time use patterns of today's households and trends in these patterns. Conceivable alternatives to today's most widely spread time use patterns will be discussed as background for a presentation of the two time regimes, namely Fast and Slow.



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Chapter 11
Housing and Other Premises*

Housing satisfies a number of basic physiological and social needs for the households. These include a life-sustaining or even comfortable climate, privacy, an existential base, the possibility for manifesting one's own taste and style, as well as individual design for special needs. Other examples are the division of the social space into arenas for various activities and the control over this space by different persons, households and organizations. The residence is seen as a basic social right serving fundamental needs, at the same time as a large part of the actual use of that residence satisfies desires of a much more exclusive type. For somewhat longer than a century now it has become much easier to use housing in a way that gives high comfort. A number of functions that once called for large work input have by now been mechanized, the most obvious being heating and water supply. This rationalization of housing use and the fact that in the long run energy costs are shrinking, makes it easier to use large surfaces and then in ways that can generate significant energy use. Another factor that has contributed strongly to increased energy use is that both the households and employees have raised their expectations on indoor climate and comfort drastically in just one generation.[1] In Sweden, the housing related energy consumption accounts for between 35% and 40% of the total. Around 80% of the energy used in residences depends on unit size. Thus rather large efficiency gains can be made with improved heating technology and insulation.[2] A collected strategy for reducing energy use in housing should also include a halt to the long-term increase of temperature controlled surfaces and probably a space reduction per capita as well.

The aim of this chapter is to discuss how households utilize the housing, the energy consumption this causes described by function and how the total energy use in all housing could be reduced in the future in order to make conurbations and life therein sustainable over time. The focus is on how the households use housing

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*Chapter written by Anders Gullberg.

[1] Shove, E. Comfort, cleanliness and convenience, 2003, p. 3.

[2] See Chap. 28 and Hedberg, L. et al. Rum för framtiden (Space for the future), 2003.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*, DOI 10.1007/978-94-007-0653-8_11,

or living space, but even on commercial premises used for different purposes. The discussion will also touch on what drives the current development forward towards a radically reduced energy use, as well as what might hinder it.

11.1 Housing Utilization, Land Use and Energy

During the last half century, the per capita housing use by households in Greater Stockholm has increased strongly, as in the rest of Sweden. This is true for residences and summer houses, as well as for premises and serves as an investment factor during the production of goods and services consumed by the households. Sweden, Norway and Denmark have the highest residence surface per capita in the world.[3] Swedes have around 45 m^2 each at their disposal. In Greater Stockholm the space is somewhat lower or around 42 m^2, probably because of the higher cost of living and the smaller number of owner occupied homes – 24% versus 45% in the rest of the country. On an average, owner occupied homes are much larger than tenant-owner or rental properties (see Table 11.1). However, when it comes to summer homes, the households in Greater Stockholm have the use of as much as one fourth of the total stock available in Sweden, though with only a population share of less than 18%.[4]

During the postwar period, residential surface per capita increased dramatically in the Stockholm region, moving from 1.02 room units per capita (room + kitchen) in 1945, to 1.95 in 1990.[5] This is just over a 90% increase over 45 years or an average annual growth of 1.45%. During the same period the population in the

Table 11.1 Housing in Greater Stockholm and the rest of Sweden

Occupancy form	Ownership	Tenant-owner	Tenant	All
Greater Stockholm				
Share	0.24	0.21	0.54	1
Unit size in m^2	133	73	67	84
m^2 per person	49	42	38	42
Rest of Sweden				
Share	0.45	0.17	0.38	1
Unit size in m^2	128	72	68	96
m^2 per person	50	43	41	46

Sources: *Survey of Housing and Rents 2000*, 2002 and *Survey of Housing and Rents 2002,* 2003 (Statistics Sweden).

[3]Danes and Norwegians have the use of more than 50m^2 per capita, a doubling over 30–35 years or an increase of about 2% annually. In Japan, a country with the same living standard, the residential surfaces are 30% lower per capita. Naess, P. "Urban planning and sustainable development", 2001.

[4]Statistics Sweden, Markanvändningen i Sverige, 1998, pp. 37f.

[5]National board of health and welfare, Bostäder och hushåll, 1952.

region grew by around 1% annually. This means that 60% of the very large housing addition during the period has been produced to satisfy the increased surface standard and only 40% to meet the region's population growth.

The area around the residences is also larger in the rest of Sweden than in the Stockholm region. The difference is especially marked when detached and multi-family homes are compared. In the low-rise areas of Stockholm County some 25 persons live on each hectare and 202 in other areas. The comparable numbers for the nation are 15 and 115 persons.[6]

An increase of the heated floor space not only causes an increase in energy used to produce, maintain and most important, to control the temperature of larger volumes. The increase also means an increase in premises surface per capita, according to some estimates as much as double in 50 years.[7] Urban spread and sprawl, and more land used for construction of detached houses in the peripheral and thus relatively cheaper land, cause a steady (per capita) land use increase. The exception was in the 1990s when new construction was exceptionally low.[8]

Increased use of housing surface per capita and land surface per housing surface has led to an increased spread of goal points in the conurbation, to a stretching of local service, a loss of urban qualities and a general increase in distances. The urban landscape has also grown more amorphous with more impediments and interstices, especially the expanding surface traffic areas. At the same time there is a constant effort to fill in gaps and make use of inactive industrial sites. Regional expansion is yet another advancing process that includes a daily exchange of labor force over the increasing distances between the already established population centers.

Not only has this increased surface standard reduced the overcrowding, but the share of households with a very high space standard has also increased strongly. Nationally it was the 45–75-year olds who increased their disposable space most between 1975 and 1990 – by the end of that period as many as 40% had a residence with high surface standard, meaning with more than one room per person, not counting the kitchen plus one other room. In the subgroup between 55 and 64 nearly 60% lived in this spacious manner. Generally however, the share of residences with 'super space' is smallest in the Stockholm area at only 32%, in part because the share of apartments in multi-family housing is higher than in the rest of the country. The surface standard is smaller for that type of housing than for the detached, low-rise type. However, the share of residents with high surface standard living in detached and multi-family housing taken separately is greater in a metropolitan area than in the rest of the country. Nearly 57% of families living in low-rise, villa

[6]Statistics Sweden 1998.

[7]Hedberg et al. 2003, pp. 59f.

[8]In Stockholm's inner city and the housing in the immediately surrounding area, the population density shrank by 7.5% between 1960 and 1990. However, the city's suburban areas increased between 1995 and 2000 by 4%. (Sources: Statistics Sweden, Tätorter 1990, 1991; Statistics Sweden, Tätorter 1995, 1996; Statistics Sweden, Energistatistik för småhus, flerbostadshus och lokaler, sammanställning avseende år 1999 och 2000, 2001 and earlier issues of "Tätorter").

in metropolitan areas enjoy 'super space' and only 15% in the multi-family segment. Both shares are higher than the national average.

A large portion of the 'super space' residences is found in detached villas where persons age 55 and up reside.[9] Other important factors for residential space are income and other financial resources. This is apparent in a spatially segregated conurbation in that the residential size varies between city districts. For example, an area in the eastern section of Stockholm with well situated residents showed a per capita room density of only 0.42, while the comparable figure for the immigrant heavy district to the north was 0.79.[10] The spatial segregation seems also to have increased during the most recent decades as a result of the overall widening of social and financial gaps.

The size of the temperature controlled floor space has always been important in calculating the houses' energy use, but the activities it houses also have a role.[11] Lighting is an important energy item for both housing and premises. Certain activities, including washing clothing and dishes, call for hot water. At the same time heat is released by both humans and devices. Depending on the season, houses may need either heating or cooling. Some 70% of the housing energy is used for heating indoor air and water. The remaining 30% is used for household, property and operational electricity. The need for heating is basically proportional to the surface and represents 70% of the total energy used. Thus the choice on indoor temperature is vital to the energy consumption. Lighting is also strongly dependent on surface, even if some of this item can be linked to activities in homes and premises as work lighting and the like. The use of hot water and circulation pumps is also in much dependent on surface, while the energy used for cooking, washing and office work is more closely linked to each activity. Seen as a whole this means that with the current technology and use pattern, around 80% of the energy used is dependent on the housing surface.

A house receives energy by buying it, plus via any sun panels and heat pumps. Heat is also contributed from devices, insolation and the residents themselves. More discussion of housing energy use and how it can be used more efficiently is found in Chap. 18.

Housing is the dominant construction type. Nationally some 67% of all heated, non-industrial space is permanent residences, mostly detached housing. Figure 11.1 illustrates the distribution of heated non-industrial space in 2000. There were 634 million m^2 of which 6% were summer houses and 27% commercial premises.[12]

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[9] Statistics Sweden and National board of housing, planning and the built environment, Boende 1975–1991, (1993).

[10] Statistics Sweden, Statistical Yearbook of Sweden 2001, Table 77.

[11] This and the next section are based on Hedberg et al. (2003).

[12] There were app. 13 million m^2 more premises surfaces in 2000 than in 1999 or 2001. The difference is mainly in office space. It seems likely that the estimate for 2000 is too large. (Sources: Statistics Sweden 2001; Statistics Sweden, Energistatistik för småhus, flerbostadshus och lokaler, sammanställning avseende år 2000 och 2001, 2002), Energy Statistics for single- and multi-family housing and offices.

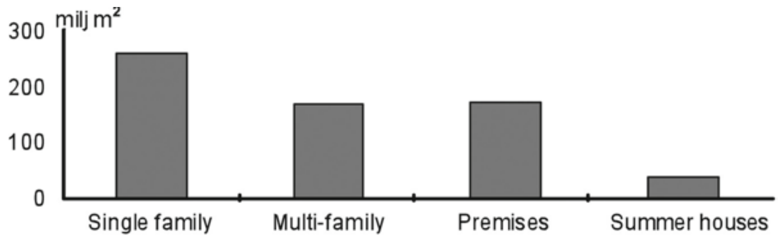

Fig. 11.1 Heated floor space in the whole country in 2000 in million square meter (Sources: Energy Statistics for single- and multi-family housing and offices, 1998/1999, 2000, 1999/2000, 2001 and 2000/2001, 2002. Single family housing includes farming properties and permanently used summer houses)

11.2 Premises

The non-industrial premises stock comprises construction for activities linked to private and public consumption of goods and services. In the country as a whole the total available is 162 million m^2 or about $20m^2$ per capita. Offices, including postal services, banks, tele-service and insurance, is the largest segment at 27%. Care, including daycare and hairdressers, covers 14% and schools utilize 16%. Recreation and culture uses 14% and includes restaurants, hotels, sports facilities, churches, theaters, movie theaters, concert halls and other public meeting places. Shops and stores account for 10% and other premises for 6%. A relatively large segment or 13% cannot be distributed by premises type due to statistical defects. These are premises in residential housing and are thought to include various activities such as trade, daycare and other private services.

Though compiled in another way than those prepared by Statistics Sweden and reported above as also including industrial premises,[13] documentation by the Office of Regional Planning and Urban Transportation (see Table 11.2) states that the premises use per capita is $28m^2$ in Stockholm County or that there is a greater premises intensity than the $20m^2$ reported above for the rest of the country.[14] According to these estimates activities with a wholly local and regional basis amount to almost 25% in Stockholm County. These include such activities as local services, social services and care, as well as health care. If education and administration for local and regional concerns also are included, the share rises to around a third or just under $10m^2$ per capita.

With just over 51 million m^2 local premises in Stockholm County, the surface per worker rises as high as $54m^2$. Still, it is questionable whether such a large aver-

[13] Surface calculations are an extrapolation to 2000 of the Property Taxation List 1997.

[14] Office of Regional Planning and Urban Transportation, Bostad? Underlag för regionplan 2000, 2000.

Table 11.2 Premises in Stockholm County by ten industry groups

	1.000m²	Percent	m² per resident
Knowledge-heavy industry	3,654	7	2.0
Other industry	5,267	10	2.9
Local services	3,759	7	2.1
Knowledge-heavy regional/national services	10,006	20	5.5
Other regional/national services	6,654	13	3.7
Public administration	2,442	5	1.4
Education	4,623	9	2.6
Health care	5,117	10	2.8
Social care and welfare services	2,743	5	1.5
Other	7,008	14	3.9
Totals	51,273	100	28.4

Source: Documentation for *Regional Plan 2001*, Regional Planning and Traffic Administration.

age premises surface is correct. A documentation PM in the regional planning work regarding premises has rather used an average of 44m².[15]

It has not been possible to locate numbers that are reliable enough to compare the premises use in the Stockholm region to that in the rest of the country. However, the relatively high cost situation in the capital suggests that premises use probably is more restrained.

11.3 Institutional Conditions

It is hardly surprising that the housing stock per capita and the consumption of housing and premises surfaces have kept pace with the rocket-like growth in consumption levels. However, there are special conditions that have contributed to facilitate this growth at the same time as an adjustment downward has been countermanded by a reduction of need and financial resources. The gradual and periodically very rapidly increase in surface standard has developed from a situation where overcrowding and lack of housing has been a problematic and at times dominating social problem, especially in growth communities such as in the Stockholm region. In part stimulated by political measures, demand there has far exceeded production capacity. The inertia in the housing sector was not matched in the other household consumption areas, except during rationing periods. This is why there has been a long-term, seemingly institutionalized reaction traceable to the periods where housing was in short supply that a larger residence was preferable to a smaller one. During the entire postwar period, excepting only after 1990, this standard has been strongly supported and at times even encouraged by housing policies that included large governmental and municipal involvement, considerable

[15] Bucht, P. Lokalefterfrågan i Stockholms län (Premises Demand in Stockholm County), 2001.

subsidies to both producers and consumers, as well as price controls in a significant segment of the housing stock. Multi-family housing was the primary recipient of the subsidies. They were traditionally the dominating housing type in the Stockholm region and had become even more so with the massive expansion during the 1960s and early 1970s. Other social norms that developed on the housing market included not taking in lodgers, ensuring that children should have their own room even at a young age and that the residence is retained even after the children move out. The patterns for housing career thus established not only meant a passage from tenant to tenant-owner or outright ownership, but also towards larger housing surfaces per capita.

After WW2 a guideline for social housing policies crystallized stating that no industrial worker should need to pay more than 20% of his or her salary to hold a suitable family residence, at the same time as the official standard for overcrowding gradually became more generous. A significant portion of the older multi-family apartment houses were demolished in the 1950s, 1960s and early 1970s, though this was frequently compensated by a broad new production. The increased access to housing meant that the spatial segregation shrank and some leveling of the space standard between social stratas occurred. The housing policies were successful in that the housing standard was radically improved and household costs for housing kept artificially low through the subsidy policies. At the same time the politics applied held no dampening effect on building costs. It is likely that the share of single-family housing would have been considerably larger if housing production in the Stockholm region had not been as controlled as it has during the last 50 years. Vacancies have been concentrated to newly built apartment buildings in the suburbs, at a time when comparable tenant-owned apartments in some cases lost all value, while villas and semi-detached row houses could be produced and sold.

It is reasonable to describe the housing production and housing policies that developed especially strongly in postwar Stockholm as a relatively coherent housing supply regime. It is a special order of power where a number of different parties have co-operated in the creation and maintenance of a specific system and a certain division of roles, even if there have been some conflicts. The structure was developed by local and national politicians, civil servants and construction industry representatives. Even tenant organizations were included. This regime was effective and successful for producing large quantities in a relatively short time. It was seen as legitimate, in much because of the strong sense of a housing shortage. The communication sector's representatives were also involved, primarily with at first the City of Stockholm and later its county as strong actor in public transport and a strong network of road enthusiasts who supported the expansion of car use and road systems. These combinations joined to build up a relatively well co-ordinated urban building regime. Its efficiency contributed to making the housing stock in the Stockholm region larger than it otherwise would have been. However, there were signs of weakening as early as in the 1970s and by the 1990s the urban construction regime had broken up without being replaced by a new order with as much strength as the one set up in the 1960s. There were a number of converging reasons. In the most recent decades criticism of many exploitation and road projects have grown apace. This has in turn led to delays and cancellations. In those cases where the projects have finally been carried out, they have been both late and more expensive.

Parallel to this development, the housing sector has been hit by immense cost increases, not only in the rental fees charged and housing price on the ownership market, but also in expenses for new production. One example is that real rents rose by more than a third during the 1990s and the housing share of household budgets rose from 25% in the 1980s to 30% around 2000.[16] The primary reasons for this development were changes in tax structures and the effects of putting the national budget on sound footing during the 1990s. The dramatic reduction in housing construction has pushed prices in the housing stock up and some of the new production in the Stockholm region has focused on a relatively small niche of exclusive living. Combined with a continued rise in regional population, the overall effect has been a slow-down in thinning the urban structure and a small annual increase in housing density (0.3%) between 1996 and 2000.[17] Though according to Turner the price rise of 20–30% during the 1990s should have led to a considerably larger consumption reduction in the 10–15% range, only a very modest reduction had been noted by year 2000.[18]

When a family shrinks, an adjustment of housing consumption is delayed as a housing change means large sacrifices for the households. A move has been calculated to correspond to more than 1,000 SEK per month in increased rent.[19] Other reasons for the tendency not to adjust residence for family size include that the household has acquired belongings on such a scale that a smaller residence is hardly attractive, that the financial benefits are limited due to price structure and tax rules, that the housing exchange market functions poorly, and maybe most of all, that the residence plays a very central role as identity object and lifetime project for many families. Another possible reason is that the right type of residence is not available on the local housing market. Study has shown that most of all moves are done over short distances and that these tend to be concentrated to certain areas in such a way that it is possible to state that Stockholm County comprises ten, relatively separate geographic housing markets. In spite of all these contrary influences, 12% of Stockholm residents move every year, a plurality of them 20–29-years old. Very few move after turning 50.

The market of non-residential floor space has been controlled by other mechanisms than the housing segment, though even there big changes have taken place. As it was for housing production, new production and rental levels were officially controlled for several decades after WW2. But there were no subsidies and new projects were

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[16]Turner, B. "Bostadspolitiskt systemskifte" (Change in the system of housing policies), 2001, p. 143.

[17]Office of Regional Planning and Urban Transportation 2000, p. 12.

[18]Turner, B. "Bostadspolitik och samhällsekonomi" (Housing politics and social economy), 2001, p. 189.

[19]Office of Regional Planning and Urban Transportation, Nio gånger i livet: förstudie om flyttning inom Stockholms län, 1997.

implemented only when the building proprietor counted on making a profit and/or needed the premises. During the expansive period up to the early 1970s the shortage of non-residential premises and restrictions on new construction was a notorious problem for entrepreneurs in growth areas like Stockholm. Many governmental and municipal institutions had problems as well, though over a long period there were no financial or other incentives for them to reduce their premises use.

Towards the close of the 1980s a number of deregulations and venturesome credit checks led to over-liquidity, galloping prices and fanciful new-construction projects. Much more so than the housing sector, the premises sector is characterized by rapid fluctuations in new construction and demand. Periods with high vacancy alternate with overheating and strong rental rises. During the latter periods there has been exceptionally strong pressure to household with premises space. Even when it comes to building new office structures, solutions favoring less space have been chosen, such as with very small cell offices in combination with special rooms for meetings or office landscapes. These attempts are seldom completely successful. After a while space use ceases to be as tightly held as was planned. Still, new, more ambulatory work methods have sometimes called for a reduced surface use per capita.

The housing stock seems to change even slower than the residential habits of the population and the desires of the premise users, serving therefore as a tangible, if unarticulated imperative for housing use in the future. At any single point in time, even during high construction cycles, new production is marginal in relation to the total building stock. Thus innovations that presuppose new construction can affect the total energy use of the sector only in the distant future. Changes that can apply through renovation can have a somewhat faster effect. For example using the renovations path the building stock used by the retail sales sector is expected to reach a full replacement level in 20 years or at 5% annually. The typical construction course is strongly fluctuating, a description supported by long lead times for new construction projects, the long life of buildings, lack of geographic flexibility and a heavy dependence on the credit market. Housing production responds sluggishly to fluctuations in demand. A stronger upward price pressure in new construction as compared to the cost picture in the building stock as a whole, creates large problems with introducing new technologies that lead to higher production costs, though with lower, long-term operating costs. This tends to inhibit the introduction of energy-efficient solutions. On the whole, the building and property industry is characterized by lack of flexibility and adaptation to demand, even if the most recent decade has seen motion in that direction. There have been considerable problems adjusting to the phasing out of the much more regulating order in force during the greater part of the postwar period. These problems are in part due to the industry's own traditions and in part to the special role division present. The person who orders the construction is in many cases inexperienced and once the construction begins can find it both hard and expensive to make his voice heard. The building entrepreneur often holds a trump in his hand, in that the final user of the premises or residence is usually not the one who ordered and/or built it. This is a contributory factor to the relatively weak relationship between supply and demand.

Problems for the adjustment to a sustainable development do not, however, lie only in the blocks within the construction industry. There are institutional patterns for the disposition of building surfaces that have led to a lack of flexibility, such as long contracts and difficulties in finding spaces for shorter tenancy periods to serve temporary and/or acute needs. Large portions of the stock is also unused, in the meaning empty of people a significant part of the day, week and year. People spend about two-thirds of their time in their homes and nearly 20% at work. Five percent is spent in other premises and as much on travel and other movement.[20] One cannot, however, draw the conclusion from this that homes are empty one-third of the time since schedules can easily overlap in a multi-person household. Still, since the majority of these households live in apartments with several rooms, the use per room is much lower than two-thirds.

11.4 The Forces Motivating Households and Users of Commercial Premises

Among yesterday's dominating goals and values in the life of Swedes, was the struggle for food, religion, inherited traditions and work towards shared goals. These no longer dominate and their place has been taken by the joys of the consumption society as the foremost motivation in people's lives.[21] In this the residence has become an important identity object and a way to present and differentiate oneself. The reduced existential security that is a result of the loosening of the traditional social bonds has made of the home a place that can provide independence, serve as the base for social relationships, provide an outlet for creativity and create a feeling of belonging.[22] It is primarily one's own house that corresponds to these existential dreams in what Almqvist sees as a continuous intimization – an increased inward orientation towards family life and the residence. Even those who are not so strongly captured by this tendency, increasingly find the home a part of their life project through which the individual identity and presentation to the surrounding world occurs. This includes the design of the residence, its furniture and furnishings, as well as its location. The desire for a home of a suitable size is thus not the only or even the primary motivation when it comes to choosing a place to live. Especially for nuclear families it would seen that the residence is a decisive part of the family project as a setting where one is free to do what one wishes.[23] For many families it is just around the home and primarily

[20] Ellegård, K. "Lockropen ljuder" (The calls sound), 2002.

[21] Daun, Å. Egennyttan och det sociala medlemskapet (Self-interest and social participation), 1982.

[22] Almqvist, A. Drömmen om det egna huset (The dream of a home of one's own), 2004.

[23] Ibid. (as a source).

their own house, that the in part separated, but compatible life projects of the husband and wife can be developed in such a way that tends to partially reinforce traditional gender patterns.

Many married men see the house as an arena where they can express their own creative zest through renovations and expansions. Thus his identity as a capable, skilful and handy person is visibly reinforced and confirmed. In addition to serving as an outsize territory for her own household efforts, one she can refine and be appreciated for, wives see the house as a way to strengthen her husband's orientation towards the home and as a place where family and friends can gather to tie social bonds more closely. The home and especially the family's own house is thus more than a residential machine of a suitable size. In spite of all the tendencies in today's society that mitigate against this dream, such as high divorce rates, fewer nuclear families and women's double work, this increasingly fragile ideal is kept alive and reinforced.

The housing habits of the households are also greatly affected by what is seen as a normal comfort level, a perception that changes over time. A clear example is the demands on indoor climate and on what is seen as a suitable temperature.[24] Attempts to measure and adapt indoor climates to scientifically defined comfortability ignores the fact that comfort is based on inherited habits, ones that even are loaded with meaning for both the person in question and the surrounding setting. The tendency has been to raise the indoor temperature and that expectations and clothing have been adapted to this at the same time as tolerance for high temperature has been dropped. It has even gone so far that it is considered normal to be unaware of indoor climate, seen in this as something automatic that does not require any attention from the users of the residence or premises. This in turn results in an increased energy use through the use of increasingly common combination of heating and cooling facilities. As mentioned, tolerance for both high and low temperatures has dropped drastically and the high temperatures now tend to cause health problems. It has also become standard procedure to increase the capacity of various devices and systems in order to handle increasingly extreme and rare situations. This too increases resource use.[25]

A similar effect has also appeared concerning space standards. What has been seen as a normal apartment size has grown over the years. Larger surfaces and at least one room per person offers a comfortable conflict solution where each family member can choose activities such as TV, computer games or music without consideration for others. In addition, considerable space is kept on hold in both

[24] Elizabeth Shove (2003, pp. 26ff) has studied how the interest of professional physiologists and housing researchers have influenced and contributed to the constantly increasing demands for control of indoor climate ever since it became more possible to measure and control these during the 1920s. Various product and systems for controlling indoor climate have been developed and marketed hand-in-hand with this research activity, at the same time as the households have accepted these products and adapted their habitual behaviors to them.

[25] Shove 2003, pp. 38, 46, 51.

residences and premises in order to handle situations that perhaps only occur once or a few times each year, such as family visits during high holidays.

But dreams of even larger residences remain in spite of the high average standard. Of a representative selection from Sweden's population 14% felt that the home was too small, while 10% wanted a smaller apartment. A similar survey of middle-aged persons in Greater Stockholm revealed that 6.5% thought their home was too large, while all of 27.5% would like a larger apartment, a fact that should be linked to the lower surface standard and higher living expenses in the region.[26]

Shifting living arrangements to more energy efficient habits hold a major challenge, namely not to avoid the question of how the human need for autonomy, relationships and creativity[27], as well as for social status and identity creation[28] can be satisfied and developed in smaller living quarters with more modest demands for climate control than what is currently prevalent.

Even premises, including those with customer contacts and those with only administration or production, are designed to satisfy symbolic values. The fact that sales space and the size of service facilities, their furnishings and atmosphere play a major role for visitor frequency and turnover is well known to those professional bodies who provide advice and proposals in this area. This is true as well for the fact that these premises need adaptation to the product range and the customer characteristics. Office and production facilities are also designed to increase personnel performance and feeling of participation. In both cases it is the size, address, furnishings and accessories that form a central role in the construction of trademarks and in competition for the attention of customers or clients.

Efforts to use offices and sales spaces more effectively are ongoing. This is especially relevant in periods of high demand and rising rents, only to weaken during low business cycles. During the most recent decades the public sector's premises supply has also been the subject of a price press aimed at making them more efficient. One example is the noticeable reduction in school facilities per student. This is also true of the hospital building stock per resident, in this case perhaps mostly via the segue to out-patient care and a reduction in the number of beds.

For a long time now an underlying tendency towards housing with greater size, increased specialization and growing resource utilization has asserted itself. Since the early 1990s this tendency has, however, been kept in check due to special conditions on the housing and premises markets, a tendency that has been created by a complicated interaction between habit, technical system design and capacity, as well as collective conventions and motivations to rise above the crowd and shape an individual identity via consumption.

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[26] See Bergman, B. et al. Hot eller bot? (Threat or cure?), 2002. pp. 86ff.

[27] Almqvist 2004, p. 174.

[28] Shove 2003.

11.5 Possible Changes

There exist underlying tendencies and expectations that housing and premises sizes will continue to increase per capita as the economy grows. The so-called SAME investigation suggested that the home surfaces would grow by 0.75% annually.[29] The same assumption for summer houses gave a growth factor of 0.5% and for premises between 1.0% and 1.3% annually. What then are the possibilities for turning this development around and setting it on a slow reduction of temperature controlled surfaces calculated per capita?

As the development of housing density in the most recent decades has demonstrated, increased costs have a restraining effect on consumption of space, even if the reduction has not gone nearly as far as the forecasts of economic theory presaged. The price press forced on the premises use for a number of public operations has proven more effective. Just the price structure for space can possibly have a role in changing housing and premises use, though primarily in interaction with other changes and various social innovations.[30]

Today large parts of the building stock are empty under significant time segments. Premises and substantial parts of housing are kept ready for future uses or serve primarily to store possessions to be paraded at suitable moments or used at some later time. On closer examination of what actual service the disposition of space in the form of residence or premises provides, it becomes obvious that it is mostly a matter of symbolism. Still, it also serves as a way to handle conflicts and demands. With generous space it is less necessary to make decisions regarding the immense flood of things. Instead it is possible to save them for future disposal and it becomes easier to develop and articulate one's identity through material collections. Potential conflicts and irritations between household members and workmates can be avoided or softened with the help of large spaces. Thus large spaces can be said to bring not only material benefits, but also social comfort. At the same time there are large possibilities for using statistically available space if only the necessary institutional, organizational and technical solutions for a more flexible use were developed. It would also be necessary to extend our life projects so that the material consumption no longer holds so dominant a position.

Measures that could contribute to counteracting space expansion include such steps as allowing short-term use of premises and supplemental housing for special

[29] Swedish Energy Agency Ett uthålligt energisystem (A sustainable energy system), 1998. The SAME investigation was a joint effort involving the Swedish Energy Agency, National Environmental Protection Agency, Swedish District Heating Association and Swedenergy in a study of existing and possible changes in energy consumption from 1995 to 2050.

[30] A noteworthy, though currently hardly possible proposal for taxing surplus space was presented by the future leader of the Conservative Party in the Stockholm City Council on June 30, 1919. What Gösta Bagge's proposal actually called for was a tax on residences with few persons in each room.

needs in combination with reduced space for routine activities in households and organizations. With a well-functioning, affordable market for extra overnight rooms, meeting rooms and party halls both households and organization of various types could manage with significantly less permanent space. Another measure would be to structure a better functioning housing and premises market that could work to let or downgrade in size those spaces currently held for future possible use.

Today large spaces are underused in villas owned by middle-aged or older couples whose children have moved out. With another building design it would be easier to let parts of such houses when the need for space is less – in Norway, for example, many private houses are built as two-family units. There are other ways to stimulate letting parts of residences in order make better use of currently dormant housing space.

If associations, companies and households in various city districts would co-operate in areas with mutual needs, an increase in collective use of space could be created. The largest stumbling block for creating such co-use is the development of suitable organizational forms. Flexible, Internet-based booking systems are useful here as they are in commercial handling of complementary premises and housing rentals.

An interesting concept known as 'facility management' functions to offer tenants not only space, but also a number of other services. It is possible that services of this type, combining space use with a number of additional services, could function to restrain space use. A high standard for service functions and technical equipment could dampen the demand for space.

At the same time as the general tendency seems to be that we acquire more and more things that we store in our homes, there is an opposite tendency. Many technical objects and media for storing information are subject to continuous miniaturization. Another, though still insignificant possibility with some space-saving potential, is the one towards furniture that can be dismantled or inflated.

One possibility that perhaps would not lead to reduced space use overall, but could still carry with it less energy use, is greater use of special spaces for storage of possessions that do not need strict temperature control. An increased general utility in housing and premises is preferable enabling easy multi-functional disposition. As work at home increases, work site space would be reduced and those housing spaces that generally stand empty all day be put to use.

Longer open hours could mean that shop space would be utilized more efficiently, though home sales and e-sales can work for actual reductions in shop space. The same can be true for different types of service and care – a continued shift to work at the home would reduce the premise space needed.

For more than a century the trend has been towards larger temperature controlled space per capita and this increasing energy-intensive demand for temperature comfort places obstacles on the road towards sustainable development. One possibility for breaking this trend would be if it were possible for smaller residences and premises to be developed into challenging, identity creating projects as well. For this to function, it would be necessary to develop activities and displays that wake admiration and respect even on a smaller surface. A flexible attitude must become an integrated, smoothly functioning part of each day as the user relates to the building related territory, to the somewhat smaller residence with unchanged autonomy and to the other premises that no longer can be used nor incorporated in the innermost private sphere.

In the images for the future it is assumed that the living space will generally be somewhat reduced per capita, as compared to today's level of around 40 m^2 per capita in the Greater Stockholm area. The living areas are used more efficiently through differentiated storage and an increased letting of previously well-used housing space. Moving is also more frequent than today with changed family situations, such as when grownup children leave the parental home. In Slow greater space is demanded than in Fast since more time is spent in the home. In both Slow and Fast, the largest space is sought in Low-rise Settlements, somewhat less in Suburban Centers and least in Urban Cores. The differences in the home sizes derive from such factors as how much service exists in the neighborhood. With the more spacious structure of Low-rise Settlements, the average distance to the goods and services desired is longer, which means that more activities happen at home and more time is spent there. Moreover, more job activities will be carried out at home, meaning that those surfaces that each employee uses at the work site will be somewhat reduced. The largest reduction is in Slow, since work hours are shorter in this alternative and the possibilities for shared use of premises increases. This reduction is seen as largest in Low-rise Settlements since working at home is widespread in this alternative.

Table 11.3 illustrates the change in the average home and work site space per capita in the three future images. If Table 11.3 is combined with the assumptions regarding population and work site growth, the results are those shown in Table 11.4 as to the net space supplement.

The current space standard in the housing stock is app. 40 m^2 per capita and in the working sector app. 40 m^2 per employee. The actual numbers are probably somewhat higher, but it is difficult to locate reliable numbers. This means that the current housing stock in Greater Stockholm would reach around 65 million m^2. The comparable estimate for premises would then be around 15 million m^2. The necessary supplement is shown on Table 11.5.

Table 11.3 Change in average housing and work site space per capita in the six future images (in percent)

	Urban cores		Suburban centers		Low-rise settlements	
Image of the future	Fast	Slow	Fast	Slow	Fast	Slow
Housing space	−15	−10	−10	15	15	0
Work site space	−10	−15	−10	−15	−15	−20

Table 11.4 Change in total space in the housing and work site stock in the six future images (in percent)

	Urban cores		Suburban centers		Low-rise settlements	
Image of the future	Fast	Slow	Fast	Slow	Fast	Slow
Housing space	22	30	30	37	37	44
Work site space	26	19	26	19	19	12

Table 11.5 Net addition to residences and work site places in million square meter in the six future images

	Urban cores		Suburban centers		Low-rise settlements	
Image of the future	Fast	Slow	Fast	Slow	Fast	Slow
Housing space	14	20	20	24	24	29
Work site space	4	3	4	3	4	2

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Chapter 12
Food*

12.1 Introduction

Food is necessary for life and must be eaten daily for people to remain healthy and function well. However, how people have related to food has changed in many ways over the most recent century, at least so for the Swedish population. At one time food production for most people was a part of daily toil. Today food has become a consumption commodity and production is mainly separated from everyday life. One hundred years ago more than half the population lived in the countryside, while today the largest part live in cities and conurbations without contributing to food production. Other major changes in the consumption of foodstuffs in Sweden lie in its new found luxury status and in the fact that it is no longer in short supply; yet another factor is that today people tend to buy highly refined products, rather than basic raw items. Finally the ingredients in today's food have been transported long distances in order to be refined and transformed, rather than as before mainly comprised of items produced locally.

There are many ways that the general welfare has benefitted from these changes. Where once the daily fare comprised poor-man's or homely fare, today's table is set with a diversity of items from different parts of the world and various cultures. However the changes have contributed to a number of serious environmental problems. The use of energy, artificial fertilizers and chemical control substances has increased and agricultural production has grown in scale with massive monocultures and biological depletion in its trail. The changes have also separated consumers and producers from each other, thus separating most everyone from plant cultivation and animal breeding.

Today's foodstuffs production demands energy. In the old agricultural society, production was for the most part a closed cycle that used renewable energy to cultivate, refine and prepare food. Today the same sequence is completely dependent on external energy supplies, primarily in the form of fossil fuels. Energy is called for to produce artificial fertilizers and operate farming machines, to dry and store raw materials and to refine them in the food industry. Energy is also needed to transport and distribute the foodstuffs, as well as to prepare and store the food in the homes.

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* Chapter written by Christine Wallgren and Ronny Pettersson.

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The aim of this chapter is to study how the food supply in a future sustainable society might look. The chapter starts with a survey of today's food supply in order to study how various parts of the food chain can be affected. The structure of the various parts, important trends and possibilities for change are discussed in order to determine the conditions for reducing energy use. This is followed by a description of different solutions that might lead to a more sustainable food production and consumption.

The discussion is limited to the food consumed in Sweden. The food eaten within Sweden's boundaries is not produced in Sweden alone as much of it is imported. Nearly 40% of what residents in Sweden eat today is produced elsewhere.[1] The production system studied comprises the cultivated raw materials, the animals that are bred, hunted and fished, as well as the net food import. The situation in the Stockholm region is discussed in other parts of the book, but this chapter discusses the food supply in the country as a whole. We assume that the Stockholm residents eat as the average Swede does.

12.2 Today's Foodstuffs Systems

The foodstuffs systems in place today form a complex unit with several segments that are linked to each other and strongly characterized by large scale and advanced standardization. The first segment is the broad agricultural production comprising plant cultivation and animal breeding, fishing and truck farming that includes the cultivation of fruit, berries and vegetables on both open land and in greenhouses. The next segment comes when the food industry refines and transforms the raw materials. This segment includes abattoirs, bakeries, breweries and the like, as well as industries that refine and preserve or produce semi-products and ready-to-eat dishes. This is followed by the trade segment comprising wholesalers and retailers, after which come the consumers, including individual households, restaurants and industrial kitchens.

Transportation links the segments and this is dealt with as a special part of the system when it comes to describing actors and motivations, as well as energy calculations. There is also a constant flow of artificial fertilizers, feed, packaging materials and additives of different types. Finally come the waste products from all segments, including the farms, industries, trade and households.

During the postwar era the agricultural actors became raw material suppliers in an industrial refinement chain. In a far-reaching specialization and intensification agricultural production became a system for mass-production and mass-consumption. At the same time the markets came to move farther and farther away. During the 1970s some partially new tendencies appeared and the system became more diversified. Mass-production of foodstuffs at low cost continues to be important,

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[1]Carlsson-Kanyama, A. and Engström, R. Fakta om maten och miljön (Facts about food and the environment), 2003, p. 37.

but not as dominating as earlier. The high incomes in significant population groups made increased flexibility possible, as well as the establishment of niche markets where a standardized base product could be custom designed for a specific consumer group. There has also been some movement towards fresh, organically cultivated products such as fruits and vegetables for a global market. Demand for foodstuffs has diversified. One example is the appearance of a "green" food consumption that is satisfied by smaller growers of special crops.[2]

Increased energy use has been the foundation of the foodstuffs system's development in the postwar period. Sweden Statistics (SCB) has prepared input–output data for the Husus project aimed at describing the energy use for food consumption in greater detail. A portion of these calculations is presented in Table 12.1 below.

A report from the Swedish Environmental Protection Agency states that agriculture, the foodstuffs industry and transportation account for one-fifth each of the total energy use in the food category.[3] The households account for one-third and trade for a tenth, all based on numbers describing Swedish food production. The largest variation in relation to the numbers in this book come in the category 'Other segments', whose 18% of the energy use shown in Table 12.1 has no counterpart in the agency's study. This is an effect of the segment focus of that study. In other words, it does not account for the energy use in segments that are not part of the conventional foodstuffs industry. Examples of segments that produce high-energy ingredients for the foodstuffs chain are the chemical and metals industries. To that can be added some 50 actors whose energy use may be small, but whose total use is significant. Another large difference between numbers from the Swedish EPA and the new results in Table 12.1 is that the category 'Packaging' includes foodstuffs related energy use in the pulp and paper industries. This is also missing in the agency's report. Seen as a whole, this means that the energy use related to food shown in the table is considerably higher than what earlier studies have shown.

Table 12.1 Energy use by Swedish residents in the category Food in 2000 distributed over the various segments of the foodstuffs production chain

	Farming fishing	Foodstuffs industry	Packaging etc.	Trade	Transport	Other	Household electricity	Totals
TWh	6.5	5.3	4.3	4.7	4.9	7.6	8.5	42
Share %	16	13	10	11	12	18	20	–

Source: Input–output analysis done using SCB's Input–output tables for 2000 plus some unreported data from the environmental accounts for fuel and electricity use. The SCB' Environmental Accounts for April 2005, are supplemented by energy use for home delivery of foodstuffs (2.0 TWh). Data for trade is corrected by assuming that in trade imported goods have the same energy use as domestic ones. The household electricity use is calculated as a share (22%) of the total electricity use in the households as shown in the SCB data. Energy for the segment 'Electricity, gas and heating facilities' is not included since this energy is mainly counted as electricity.

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[2] Atkins, P. and Bowler, I. Food in society, 2001, pp. 27–32.

[3] Carlsson-Kanyama and Engström 2003, p. 45.

12.2.1 Agricultural Production

For a long time now farming has followed a developmental track characterized by intensification, mechanization, specialization and concentration. There are signs, however, that these trends are weakening somewhat. Diversification is appearing that includes varied production and the addition of activities outside the traditional production areas. Tendencies have been noted of reduced production input and lower production yields per area. This is in part a governmental attempt at solving overproduction problems by taking agricultural land out of production and other measures and in part the development of alternate production systems.[4]

The main focus of Swedish foodstuffs production has long been cereals, milk and meat, together representing almost two-thirds of the production value. The single most important sector is milk, holding around one-fifth of the value, followed by cereals at one-sixth. Most of the cereal production is used as feed for meat production.[5] However, the picture is different if agriculture and fishing is studied from the perspective of what Swedes actually eat. As stated above, agriculture uses 6.5 TWh of energy annually. Meat and dairy products account for one-fifth each, while vegetables, fish and fruit account for one-tenth each and other products the rest.[6]

At 4%, cultivation of fruits and vegetables account for a proportionately small part of Sweden's total production value. Twenty percent of the approximately 250,000 t fruits and vegetables grown in the country is grown in greenhouses. Vegetables such as carrots, garlic, onions, red beets and iceberg salad are mostly grown outdoors, while tomatoes and cucumbers are grown in greenhouses. Apples and strawberries dominate the fruit and berry cultivation. Greenhouse cultivation represents only a fifth of the production in the truck farming segment, while requiring four-fifths of the energy, mainly produced from diesel fuel.[7] The Swedish production of fruits and vegetables covers only a smaller part of the Swedish consumption. Around 40% of the vegetables and 80% of the fruit is imported.[8] According to the calculations of the Swedish EPA around 0.5 TWh are used to transport imported fruits and vegetables by boat from a foreign port or by truck to the Swedish border.[9]

The total catch by the Swedish fishing fleet was 270,000 t fish in 2006. In 1995 it was 310,000 and in 1990 220,000.[10] Questions have arisen lately as to whether today's fishing methods are sustainable in the long term. These questions have led to suggestions for a total fishing hiatus.

[4] Atkins and Bowler 2001, pp. 64–72.

[5] Jordbruksstatistisk årsbok 2003 (Agricultural statistics annual), 2007, pp. 151, 154–155.

[6] Input–output analysis done using SCB's Input–output tables for 2000 plus some unreported data from the environmental accounts for fuel and electricity use. Calculations done by the Department of Environmental Accounts, Statistics Sweden.

[7] Jordbruksstatistisk årsbok 2003, p. 154; Att äta för en bättre miljö (Eating for a better environment), 1997.

[8] Carlsson-Kanyama, A. Personal contact, 2004-11-15.

[9] Att äta för en bättre miljö (Eating for a better environment), 1997, p. 14 and p. 93.

[10] Eurostat. Fishery statistics. Data 1990–2006, (2007), p. 42.

Aquaculture brought in around 5,000 t in 2005.[11] This industry has become more common in countries such as France and Japan; nearly all fish consumed in the Salmonidae family are farmed in these countries.[12] Sport fishing is wide-spread in Sweden with around 3.1 million Swedes stating that they are interested in fishing. The total catch in 2005 was estimated at 46,000 t, of which 27,000 t where used in various households.[13]

The largest part by far of the agricultural production is done using conventional methods with high saturation and large energy input. However, since the 1980s ecological production has grown, though as a marginal if clear trend. The area of certified, organic cultivation fields was around 30,000 ha in the early 1990s, or 1.1% of Sweden's total agriculture area with only 320 certified farms. In 2007, 216.000 ha, or 7% of the area was organically certified, but this is still far from the Swedish governments target of 20% in 2010. In the EU-25, 1.9% of the farms were organic in 2005.

The ecological animal husbandry is still small in proportion to the total number of animals. The number of KRAV approved milk cows increased from 11,000 in 1997 to 24,000 in 2006, or 6% of the total number. Nearly all organically certified animal types have increased since the mid-1990s. The largest increase was for laying hens, going from 46,000 in 1997 to 360,000 in 2006.[14]

One of the arguments for ecological cultivation is that the energy use could be well reduced. A Swedish study of expected energy use in the future (2021) using conventional versus ecological techniques showed that the energy use would be 9% lower with ecological cultivation of winter wheat per kilogram grain.[15] Another Swedish study, this one about milk and meat production, showed that ecologic methodology would reduce the energy use by 50% for meat production and 30% for milk production, both in comparison with conventional techniques.[16]

In a Swiss study the differences in the long term (21 years) showed that energy consumption using ecological techniques in Central Europe would shrink by 20–56% per kilogram grain depending on reduced use of artificial fertilizers.[17] The study included energy use for the production of machines and infrastructure, as well as for fertilizer and control substances. However, the alternate value for energy production was not included in the calculation.

According to a survey of research about ecological cultivation, a majority of the studies suggested that the energy use on ecological farms was lower than on conventional ones. The energy effectivity when growing annual, permanent crops

[11] Ibid., p. 15.

[12] Que choisir, www.quechoisir.org, 2003.

[13] Fakta om svenskt fiske 2006, 2006, p. 12.

[14] Statistics Sweden, Jordbruksstatistisk årsbok 2003, Statistics Sweden, Jordbruksstatistisk årsbok 2009 and Eurostat. Agricultural statistics 2006–2007, 2008.

[15] Kumm, E. "Hållbart jordbruk" (Sustainable agriculture), 2002, pp. 66–68.

[16] Cederberg, C. and Darelius, K. Livscykelanalys (LCA) av nötkött (Life cycle analysis LCA of beef meat), 2002.

[17] Mäder, P. et al. "Soil fertility and biodiversity in organic farming", 2002.

was found to be higher in most cases. The energy use was 21–43% lower for winter wheat and 33–45% lower for citrus fruits and olives in organic (ecological) production than in conventional, counted per kilogram crop. The exception was potatoes. One study indicated a reduced energy use (−19%), while two showed increases (+7% and +29%). One reason for this was the significantly increased need for fossil fuels for mechanical weeding.[18] A survey of four European studies done by Drake and Björklund in 2001 suggested that organic farming is more energy efficient than conventional. When comparing milk production, energy savings of 20–35% were demonstrated in Switzerland and a German study indicated a factor three saving. The third, a Swedish study, showed a reduction by 15% for ecological milk production and 40% for meat production when compared with conventional methods.[19]

In any comparison of ecological and conventional cultivation it is necessary to take into consideration that ecological cultivation generally calls for more land than the conventional. It would have been possible to grow energy crops on the extra surface ecological farming calls for. Thus the net energy this would have supplied should be credited to the conventional cultivation. On the other hand, there are factors suggesting that ecological cultivation could be even more energy efficient than it is today. So far ecological farming has developed to minimize the use of poisons in agriculture. If the focus also lay on minimizing the energy input, it is possible that other cultivation methods would be developed. Thus 50 years down the line the potential for reduced energy use via energy efficient cultivation ought to be higher than the reduction attained today via ecological cultivation.

Its higher price is one factor that slows consumption of ecologically cultivated food. Since 2000 the Consumer Protection Agency has studied price and availability of ecological foods in several municipalities. The Agency has calculated that for 100 SEK more per month a family or a single household can buy a significant amount of ecological staple commodities.[20] Still, the question is whether the consumers are willing to pay this higher cost. Studies to establish which characteristics consumers value most when buying milk, meat, potatoes and bread show that "ecologically produced" is a less meaningful factor. Highest are such values as good taste, long shelf-life and beneficial. The consumers view ecological foods as more expensive, but also more nutritious than conventionally produced ones. However, a positive attitude towards buying ecological products does not automatically translate into actually buying them.[21]

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[18] Stolze, M. et al. The environmental impact of organic farming in Europe, 2000.

[19] Drake, L. and Björklund, J. Effekter av olika sätt att producera livsmedel (The effects of various ways of producing foodstuffs), 2001.

[20] Swedish Consumer Agency (2003) Pris och utbud av ekomat, undersökningar 2002, PM 2003:3 Stockholm.

[21] Kumm 2002, pp. 63–64.

12.2.2 The Foodstuffs Industry

That share of the value of foodstuffs that comprises the costs for the treatment these are submitted to in various industrial processes is constantly growing. Still, the foodstuffs industry has become an increasingly important step between the farmer's agricultural products and the food the consumers buy and prepare. The industrial component varies depending on the type of food. Some foodstuffs, such as deep-frozen vegetables and tea and coffee, have large, natural components, while others have a considerably larger industrial component, such as chicken nuggets, meat replacement products based on soya and a number of fruit drinks.[22]

The foodstuffs industry was heavily restructured during the postwar period, a tendency that was reinforced starting in the mid-1970s. The number of dairies shrank by 58% between 1975 and 2000. Centralization became one industrial reaction to increased international competition. Mass-production of staple foodstuffs was the dominating strategy, though some companies chose a niche production of high-technology health foods. There was also some space for investment in traditional, handmade products. Leading companies entered into strategic alliances – Arla, for example, merged with Danish MDFood in 2000, forming the largest dairy company in Europe (Arla Foods).[23]

Foreign ownership in the foodstuffs industry has grown. What once were Swedish industries such as Findus and Wasabröd now have foreign owners and the cigarette company Philip Morris subsidiary Kraft has bought Marabou, Gevalia, O'Boy and Estrella.[24] Foreign companies have also established production in Sweden, while a new trend is that Swedish companies produce food abroad on license for the Swedish market, including pea soup (COOP) and vacuum packed ready-to-eat dishes (TiFood).[25]

The growing foreign ownership is an expression of a globalization trend in the foodstuffs industry. One of the results is that multi-national companies gain an increasingly strong position in the market. Also it counteracts to some extent another trend, namely the regionalization trend that had provided smaller companies with a regional character a relatively large opportunity to find a market for their products though with comparably small volumes. A third trend is the environmental one that offers a stronger position for environmental brands and to those companies that have succeeded in adapting their production to a closed-cycle system.[26]

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[22] Atkins and Bowler 2001, pp. 74–75.

[23] Molin, L. Mejerisektorn och den nya biotekniken (The dairy sector and the new bio-technology), 2002, pp. 37–39.

[24] Borgström, H. and Sjöndin, K. Mat – vad är det? (Food – what is it?), 2001, p. 114.

[25] Personal communication from Mats Jonsson, TiFood AB, 2002-10-28.

[26] Swedish Government Official Reports (SOU) (1997) Svensk mat – på EU-fat. Betänkande av Utredning om en ny konkurrenssituation för livsmedelsindustrin, 1997:25 Stockholm.

12.2.3 Trade

Trade, and then especially the perishables trade, has undergone a very rapid structural rationalization during the postwar period. Both wholesalers and retailers have been fewer and larger. At the same there has been a revolution through the introduction of self-service, new packaging techniques and new corporate blocks in the form of both voluntary chains and centrally controlled, wholly owned subsidiaries.

The food trade consists of wholesalers and perishables retail stores. The wholesale sector is dominated by the three large market blocks, namely ICA, COOP and Axfood, together commanding more than 90% of the market. They dominate the retail trade as well. The retail sector has developed towards concentration as well, with fewer large stores that account for an increasing share of the total turnover. In 2007 there were 5,500 retail stores in Sweden, to be compared to 7,000 in 1997 and just over 10,000 in 1976. Most of the stores receive their deliveries from one of the three wholesalers. Still, the dominance has been given a turn in recent years, as low-price chains like Lidl have established in Sweden and Bergendahl, the Scanian low-price chain, has broken out of Skåne.[27]

The wholesalers not only have their own production, but also their own store chains. These chains control the range in their stores closely and it can often be difficult for a consumer to persuade a store to order special items. This limits the possibility for a customer to choose items such as lamb or locally produced raw commodities. It also means that local producers find it hard to get their products on the shelves of the local stores. Thus relatively few trade actors have a decisive influence over the brands that are found on the shelves of Swedish stores, at the same time as these same actors develop their own brands. The retail chains have likewise structured their distribution organization, meaning that fewer and fewer distribution terminals distribute to expanding areas within the country.[28]

In the larger cities such as Stockholm the food stores in the inner city are threatened by the increasing number of supermarkets in the suburbs and near the city limits.[29] Yet another trend is that large shopping centers are built in the countryside at reasonable distances from one or more medium-sized cities. These also tend to develop into experience centers suitable for whole-day family excursions.

One trend that has not achieved a large scale breakthrough is the investment in e-trade in the food area. A Lund University study shows that energy savings exist in e-trade with food items in the densely populated areas where the full load capacity of the delivery vans can be fully utilized and a sensible route planning is possible. If some 50% of the daily purchases could be done via the web and the delivery routes average around 70 km, the reduction in energy use would be approximately 30%.[30]

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[27] http://www.livsmedelssverige.org/statistik/butikstyper_00.htm and Statistics Sweden, www.scb.se: Enterprises and employees (FDB) by industrial classification.

[28] Personal communication from Jonas Regnér, Distribution Manager, perishables, Coop Sverige AB.

[29] Fri Köpenskap 2003a (Open trading).

[30] Orremo, F. and Wallin C. IT, mat and miljö (IT, food and the environment), 1999.

12.2.4 Consumers

Everybody needs food for the day. Eating may seem self-evident, something everybody does without thinking much about it. However, eating is more than just meeting nutritional needs. It is one of many allied aspects of people's lives fraught with special meaning. It is a social activity, since most everyone eats in company. The fact that most people live in multi-person households make food consumption less open for individualized tendencies than other areas. Food consumption is also consumption in its literal sense. When the refrigerator is empty, it is possible to arrange for filling it. Earlier decisions do not limit current choices. In spite of a marked reduction over time, foodstuffs purchases are still a major part of our budgets, larger indeed than what is paid out for clothing or entertainment. A significant part of the household time is spent buying, preparing and eating food. Together with living and transportation, food consumption is also one of the activities that contribute most to the environmental impact of households. The households could reduce their environmental load by buying ecological products, avoiding meat, choosing locally produced food and shopping without a car.[31]

For a long time now foodstuffs consumption costs have been decreasing as a share of household expenses, accounting for 14.9% in 2008 (food and drinks, including alcoholic beverages). The share has decreased from 17.1% in 1993. Looking at only foodstuffs, the share has decreased from 13.1% to 11.5%. Drinks are the single largest post in the private food consumption with 23%, where alcoholic beverages took 14% and non-alcoholic the remaining 9%. Meat accounts for 16%, milk, cheese and eggs for 13% and bread/cereal products 12%. Vegetable took 9%, fruit 7%, fish 5%, salt, spices and sauces 4% and butter/margarine 2%.[32]

Foodstuffs production has changed significantly during the most recent decades. More bread and cereal products are consumed, especially pasta, soft sandwich breads and bakery products. Both fresh and deep-frozen meat consumption has also increased, focusing on fowl. However, delicatessen items and meat preserves have decreased. People also eat more vegetables, mainly fresh, but also frozen. The consumption of root vegetables has decreased. More imported fruit is eaten than domestic and less fresh potatoes than potato products like French Fries and chips, as well as less milk and sour milk than yoghurt. Cheese consumption has increased, primarily in the soft cheese variety. People drink more soft drinks and alcoholic beverages and eat more fast food, such as crepes, pizza and pirogues.[33]

Some of these changes in food habits move towards greater sustainability from both an environmental and health perspective, while others do not. The former would

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[31] See Warde, A. Consumption, food and taste, 1997. Regarding food and the environment, see Karlsson R. and Carlsson-Kanyama A. Mindre miljöpåverkan från hushållens konsumtion på Södermalm? (Lower environmental effect from household consumption in the Södermalm district?), 2003, summary of Chapter 7, and Carlsson-Kanyama, A., Engström, R. and Kok, R. "Indirect and direct energy requirements of city households in Sweden", 2005.

[32] Jordbruksstatistisk årsbok 2003, pp. 263, 271.

[33] Carlsson-Kanyama and Engström, 2003; Jordbruksstatistisk årsbok 2003, p. 265.

mean more food from the food groups cereals, fruit and vegetables, as well as an increase in consumption of bread, flour and flakes. Increased consumption of potatoes and a reduced consumption of rice would result, along with a significant increase in the consumption of fruits and vegetables, especially more Swedish and European fruit along with a shift to rougher vegetables and root vegetables. However, there would be less salad greens, as they are generally greenhouse cultivated. Yet another step towards sustainable food habits is a strong increase in the consumption of dried leguminous plants. The total meat amount would shrink and a significant share of what was left would come from Swedish pasture animals.[34] Bulk food would also decrease, meaning food that is not needed from a nutritional point of view, such as soft drinks, wine, sweets, chocolate, cream, chips, dessert cheese, ice cream and coffee breads.[35]

More and more food consumption happens outside the home, something that is made clear in data about the number of meals served in institutional situations. The share of such meals of the total food consumption increased from 14% in 1975 to 19.8% in 1999.[36]

Another trend is that there are more demands for ready-cooked food. This increase has approached 10% annually; in 2002 ready-cooked was bought in stores, gas stations and restaurants for some 15 billion SEK. The boundary between store and restaurant is weakening as the stores employ chefs and the restaurants invest in 'take-away'. This trend is based on a lack of time, increased welfare, poor food preparation know-how, more small households and increased shelf-life with retained quality thanks to technological developments. Yet another reason is that the margins on ready-cooked are higher than on other commodities.[37] People eat larger amounts of prepackaged fast food because they want the food to be easy and simple to prepare. An increased household demand for such food causes more refinement and thus greater resource use in the foodstuffs industry. This is especially true for frozen ready-cooked items. At the same time it is possible that this will result in a lower resource use in the homes. If so, there is a clear trend for the market to take over the refinement that earlier occurred in households or homes, meaning it will move to the foodstuffs industry or to some extent into the stores. The time that the households offer to prepare food shrinks, while purchases take more time than before.[38]

Since the 1970s a health trend has taken a major role in the foodstuffs consumption area. This is a part of the search for a longer, happier life, but also has ties to a growing focus on looks. This trend is expected to lead to increased milk consumption, since milk products are seen as natural, healthy and nutritious.[39]

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[34] Dahlin, I. and Lindeskog, P. Ett första steg mot hållbara matvanor (A first step towards sustainable food habits), 1999, pp. 74–75.

[35] Ät S.M.A.R.T – utbildningspaket om mat och miljö (Eat S.M.A.R.T – teaching materials on food and environment). http://www.mat.konsumentverket.se/.

[36] Storhushållsguide 2000 (Guide to institutional kitchens), 2000.

[37] Fri Köpenskap, DLF appendix 2003.

[38] Regarding the trend towards increased market supply, see Warde 1997, pp. 191–196.

[39] http://www.mjolkframjandet.se/www/mf.nsf/vF/F?open&./vLP/F1B34FD704CC853A41256B29005E93F3~B.

The increased importance of the health aspect is a factor behind growing consumer interest in the source and quality of commodities. Earlier the food debate was mainly focused on price, but there are many indications that quality and source will be just as important in the future. The consumers want to be sure that the item they buy has been treated in an acceptable way and where it comes from. Traceability will probably become increasingly important in the future as people will want to know in various ways where the food comes from and how it has been stored.[40] Food safety and traceability can be attained in various ways. One way to increase mutual confidence is to create a dialogue between producers and consumers through increased contacts. Another way is to use technical information systems that make it possible to trace each ingredient to its source or to get indications that the product has been stored properly. An increased level of traceability and greater knowledge about the product can increase consumer confidence and thus contribute to the creation of new local markets.[41]

There is a strong vegetarian trend, but one study has shown that at the same time some 85% of today's younger generation eats meat at least twice a week. However it is becoming more important for consumers to know that the animals have had a good life and the vegetables have been grown with consideration taken to the environment. Studies of the factors that affect consumer choice of foodstuffs show that they place weight on animal care. It is also especially important that the products are salmonella-free and that the breeding does not create unnatural animals, as well as that the farmer takes good care of his/her animals, feeding them well, letting them graze outside, does not press them hard and does not use antibiotics to increase production. Other important considerations are a minimized use of chemical control substances, an open landscape and ecological production, though not as important as the animal related questions. Good taste and freshness are still varied highest by the consumers.[42]

Some of the trends seem to be heading diametrically opposite directions. One example is that the sales of low-fat, sugar-free products (light products) increases at the same time as problems with fatness and overweight grow. Another is that meat consumption increases at the same time as being a vegetarian is more common. A third is that people go to restaurants more, while interest for cooking increases and food preparation is a household activity that much time is spent on.

Yet another expression for opposing tendencies is the increased polarization between 'required food' and 'adventure food'. During the week most people live under time pressure and eat because it is necessary. The choice is then often ready-cooked, whether at home or not. Many think it would be better to eat 'real' food, but make a choice feeling that fast food is OK in just this situation. However, there is demand for a larger range of fresh fast food. Fast food is also seen as simpler and

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[40] Trend analyst Christina Cheng at the Embrink Design Bureau in Fri Köpenskap 2003b, DLF appendix, Dagligvaruleverantörers Förbund (DLF) (Grocery Manufacturers of Sweden).

[41] Pettersson, L.-G. "Närproducerat i framtiden – LRF:s syn" (The view of the Federation of Swedish Farmers on tomorrow's locally produced food), 2002, pp. 19–20.

[42] Kumm 2002, pp. 83–84.

more time-saving than to fix and eat at home, since there is a desire not to have to plan several days ahead. A desire for comfort reinforces the ready-cooked trend. The concept ‘fix and eat food’ seems to be fading and is replaced by two separate activities, namely ‘fix food’ and ‘eat food’. Cooking is something done on weekends when there is time and then with friends if possible, with good quality raw materials, cooked from the base up and in a well-equipped kitchen.[43]

12.3 Where the Food Comes From

For a long time most of the food people ate came from the local area and the range of eatables were limited by local supply and the seasons. It was not until the second half of the 1800s that new technology in the transport sector made it possible to lengthen the distance between producers and consumers for significant parts of the population. This development continued during the 1900s and in time drastically changed the range of food products in the stores. New preservation method and the development of the food industry contributed to enabling increasing amounts of food to be transported farther and farther, mainly because their shelf-life was extended. Quicker, more efficient transport means were also developed. Cooling technology made longer transport possible for raw materials and ready-cooked products that previously would not have lasted the distance and increased the distribution range for many foodstuffs, such as milk products, fish and meat. With the advent of freezing technology and the techniques for transporting frozen items, the distribution system was increased for both vegetables and read-cooked foods as well.

Today these transports account for around 12% of the food system’s energy use (Table 12.1), but release relatively more carbon dioxide and nitrogen oxides than other parts of the foodstuffs chain since almost all the transports use fossil fuels.

Over the most recent decades foodstuffs production has become increasingly large scale and centralized. This has brought with it more, longer transports of its products. The consumer has become used to and more dependent on access to foods from other countries.

The most recent 40 years have seen a doubling in population, while there has been tripling of the value of international food trade and transports between countries have quadrupled when counted in tons. In the US today’s food normally travels between 2,500 and 4,000 km from earth to table or 25% longer than in 1980. In Great Britain the transports are 50% longer than for 20 years ago.[44] According to calculations from Iowa in the US, a locally or regionally produced meal according to the consumer’s residence would reduce diesel consumption by factors of between 4 and 17, compared with how food is transported today.[45] A study in Stockholm

[43] Carlsson-Kanyama and and Engström 2003.

[44] Halweil, B.“Home Grown”, 2002, p. 5.

[45] Ibid., p. 18.

compared the energy use for transporting 13 different staple foods representing 16% of the consumption from both near and far away. A regular choice of the commodity produced closest would reduce the energy use by around 30% as compared to having chosen the one produced farthest away.[46]

The increased transport are linked to the fact that urban populations have grown and to the technological developments that allow for better food storage possibilities. An additional factor is the development of infrastructure and logistics that have created rapid, long-distance transports. This is all made possible by improved preservation and storage methods, as well as more efficient transports, organization and logistics. This in turn has lowered the costs for handling warehouses and distribution. Yet other factors are that transports account for a relatively small share of the total price for most foodstuffs and that both foodstuffs and transports are subsidized via agricultural and freight support in such a way that transports do not carry their own environmental costs.

The increased foodstuffs trade between different regions and continents offer the consumers a broad spectrum of products previously unavailable, but also has negative consequences. In addition to the environmental effects such as carbon dioxide emissions, exhaust gases, noise, problems in densely populated areas and barrier effects, the food transports means that the food must be treated in various ways in order to withstand long transport distances. Thus the food is primarily adapted to tolerating long transport, instead of focusing on taste and variation. Different chemical additives are needed to ensure that the products do not go bad or ripen too quickly. In this way the food becomes more anonymous and the contact between the producer and the consumer disappears, something that engenders concern among the purchasers as to the original source.

Long-distance trade is frequently cost-effective since foodstuffs industries and nations can buy products on a larger market and thus press the price. However, this has often led to the elimination of smaller, local producers. The loss of local or regional foodstuffs self-support can lead to invisible costs for the environment, the landscape picture and even for farmers. Examples from North America and Great Britain show that when the market grows, the buyers press the prices to such an extent that smaller producers are eliminated. Those that remain are forced to produce at prices that only very large scale, intensive agriculture can manage. It is also doubtful if the financial gains benefit the consumer. It is rather the large foodstuffs actors who profit from the changes.[47]

A countertrend has appeared in recent years that presents a growing interest in and demand for locally produced foodstuffs. In the US, in Great Britain and even in Sweden during the most recent decade, investments have been made in creating markets for locally produced food. This development has provided many smaller producers with a new opportunity to come into contact with interested consumers and find new sales venues. A few of the motivations behind investments in small-scale

46 Sunnerstedt, Spar energi genom minskade livsmedelstransporter, 1994, pp. 57–61.

47 Halweil 2002.

foodstuffs production intended for local markets include a desire to diversify agriculture, preserve a living countryside and satisfying an increasingly aware, demanding consumer group.[48]

In the States the interest for locally produced food has brought many initiatives to the fore for new ways to reach the consumers, including both new distribution forms and new financial co-operation structures. A collective name for these types of initiatives is Consumer Supported Agriculture (CSA).[49] In Sweden one such effort is called 'Bondens egen marknad' – The Farmer's Own Market.[50] The first one began in the southern district of Stockholm in 2000. By 2006 there were 14 markets under this structure in Sweden, with two of them in Stockholm. Currently the Farmer's Own Market is primarily a market place producers travel to themselves to sell and advertise their own products. However, there has been efforts to create an integrated distribution and sales system for deliveries to restaurants, institutional kitchens and local foods stores, as well as direct deliveries in the form of box subscribers.[51]

This development can contribute to reviving the local farms and mean salvation for many small producers that currently do not see any possibilities for managing the generational shift. An increased range of fresh, healthy products could be the result. An increased use of previously unused greens near larger cities would be an additional result. Areas no longer needed for roads and parking lots within the cities could be used to cultivate fruits and vegetables. An increased local production of foodstuffs could even contribute to the reintroduction of local crops, thus increasing biodiversity. There is much that suggests that consumers increasingly worry about how their food is produced and how this affects their healthy and the outer environment.[52]

However, this growing concern is not matched by increased possibilities for influencing the choice of foodstuffs. The globalization of the foodstuffs system has greatly separated production and consumption. Thus it has become harder for the consumer to obtain information about how foodstuffs have been produced and the consumers lack possibilities for informing the producers what they think about the products.[53] Nor are the middlemen of any help in transmitting information between consumer and producer. Even the conditions for local foodstuffs markets have changed completely. Modern communication technology such as the Internet, hand-held computers, powerful logistics programs and the like today provide other possibilities for creating distribution systems that support local markets than once

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[48] von Haartman, F. and Eriksson, T. Närproducerad mat, miljövänlig?, affärsmässig?, djurvänlig?, 2002 (Locally produced food environmentally adapted? Good business? Good for animals?).

[49] www.csacenter.org.

[50] www.bondensegen.com.

[51] www.bondensegen.com (2004-10-20) and personal communication from John Higson, funder of the Farmers Market (Bondens egen Marknad) in Sweden (2004-02-26).

[52] Lyson, T. A. and Green, J. "The agricultural marketscape", 1999, Atkins and Bowler, 2001.

[53] Princen, T. "The shading and distancing of commerce", 1997.

was the case. Such markets could in part satisfy the needs a large-scale foodstuffs system has not succeeded in satisfying. It is possible to imagine a future system for distribution that is more diversified and complex than the current one. Both large-scale foodstuffs production and local markets could be served by it. The different distribution systems could either exist in parallel or be partly or fully integrated. Whatever the case, they should be able to supplement each other.

As has been said above, many consumers show an increased demand for locally produced food since they feel these satisfy better their need for consumer security, quality and variation, while demonstrating environmental adaptation. This development has created new possibilities for small foodstuffs producers to reach the consumers. In many parts of the country initiatives have cropped up in the form of local markets, as well as through subsidies for local production and refinement.[54] Eldrimner, a Swedish regional resource center for small-scale and local foodstuffs production in Jämtland Province, has been given a governmental assignment to develop small-scale, craftsmanlike foodstuffs refinement.[55]

Still, local markets need not automatically lead to reduced energy use. At the Farmer's Own Market, for example, only the nearest farms and certain products could demonstrate less energy use than in the conventional system. In many cases the items are brought in small quantities by personal car, which actually can lead to a higher energy use.[56] In addition it is probably necessary to reconsider the accepted distance for the locally produced concept. In this case, the accepted distance was as high as 250 km, a distance seemingly chosen to get the desired number of supplier to the market. Thus it is obvious that today, the transports of locally produced food is far from energy optimized and that there is a potential for organizing transports from small farms in a much more energy efficient way.

At the same time as the potential is calculated for reducing energy use by reducing transports, it is important to take into consideration that a shift to local production can bring other changes leading to an increased energy use in other parts of the foodstuffs system. Examples of this would include bakeries and dairies, where large-scale industries often are more energy efficient than the small-scale alternatives.[57] Another example concerns the cultivation of apples, where the geographic cultivation necessities make the harvest per hectare around twice as large in France as compared to Sweden, while the energy use per hectare for agricultural machines is the same.[58]

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54 Swedish university of agricultural sciences, Lokal livsmedelsförsörjning och regional mat, 2000.

55 http://www.z.lst.se/pressmeddelanden/pressm_050428.php.

56 Wallgren, C. "Local or global food markets – A comparison of energy use for transport", 2006.

57 Thomsson, O. Systems analysis of small-scale systems for food supply and organic waste management, 1999.

58 Stadig, M. Livscykelanalys av äppelproduktion (Life cycle analysis of apple production), 1997.

12.4 Images of Future Food – Suggestions for Solutions and Alternatives

This survey of trends in the postwar foodstuffs system paints a picture of developments that on the whole have moved towards increased energy use or at least, continued high energy use. However, the picture is not unambiguous. On several areas there are signs of change, even if so far these signs are vague. Some diversification is visible in agricultural production and the ecological production is growing. There are signs even within the foodstuffs industry in the form of regionalization and environmental trends. The investment in e-trade and a growing number of local markets shows that there are indications of a certain diversification even in the trade area. Among the contradictory tendencies in the consumer actions pointing in new directions, the primary ones are the concern with health and the growing interest in origin, quality and animal care. As a whole, these signs suggest that there is a basis for expecting that the foodstuffs system of the future will be more diversified and complex than the systems that have dominated the greater part of the postwar period.

The point of departure for the images for the future presented in this book is what happens in the city and what city residents do. Questions regarding the design of farming is thus outside its boundary. The role of city residents in this context is that they can influence the agricultural focus through their purchasing power. Through their purchases, the urban consumers can decide such things as whether the food will be produced conventionally or ecologically, as well as whether it will be carried out in large or small scale. Thus the influence of the urban residents on the foodstuffs system's energy use is through purchase of the food that has been produced and transported in an energy efficient manner, as well as through the way they prepare the food. In addition, they can influence the system by producing foodstuffs within in the city limits, thus producing some of their own food. These links between the action of the urban residents and foodstuffs production will be discussed here.

12.4.1 Producing Food Within the City Limits

The possibilities for producing food within the city limits vary with the urban configurations. A city with many greenswards offers many spaces for cultivation in such spaces as allotments, backyards, balconies and roofs. Some limited animal husbandry can be organized on suitable spaces, such as in the form of large local fields, though such activity must naturally satisfy hygienic requirements. Socially and culturally such an activity would be valuable for children from a pedagogic point of view and for adults desiring active contact with animals. The local field alternative can also be combined with cultivation plots operated as training sites or for specialized production, both with some possible sales through small, local stores. An increased food production within the city is possible in a future where people have more time at their disposal. It also calls for interest and know-how.

In-city production also reduces transport distances and thus energy use, presupposing that the allotment or the cultivated area can be reached by public transport, on foot or by bicycle. The use of fossil fuels and control substances in the production can also be reduced, provided that fertilizer can be added in the form of composted material and possible manure from the local fields.[59] Another way food may be produced locally is in the form urban agriculture, such as using Vertical Farms.[60]

Growing your own food may seem a nostalgic attempt to return to a long gone era. But the leisure time cultivators in Sweden already produce some 90,000 t of potatoes, as much as 30,000 t of vegetables and around 80,000 t of fruits and berries.[61] The value of being part of the production of one's own food in the future is growing. However, it does presuppose time and access to cultivatable land or space for animal breeding. In a modern version of self-production the community could set aside common land for this purpose, find suitable know-how and provide training. For this to work, there needs to be a community organization and a co-ordinated logistic structure. The urban residents will also need to have time off to plant, weed and harvest, as well as preserving.

Another form of self-production in the households is through the organization of trips to areas rich in berries and mushrooms. The trips can be combined with camp activities for making jam and juice, as well as taking care of the fungi. At this time, moose hunting is an informal activity of this type, although taking care of moose meat today requires a freezer. In the future, an energy efficient technique for storing meat from such activities could be a sous-vide method or an energy efficient method for drying and smoking. In the same way it is possible to set up local bake houses where bread can be baked in modern, energy efficient facilities instead of separately in the home. Common preparation kitchens could also be set up for preserving fruit and vegetables.

12.4.2 Changed Food Habits

Tomorrow's energy use can be reduced if people eat less meat from animals raised on concentrated fodder, as well as less milk and butter products – both of these food groups depend on an intense meat production. The necessary proteins can be gained by eating more meat from pasture animals, more beans and legumes.[62] Another alternative to meat is to choose industrial meat replacements such as quorn, a mycoprotein made from cultivated mushrooms. A reduced consumption of cultivated fish would also reduce energy use, since fish farming is dependent on feed

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[59] There exist drawings for a combined greenhouse/henhouse where the hen droppings are sufficient for the greenhouse cultivation, at the same time as the hens provide some of the necessary warmth. See Segergren, G. "Hönsodlingshus" (Hen houses), 2002.

[60] See www.verticalfarm.com.

[61] Björkman, L.-L. "Fritidsodling ett intresse att räkna med" (Home farming – an interest to take into account), 2002.

[62] Dahlin and Lindeskog 1999.

additives mainly derived from fish captured using fossil fuels. Nearly two-thirds of all caught fish is used for animal feed for chickens, pigs and even cultivated fish.[63]

Yet another way to reduce energy use is to eat fewer vegetables grown in greenhouses heated with fossil energy, choosing instead to eat more grown in the open or in greenhouses heated with renewable energy. One alternative is to heat the greenhouses with biogas extracted from the farm's own waste products. This technology is currently being developed and the first trial facility has been built in Skåne in southern Sweden. In addition to energy in the form of biogas, nitrogen fertilizer is a rest product. Today tomatoes account for around 40% of the Swedish greenhouse production. If these tomatoes were replaced by other vegetables, such as carrots, or changed to more environmentally adapted ways for heating the greenhouses, the energy used in such facilities would shrink significantly. A small hint of the possibilities for saving energy through reduced greenhouse cultivation is provided by calculations of how much energy is used per krona paid for various foods. Vegetables grown in greenhouses come high on the list – iceberg salad requires 4.18 MJ, cucumbers 2.51 MJ and tomatoes 2.86 MJ. This can be compared to lingonberries and strawberries that need 0.25 and 0.29 MJ, as well as to root vegetables with an energy use at 0.40 MJ per krona.[64]

Energy use linked to the importation of fruits and vegetables could be reduced by developing environmentally adapted technology and methods for increasing Swedish cultivation of these products. Increased consumption of such domestic foodstuffs would also be positive from a health perspective. One example is the local production of apples in Sweden. These are stored in ways that make it possible to meet demand 8 months of the year. With such a small-scale, local apple production the need for fossil energy can be minimized for both production and transport. The Swedish climate is well suited for apple cultivation and there are many tasty variants that could be returned to cultivation for sale.

12.4.3 Changed Food Preparation Habits

The energy used for preparing food can be reduced if urban residents would eat more dishes prepared in large batches, either in institutional kitchens, in restaurants or some form of shared food preparation. If the food is prepared at home, largerww batches can be fixed each time and then used in various dishes over several days or frozen for later use. An alternative to eating at home is to eat together with others. A future possibility is to construct some form of housing dining rooms with organized communal food activities much as in today's collectives. Another possibility is to buy food from some institutional kitchen, such as school dining halls, restaurants or personnel dining rooms. It is possible to organize a return system for heat-preserving

[63]Fiskeriverket, Fakta om svenskt fiske – Statistik till och med 2005 (Facts about Swedish fishery) (Facts about Swedish fish and fish consumption), 2006 p. 5; Cederberg, C. and Darelius, K. Livscykelanalys (LCA) av griskött (Life cycle analysis of pork), 2001, pp. 13–14.

[64]Carlsson-Kanyama, A. et al. Household metabolism in the five cities, 2002, Appendix 6.

packaging, a system that could be the same for all institutional kitchens. This would also contribute to a reduction in today's significant waste in these facilities.

Other methods for reducing energy use when preparing food would naturally revolve around improving the techniques for that preparation and for storing. Increased use of microwave ovens and less of normal ovens would contribute to such a reduction. Eating less frozen, ready-cooked food would also help keep energy use down. The frozen food not only needs energy to be stored in the home, but also large amounts for freezing, storing and distribution prior to final use. In the future other techniques for industrial preparation of ready-cooked food will be more common. Techniques exist already that have not yet been accepted, but are much more energy efficient than the freezing technique. One example is the sous-vide technique, another preparation using micro-waves. However, the technique used for the latter calls for very expensive investments. When this is being written, there is only one such facility in Europe located in Brussels. This factory prepares food on license for many European companies, including Tifood from Sweden.[65]

A renewed interest in rejuvenated older methods for preservation, such as drying, lactic acid fermentation and home conservation on glass can ensure that locally produced fruits and vegetable are effectively preserved. This can be done in small, local workshops, through association efforts or in institutional kitchens. A development of this kind will probably call for courses teaching energy efficient food preparation, cultivation and preservation. There will also be a need for instructions that make it profitable to harvest, preserve and perhaps sell these products.

The rejuvenation of local and regional food cultures can also contribute to an energy use reduction by initiating an increase in local production and seasonally informed foodstuffs. This presupposes the spread of know-how to organizations and households, something that can be facilitated as cooking becomes a high-status knowledge and the chef profession is upgraded.

12.4.4 Changed Purchasing Habits

Energy used for transport can be reduced through the development of e-trade with foodstuffs. A Lund study demonstrates that the energy use for shopping trips could be reduced by 26–36% if all households in a given area would shop via the web. The calculation is based on sending a delivery van (today's model) on a route from a picking storage facility direct to the customers within a delivery area with 5,600 customers. According to the study this could work financially with a population of 50,000 within 30 km of the storage facility.[66] E-trade could well be profitable in a metropolitan area such as Stockholm and it could contribute to a significant reduction in energy use for shopping trips. If the calculation above is correct, it would mean that if everyone in the Stockholm area availed themselves of e-trade in the future,

[65]Personal communication from Mats Jonsson, TiFood AB, 2002-10-28.

[66]Orremo and and Wallin 1999.

the energy use for their shopping trips could be lowered by between 50% and 70% as compared with today.

An alternative to direct customer delivery is to set up distribution centers in the residential areas. There were plans for a trial facility in the Södra Hammarbyhamnen in southern Stockholm, but it was not built due to profitability problems. The proposal was that the residents could co-ordinate their purchases of various goods such as chemist's items and clothing with distribution of library books, dry cleaning and packages from e-trade, as well as in the delivery of durable goods such as furniture and garden equipment. It could serve as a suitable model for densely populated areas with many shops within walking distance. It could also be model for areas where many have a more mobile lifestyle, since the items could be fetched when there is time. An extended variant is delivery to special goods boxes at the residence with separate sections for cooled or frozen items.[67]

Other foodstuffs that need more frequent purchases such as milk, bread, fruit and vegetables, as well as such commodities that can be bought at news-stands, in the subway, at restaurants or in personnel dining halls. Ready-cooked food ordered from personnel dining halls, schools, combined restaurants and nondurables stores and the like can perhaps also be delivered in this way. Prepackaged ready-cooked food made using some energy efficient technique such as sous-vide or microwaves can easily be delivered via e-trade or be sold in acute situations at the corner shop. Such dishes can even be found at work sites in the form of food automats that even can heat the food. An ordering system could be set up where the dinner food was ordered via the web in the morning and picked up in the afternoon or evening. A motivating factor might be reduced sales tax for such food.

If, thanks to e-trade, most households could shop for food without a car, the market would adapt itself to the situation. The non-durables trade would then be restructured to serve as distribution channels for such commodities. One effect would be a reduction in personnel costs and store heating needs, the former because staff could be used more effectively in that the need for unpacking and sitting at the check-out would be obviated. Picking for e-trade ought to be much more effective than today, perhaps in part with robots. Distribution to restaurants and shops in the communication system could be done with energy efficient vehicles and via efficient logistics.

Persons living in the countryside could manage without a car if a weekly distribution of food could be combined with availability of last minute purchases in some meeting facility, shop or restaurant where people can meet, such as the library or local people's house. On the condition that there is a functioning public transport system, new meeting points can be created that can carry out the function stores, gas stations and hot dog stands have in today's scattered countryside.

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[67] Stockholms Stad, LIP-kansliet (2001) Samordnad logistik för boende och företag i Hammarby Sjöstad (Co-ordinated logistics for residents and companies in Hammarby Sjöstad) *in* Logistikfunktioner inom Hammarby Sjöstad (Logistical functions in Hammarby Sjöstad), Slutrapport Dnr 209/2000-74/475, 2001; Ericson, U. Handla dagligvaror över nätet (E-trade for food items), 2001; Persson, A. Logistik och e-handel av dagligvaror i Hammarby Sjöstad (Logistics and e-trade of nondurables in Hammarby Sjöstad), 2001.

The role that shopping centers play today as venues for shopping recreation can in the future be taken over by experience centers that also have show rooms and exhibition cases. These would serve as places where clothes could be tried on or food tasted, after which they could be ordered via the Internet. Such facilities would primarily serve for luxury purchases, not for daily needs. Luxury food purchases will in that context be similar to going to a restaurant, though more focused on tasting, and would offer the possibility of taking an exclusive item along at once. Buying special clothing items would include the process of trying on and ordering clothes in order to receive them later via the distribution system. Everyday items such as socks, underclothing, mittens, caps and the like could be bought via subscriptions. These centers should be easy to reach by public transport and cars would not be needed to take the items home.

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Chapter 13
Travel*

13.1 Introduction

Traveling or mobility helps people satisfy a number of needs and creates conditions for the households to shape their own activity patterns. Traveling can also serve other functions than the purely logical ones. Travel targets and means both function as social markers and the traveling can also own a value in itself, in that it can offer the concrete possibility of escaping from something or creating an opportunity for recovery and adaptation between different settings.

The fact that travel is in many contexts linked to positive ideas does not mean that increased traveling always can be seen as an indication of greater welfare. The main point with moving about is often gaining access to something found at another place, such as a person, a work place, a specific store or a certain leisure activity. In this context traveling more can be seen both as an increase in possibilities and as a sign of compulsive mobility.[1] The former means that the increased potential mobility opens up possibilities for reaching so many additional goals that more wishes can be fulfilled than was the case previously. Compulsory mobility arises when societal structures assume that people will travel farther in order to carry out their daily chores.

In a Swedish transport futures study this distinction is described by dividing the trips into 'desired' versus 'structurally forced' trips.[2] The first category contains leisure trips while the second includes commuting, business and shopping trips. Intuitively the separation seems useable in that it emphasizes the differences between trips an individual must make and those they want to. The book assumes that a wish to keep structurally forced trips to a minimum can arise, but it is harder to see why the households would wish to limit the leisure travel, except possibly for lack of time.

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* Chapter written by Mattias Höjer.

[1] Berge, G. et al. "Velferdsvirkninger af redusert mobilitet" (Welfare effects of reduced mobility), 1992.

[2] Steen, P. et al. Färder i framtiden, 1997.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*,
DOI 10.1007/978-94-007-0653-8_13,

Travel has changed radically over the last century. The possibilities for moving about quickly have been greatly expanded by various technical inventions and continued development, as well as a strongly extended and improved infrastructure. Commuting 10 or 20 km is not seen as a problem for those who live in an area with good public transport or who have a car. In combination with excellent roads bicycles have also contributed to making it at least possible to move over longer distances.

Long-distance travel probably changed even more dramatically due to the development of cars, trains and primarily air travel. Each year many Swedes take vacations in some other country – the average number of trips is actually 1.2 per year and some also travel heavily as part of their jobs. Global tourism has increased 25 times during the postwar period.[3]

The time Swedes spend on traveling has not changed as much as its extent. There is even a broad notion that the population's travel time is a historic constant standing at an average of 80 min per day. This 'theory of the constant travel time' has been criticized.[4] The critics suggest that both the theoretical and the empirical bases for the theory are insufficient. Statistics do show, however, that the differences between the time used by men and women has shrunk over the most recent 25 years. The extent of daily travel quite naturally has a very concrete upper limit at 24h. During this time span travel must share the time available with sedentary activities, thus setting a limit for how much travel can increase. This parameter means that when people make decisions about such things as residence and work, daily travel becomes an important factor, one that limits the possibility for and the risk with continuously increasing travel volumes. However, it is important to remember that some of today's jobs that currently are tied to one place can become place independent, thus reducing this limitation on travel possibilities.

An interview survey of 634 households in Greater Stockholm provides support for the notion that travel time is a factor when everyday habits are formed.[5] The respondents were asked to indicate the perceived pros and cons with the usual travel means in their everyday travel, including not only commuting and school related trips, but all travel.[6] Time gained is the reason mentioned by most of those who prefer to use their car for everyday travel. Some 78% of the car drivers choose the car because it's quick. The second major advantage with cars mentioned by 75% of the respondents is its comfort. But even those who use public transport state that time is a plus for this transport means as well, with 56% stating that its quickness

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[3]Frändberg, L. Fritidens globalisering ur ett rörlighetsperspektiv (Globalization of leisure travel from a mobility perspective), 2000, p. 7.

[4]Höjer, M. and Mattsson, L.-G. Determinism and backcasting in future studies, 2000.

[5]Bergman, B. et al. Hot eller bot? (Threat or cure?), 2002, pp. 86ff.

[6]Forty-six percent said the car was the usual travel means, followed by 37% indicating public transport, 8% bicycles, 8% walking, 1% carpooling and 0.2% indicated other means. A number of pros and cons could be listed.

is one advantage with public transport.[7] Among those who state that the bicycle is their usual travel means, all of 72% feel that time is a factor in their choice.[8]

When it comes to long-distance travel it is difficult to see time as a limiting factor in the same way as for short distances. Economics is more of a decider than lack of time.[9] This has been confirmed in another interview survey where it is shown that people would travel more often and farther if they had more money. However, the survey also shows that even more free time would be used to fly.[10]

Even if the time used for travel has not changed as dramatically as trip length, the development of travel has been important for people's activity pattern and time use. An expanded, developed transport technology in combination with improved living conditions and a growing consumption scope have created a dramatically increased freedom of choice. However, this freedom can come to seem illusory if the attempts to realize the multitude of new possibilities rather lead to stress when there isn't time enough to do so. People see life filled with possibilities, but in practice these cannot be utilized as so much of each day is already spoken for.[11]

It is possible to view the increased travel opportunities as one of several ways to change the time balance among the various household functions the population carries out. Though there is no available data showing how the time use has changed historically among just these functions, it is reasonable to think that a well-functioning transport infrastructure would increase the possibilities for shifting between different functions. It would also be easier to fit certain activities into the day that were difficult to find time for earlier, including large-scale shopping or certain leisure activities.

This chapter presents statistics over travels by Stockholm residents prepared specifically for this book. These statistics have not been published earlier and offer a somewhat new picture of the differences between Stockholm residents and the rest of the Swedish population. We have also linked data concerning the travel energy use to the travel statistics, thus being able to show how the energy use varies between the two groups. The focus is on travel data distributed by errand, but we also discuss travel means, trip length and gender variations.

The picture we provide on how much Stockholm residents travel is in part used for comparisons of the travel habits of the two population groups and in part as comparative material in our discussions of how travel and its related energy use can be changed.

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[7] Fifty-eight percent of public transport users aver that it is an inexpensive transport means. Nearly as many or 55% think that it is comfortable to travel on public transport. However, the advantage most often brought forth by the respondents is that public transport is good for the environment – 63% say so while less than 1% think cars are good for the environment.

[8] Sixty-four percent of the bicycle users see it as good for health, 43% that it is inexpensive and 38% that it is comfortable. The environmental gain is stated as an advantage by 49%.

[9] Steen et al. 1997.

[10] Gullberg et al. Bilder av framtidsstaden, 2007, Chap. 28.

[11] Ellegård, K. "Vardagslivets valfrihet – om energianvändning, vardagsliv och bebyggelsemönster" (Freedom of choice in everyday life – …), 2004.

13.2 Today's Trips and the Energy Used for Them[12]

The annual energy use by Swedes for travel, not including goods transports, is app. 75 TWh[13] or a bit more than 20% of their total use.[14] The households are responsible for around 83%. The remaining 17% is used for business trips. Travel conditions vary in different parts of the country. In Greater Stockholm public transport is well built out and has developed parallel to the mainly star-shaped urban structure. In comparison to other cities the well-adapted relationship between this structure and public transport is a condition for a broad utilization of public transport. From an international perspective the share of persons using public transport is logically high in the Greater Stockholm area[15] and in comparison with the rest of Sweden, Stockholm residents use public transport three times as often.[16] Car ownership is also considerably lower in Stockholm than in the rest of the country, a fact most obvious in the inner city.[17]

Flying is a very energy-intensive way to travel, yet it is a transport method that has increased strongly over the last 20 years, both globally and in Sweden, even including the slowdown after 9/11.[18] The composition of airplane emissions and the fact that they are released at high altitudes also means that their contribution to the greenhouse effect is considerably larger than comparable emissions would be at ground level.[19] This is why air travel is a large, growing problem if limitation of the greenhouse effect is the goal. On a national level the contribution of Stockholm residents to this problem is quite large. Drawing on the data in the National Travel Survey (RES), our studies show that people living in the Stockholm region fly 80% more than other Swedes (see Table 13.1). They also fly three to four times as much as part of their jobs, as described in the section on business travel below. In part this can be explained by higher incomes and by access to an international airport. However, should the energy access be limited, it is hard to see how Stockholm residents could continue to fly at these levels.

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[12]The travel data in this chapter is taken from the National Travel Survey (RES). The data derived from the RES database has been prepared specifically for this book. In all runs where long-distance travel is included, data for air travel has been taken from the special database for long-distance travel and supplemented with data for other trips taken from the special database for trips on the survey day. All runs comprise annual averages for 1999–2001.

[13]For sources, see Table 13.1.

[14]According to Chap. 27 the total energy by Swedish residents is app. 350 TWh.

[15]Newman, P and Kenworthy, J. Sustainability and Cities, 1999.

[16]Data taken from the National Travel Survey, RES, annual average 1999–2001, travel means from the measurement day.

[17]The number of private cars in Stockholm City was 363 per 1,000 residents at the end of the year 2009. The comparable figure for the county was 393 and for the country 461. Source: Statistics Sweden 2010.

[18]SIKA, Luftfart 2004 (Aviation), 2005.

[19]IPCC, Aviation and the global atmosphere, 1999.

Table 13.1 Energy use for private trips for Stockholm residents and other Swedes, plus the relationship between these groups, per capita. Annual average 1999–2001

Energy	Stockholm TWh	Other Swedes TWh	Stockholm/other per capita
Car	6.9	41	0.75
Airplane	3.2	7.9	1.8
Subway, commute, local bus	0.7	1.1	2.9
Boat, train	0.3	1.1	1.3
Total private	11	51	0.97

Sources: Travel data from National Travel Survey (RES). Long-distance segments for airplane and for others the means of the day. Energy data from Åkerman, J. and Höjer, M. "How much transport can the climate stand?" 2006.

Summing up it is possible to say that in spite of the fact that an average Stockholm resident flies so much more each year than other Swedes, their energy use for private traveling is no larger than the other Swedes (see Table 13.1). Energy use is distributed in completely different ways so that the very high energy use for air travel by Stockholm residents is offset by a much lower energy use for car trips. However, their 29% air travel share of the total energy use is twice that of other Swedes (15%).

For Stockholm residents Personal and Support are the two household functions that require the greatest amount of energy for travel (80% and 16% respectively). The remainder is for food shopping and various care trips, such as day care driving and medical visits (see Table 13.2). At 92% leisure travel accounts for the lion's share of the part linked to Personal. The energy use here is distributed much the same for other Swedes.

When travel is discussed the focus is often on commuting or support trips. This can seem odd when one remembers that these only account for one-fifth of the private travel, while leisure travel is many times larger. The explanation is probably that the commuting trips are more concentrated in time and thus are significant for if, when and where congestion occurs. Thus they are central in such controversial discussions as congestion fees and new road construction. Leisure trips are not a noticeable factor since they are spread out in time and space, even if there are exceptions with heavy leisure traffic around the larger cities during larger holidays.

People who live in Stockholm spend around 1 h every day on private travel. Thirty minutes are for various leisure activities and around 20 min or a third on commuting. They invest around 15% more time or about 10 min more than other Swedes on private travel. The main difference is that it takes longer for them to get to work (see Fig. 13.1).

Obviously the length of the trip is important for energy use. Around 30% of all trips are shorter than 3 km, but only account for 2% of the total travel. For the long-distance travel the relationship is if anything the opposite. Three percent of all trips

Table 13.2 Energy use in travel distributed by errand; annual average 1999–2001

Private travel	Stockholm residents	Other Swedes
Personal (%)	80	74
of which leisure (%)	*92*	*88*
Support (%)	16	20
Food (%)	3	4
Care (%)	1	2
Total energy use in TWh	11	51

Sources: Travel data from National Travel Survey (RES). Energy data from Åkerman, J. and Höjer, M. "How much transport can the climate stand?" 2006.

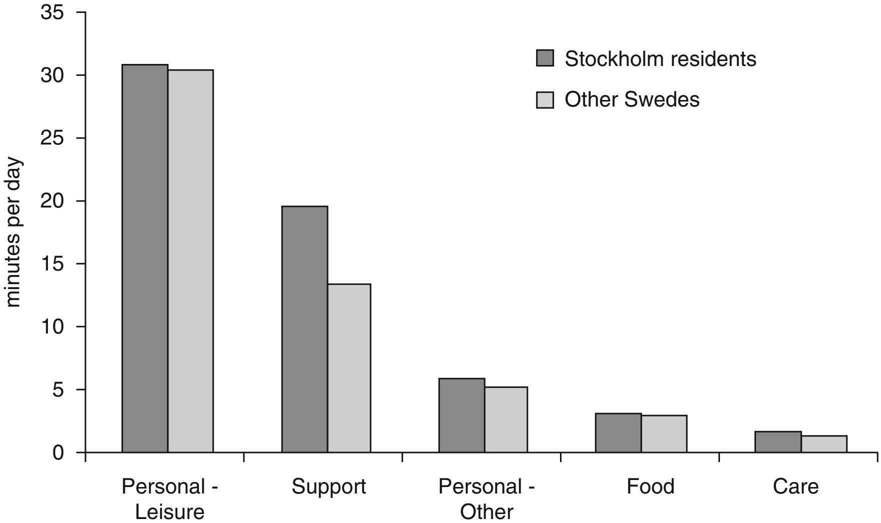

Fig. 13.1 Average daily time use in minutes for trips linked to various household functions. Annual average 1999–2001 (Source: Travel data from the National Travel Survey (RES); trips on measurement day)

are longer than 100 km and account for half of all travel (see Fig. 13.2). In terms of energy use this inverse relationship is even clearer since the long-distance travel mostly is done via flying or driving, while the shorter ones call for walking or cycling. There is no significant difference between Stockholm residents and the other Swedes when it comes to trip length.

In terms of energy use the size of the total pedestrian and bicycle traffic makes little difference, unless it is seen as energy saved. The total walking and cycling done by Stockholm residents is about the same for other Swedes, in both cases they account for a few percent of the total travel. If instead of studying trip length, the number of trips per means used is looked at, one discovers that nearly half of all trips in the Greater Stockholm area are done on foot, as opposed to only one third in the rest of the country (see Fig. 13.3). In addition, a much larger share of all trips are done on public transport.

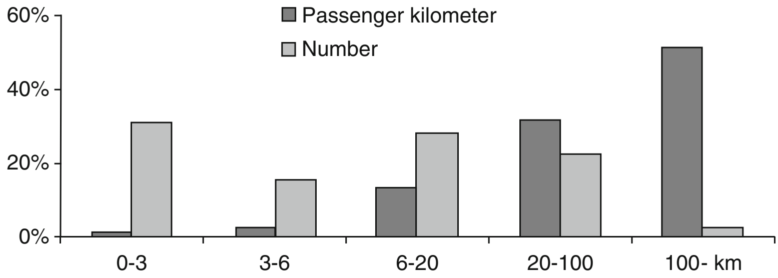

Fig. 13.2 Private trips by Stockholm residents measured in length and number of trips and distributed in five distance classes with the shortest to the left. Annual averages 1999–2001 (Sources: Travel data from the National Travel Survey (RES). Long-distance trips are used for air travel and trips on the measurement day for other means)

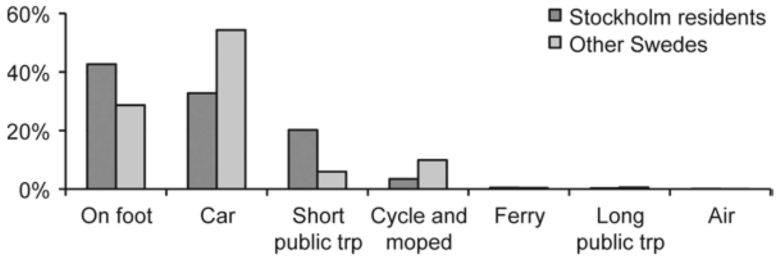

Fig. 13.3 Private travel for Stockholm residents and other Swedes distributed over travel means and number of trips. Annual average 1999–2001. Train, boat and airplane trips are so few as to be unnoticeable (Sources: Travel data from the National Travel Survey (RES). Long-distance trips are used for air travel and trips on the measurement day for other means. In passenger kilometers)

It is a well-known fact that men travel more than women. Discounting work travel, however, the differences are rather small. Figure 13.4 shows that women in Stockholm travel somewhat more than men in non-working hours, while men have somewhat more Support trips, meaning that their commuting is a bit longer. When trip length is used there are no differences.

If instead the number of trips for men and women is used other differences appear. The main one is that men make half as many care trips as women and they do not food shop as often. Shopping and care trips are generally rather short trips. Thus men have a lower share of short trips than women do. But the numbers also illustrate that even for leisure travel men make somewhat fewer trips than women do. The explanation for this disparity is that women fly 20% more than men and those trips are often long. Men drive more, while women both walk and use public transport more. There is no noticeable difference in time use for private trips nor how this time use is distributed over the household functions (see Fig. 13.5).

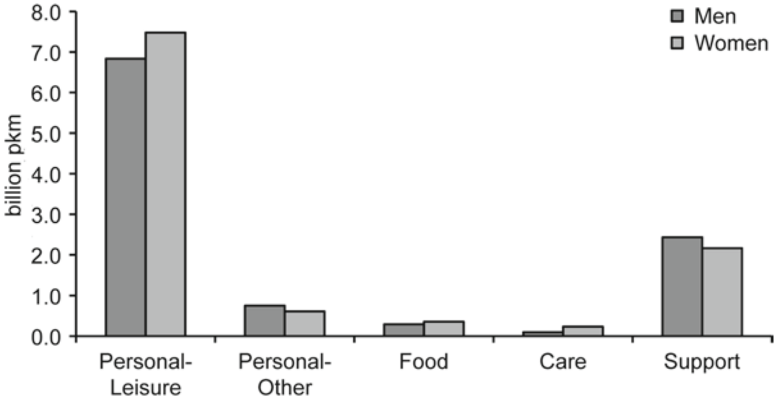

Fig. 13.4 Private travel by Stockholm residents distributed by household function and measured in trip length (passenger kilometer). Annual averages 1999–2001 (Sources: Travel data from the National Travel Survey (RES). Long-distance trips are used for air travel and trips on the measurement day for other means)

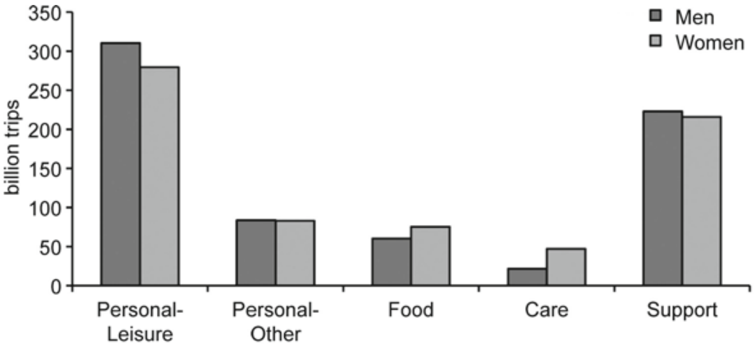

Fig. 13.5 Private travel of Stockholm residents by household functions as measured in number of trips. Annual averages 1999–2001 (Sources: Travel data from the National Travel Survey (RES). Long-distance trips are used for air travel and trips on the measurement day for other means)

13.2.1 Work Related Travel

Work related travel is paid for by the employer, which is why energy use for these trips stated is not seen as a separate item when we present energy use for various household functions. The households have no direct possibility for managing these trips, which is why they are seen as an investment in production of the goods and services consumed by the households. In this chapter we treat work related travel as a separate unit without trying to distribute on the six household functions. This is done in Chap. 28.

Work related travel by Swedes accounts for approximately 3% of the total Swedish energy use or about 12 TWh (see Table 13.3), and one sixth of all travel. About two thirds of the trips use cars, one-third air and a smaller share train and bus.

Table 13.3 Business travel by Swedes using car, airplane and other means. Annual average 1999–2001

Means	Travel (bn pkm/yr)[a]	Energy (TWh)	Share of Stockholm residents (18.2%)	Energy per travel means (%)
Car	12	8	1.4	63
Airplane	6	4	0.7	31
Other	4	0.7	0.1	6
Total	22	12	2.2	100

Sources: Travel data from National Travel Survey (RES). Long-distance segments for airplane and for others the means of the day. Energy data from Åkerman, J. and Höjer, M. "How much transport can the climate stand?" 2006.
[a]Billion passenger kilometers per year

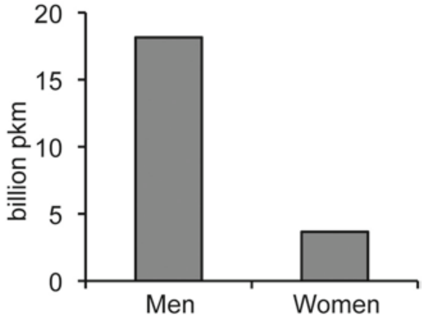

Fig. 13.6 Business travel by Swedes by gender. Annual averages 1999–2001. In billion passenger kilometers (Sources: Travel data from the National Travel Survey (RES). Long-distance trips are used for air travel and trips on the measurement day for other means)

As mentioned above the differences between the private trips of men and women is not that large measured in total trip lengths. However, the differences are considerably larger for traveling on the job – men travel nearly five times as much as women (see Fig. 13.6).

13.3 Change Potential

The Environmental Strategies Research Group (fms) has published a number of reports about sustainable transport systems.[20] As a group these proposals often use a strong increase in leisure travel as a point of departure and have investigated how

[20]In a number of studies of future transport done at the Environmental strategies research group, (later the Division of Environmental Strategic Analysis, Royal Institute of Technology), images of a sustainable transport system in Sweden have been prepared. Examples include Steen et al. 1997, Åkerman, J. et al. Destination framtiden (Destination future), 2000; Höjer, M. What is the point of IT? 2000; Höjer, M. "Telecommunicators in the multinuclear city", 2001, Åkerman, J. and Höjer, M. How much transport can the climate stand? Sweden on a sustainable path in 2050, 2006 and Åkerman J. Transport systmes meeting long-term climate targets, 2011.

such travel could be retained and even increase, at the same time as comprehensive requirement for a reduction in energy use is satisfied. The main question then became how structural required travel could be cut back meaning travel needed to manage daily life, primarily commuting and service. The answer was illustrated as an image of the future. The urban structure in Suburban Centers is closest to the structure in that image and the tempo was most like Fast. In the presentation that follows, the general differences between Fast and Slow are described first. Then we use travel in the earlier image of the future as a representation of travel in Suburban Centers – Fast and close by relating the other structures to Suburban Centers.

13.3.1 Tempo Slow in Relation to Fast

Leisure travel has changed in the same direction in both Slow and Fast, namely that people tend to fly less, but that the combined travel is greater. The tendency has even gone farther in Slow than in Fast. Since people generally have less money, but more time in Slow than in Fast, the move to other travel means than air has gone farther. However, the total travel distances do not differ much between the two tempi.

There is more time for various types of leisure activities in Slow than in Fast. Thus the greater demand means that the localization can be rather spread out and people in Slow can mostly find their favorite activity at a not too large distance. This leads to a greater share of walking and cycling in Slow and that short-distance travel is somewhat greater.

Commuting is clearly less in Slow than in Fast. This is mainly due to the fact the people work less. Many take out the shorter work hours in the form of fewer, but no shorter workdays leading to fewer commuting trips. The non-motorized means are popular because they are cheaper. While in certain travel situations they are slower than car and public transport, the desire to pay for speed is generally less in Slow than in Fast.

The daily, short-distance travel in Slow is mainly comprised of cycling and walking, while car travel remains at about the same level in both tempi.

13.3.2 Suburban Centers

The Suburban Centers structure in this book is very much like the urban structure in the future transport studies mentioned above. In these commuting is about half of today's measured in passenger kilometers, since people travel shorter distances to work and many of them work at home. The large reduction is a result of the fact that many persons with long commuting trips (>20 km one way) change work place to a closer node, since around one half of all people work in a node closer to home.

A simple calculation based on such an image of the future shows that 52% of all commuting trips were shorter than 6 km as compared to 40% today. Ten percent of all trips was replaced by distance work.[21] This is based on the fact that many jobs became site dependent to ensure that the employees would have access to good information and communications technology and learn to use this technology fluently for telecommunication – they become ‘telecommunicators’ with good ability ‘to telecommunicate’.[22] The site dependent jobs make it possible for persons to work closer to home, something that in turn creates a demand for services around places that reach a certain office job concentration. Those who work in a node thus comprise both normal service employees and network employees who have their colleagues spread to other sites.

The highly developed node structure in Suburban Centers encourages shorter service and shopping trips. In general more residents live closer to a greater number of activities. In addition there are well-developed systems for distance purchasing of everyday goods, meaning that it is easier for customers to find, order and return purchases and the companies have created efficient systems for handling orders and delivering goods. In that way the shopping trips are only half as many as currently.

The short-distance leisure travel in Suburban Centers remains at about the same level as today. However, a large share of these trips use other travel means than cars. This is mainly due to the fact that car ownership decreases, but also because the urban structure is more permissive in the sense that the distance to more activities decreases and it is easier to use public transport to other ones. It also means that with reduced car traffic, it is more attractive to bicycle and walk.

The long-distance leisure travel is different from today’s mainly in the reduction in air travel and in that the trips generally are for longer periods. In the most developed image of the future presented by Steen et al. the total air travel is reduced by an average of about one fourth for all Swedes as compared to today.[23] A 25% reduction in travel by Swedes combined with the fact that all travel sinks to a Swedish average means that Stockholm residents fly half as much as they did in 2003. Looking back in time this corresponds to about the levels Stockholm residents had in the mid-1990s. The long-distance travel with other transport means increases when air travel is reduced. In Steen et al. car travel increases by 50% and train travel by a factor of three.[24] If you can visualize the future image Suburban Centers as a part of such a transport system, then car travel would increase less and train travel more than the Swedish average. In this future image car travel is 30% greater per capita than today and the public transport use four times larger. In all the long-distance leisure travel by Stockholm residents is 33% greater per capita than in

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[21] Höjer, M. A hundred nodes in the Stockholm region, 2002.

[22] Höjer 2001.

[23] Steen et al. 1997.

[24] Ibid.

Table 13.4 Travel in Suburban Centers – slow and fast compared to today measured in billion passenger kilometers. Population growth between today and the images of the future is 44%

Suburban Centers		Today	Fast	Change, per capita %	Slow	Change, per capita %
Distant	Car	5	8.5	30	9.4	43
	Public	1.5	8.4	300	8.8	320
	Air	5	3.7	–50	2.9	–60
	Subtotal	11	20.5	29	21.5	32
Short	Car	4	4.1	–20	4.1	–20
	Public	1.3	2.3	30	2.6	43
	P & B[a]	0.4	1.9	200	2.1	230
	Subtotal	5	8.4	11	8.8	16
Commuting	Car	2.2	1.0	–70	0.8	–76
	Public	2.0	2.1	–25	1.8	–36
	P & B[a]	0.3	0.5	35	0.6	49
	Subtotal	4	3.6	–44	3.1	–51
Food and Care	Car	0.7	0.3	–70	0.3	–70
	Public	0.2	0.2	–5	0.2	–5
	P & B[a]	0.1	0.2	100	0.3	120
	Subtotal	1	0.8	–42	0.8	–41
Totals		22	33	6	34	8

Sources: Data for Today from National Travel Survey (RES). Long-distance segments for airplane and for others the means of the day. Other data is illustrative of travel in the Suburban Centers image of the future

[a] Pedestrian & Bicycle

2000, but another type of trip is done now that car travel dominates more and air travel is more marginal (see Table 13.4).

13.3.3 Urban Cores

It is not possible to use exactly the same argument as above for the other two urban structures in the images of the future presented in this book. The commuting in Urban Cores is reminiscent of much of the commuting in Suburban Centers, but there are more really short trips and fewer somewhat longer ones. This is because Urban Cores include fewer, but larger nodes than Suburban Centers. Service and shopping trips in Urban Cores relates to Suburban Centers in the same way as the commuting trips. The daily leisure trips in Urban Cores are at about the same level as in Suburban Centers, but the long-distance travel is greater in Urban Cores. People invest less in a large residence and somewhat more on leisure travel (see Table 13.5).

Table 13.5 Travel in urban cores – slow and fast compared to today measured in billion passenger kilometers. Population growth between today and the images of the future is 44%. The columns stating changes per capita cannot be interpreted as percentage differences between the images of the future and today

Urban core		Today	Fast	Change, per capita %	Slow	Change, per capita %
Distant	Car	5	8.5	30	9.4	43
	Public	1.5	12.5	500	13.2	530
	Air	5	3.7	−50	2.9	−60
	Subtotal	11	24.7	55	25.5	60
Short	Car	4	4.1	−20	4.1	−20
	Public	1.3	2.3	30	2.6	43
	P & B[a]	0.4	1.9	200	2.1	230
	Subtotal	5	8.4	11	8.8	16
Commuting	Car	2.2	0.8	−75	0.6	−80
	Public	2.0	2.4	−15	2.0	−28
	P & B[a]	0.3	0.6	50	0.6	65
	Subtotal	4	3.8	−41	3.3	−48
Food and care	Car	0.7	0.3	−70	0.3	−70
	Public	0.2	0.2	−10	0.2	−10
	P & B[a]	0.1	0.3	150	0.3	175
	Subtotal	1	0.8	−39	0.8	−37
Totals		22	38	20	38	23

Sources: Data for Today from National Travel Survey (RES). Long-distance segments for airplane and for others the means of the day. Other data is illustrative of travel in the Urban Core image of the future.
[a] Pedestrian & Bicycle

13.3.4 Low-Rise Settlements

In Low-rise Settlements life is more centered on home, something that is seen in all trip types and that affects the activity pattern. The most obvious sign is that work at home is more common in Low-rise Settlements than in the other future images. There is even an effect on everyday leisure travel and long-distance trips. Since the recreational activities are in general more widely separated, the daily leisure travel is somewhat greater in Low-rise Settlements than in Suburban Centers, but vacation trips are somewhat fewer. More activities are carried out in the areas near the residence. The long-distance leisure travel is less in Low-rise Settlements since there is less travel to summerhouses in favor of staying home over the weekends and on vacations (see Table 13.6).

13.4 Work Related Travel

As the alternatives to travel become more competitive and the concern about flying grows, business travel becomes less attractive. It has reached the point in the images of the future that people avoid business air travel as much as possible.

Table 13.6 Travel in Low-rise Settlements slow and fast compared to today measured in billion passenger kilometers. Population growth between today and the images of the future is 44%

Low-rise Settlements		Today	Fast	Change, per capita %	Slow	Change, per capita %
Distant	Car	5	8.5	30	9.4	43
	Public	1.5	6.3	200	6.6	215
	Air	5	3.7	–50	2.9	–60
	Subtotal	11	18.5	16	18.9	18
Short	Car	4	4.6	–10	4.6	–10
	Public	1.3	2.2	20	2.4	32
	P & B[a]	0.4	2.6	300	2.8	340
	Subtotal	5	9.4	23	9.9	30
Commuting	Car	2.2	1.4	–55	1.2	–64
	Public	2.0	2.4	–15	2.0	–28
	P & B[a]	0.3	0.6	65	0.7	82
	Subtotal	4	4.5	–30	3.9	–39
Food and care	Car	0.7	0.6	–40	0.6	–40
	Public	0.2	0.2	–20	0.2	–20
	P & B[a]	0.1	0.3	200	0.4	230
	Subtotal	1	1.1	–15	1.2	–12
Totals		22	33	7	34	8

Sources: Data for Today from National Travel Survey (RES). Long-distance segments for airplane and for others the means of the day. Other data is illustrative of travel in the Low-rise Settlements image of the future.

[a] Pedestrian & Bicycle

The alternative is to use a combination of user-friendly telecommunication technology and the telecommunication skills developed since childhood. Indeed, this method is often preferred to the more expensive and time-wise more costly air travel. Thus traveling by air on-the-job is only one third of today's level, fully in line with the images of the future referred to earlier in the studies of future transportation. Statistically this means that work related air travel sinks to today's average level for Swedish women on a per capita basis.

Work related travelling by car has also gone down in the country. As with air travel, it has also been replaced by more efficient communications methods and with better planning. In general, awareness of the costs in time, money and energy leads to a reduction in on-the-job travel.

This type of travel is not noticeably affected by the urban structure, but certainly by the tempo. This is true because work related travel is only relevant to study for the entire country. Urban structure in Stockholm or any similar conurbation has little meaning in that context, while the financial activity level and thus business travel is tied to the tempo.

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Chapter 14
Durable Goods*

14.1 Introduction

There are two types of energy use engendered by durable goods. One is in the production and distribution up to the point of purchase, including such items as ore mining, manufacture, transport and sales. This aspect is discussed in depth in Chap. 16. The other deals with the considerable amounts of energy used in the actual utilization of durable goods. This chapter divides this aspect into two segments, namely energy use in an passive mode and the same in an active mode. All products can be said to generate a certain energy use in their passive mode. Heating a garage is one example. Even a sofa or a pair of skis can be said to draw energy in the passive mode, as they require space in the home. The active mode, on the other hand, includes the energy required to operate or use a product, such as the fuel used to drive a car or the electricity used to keep the refrigerator cold. However, not all durable goods use energy in their active mode. Examples of such include a sofa or a pair of skis, though they can generate some energy use during repairs or preparation.

The durable goods find energy for their operation via one of two dominating energy distribution systems – either for fuels or electricity. Use of electricity in household functions has increased by an average of 3% annually between 1970 and 1998. This increase is mainly due to the shift from oil to electricity for heating, but also to the per capita increase in the number of household devices, as well as an increased use of operational electricity for items other than temperature regulation and hot water. However, the rate of increase is slowing and today is mainly due to the acquisition of more devices, such as dishwashers, freezers, towel dryers, extra TV and computers. At the same time there is counter-effect as older devices are gradually replaced by new, more energy efficient ones.[1]

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*Chapter written by Björn Granberg and Mattias Höjer.

[1]Elåret 2009, Svensk Energi, Stockholm 2010, p. 19 and Wahlström, Å., Olsson-Jonsson, A. and Ekberg, L. Miljöpåverkan från byggnaders uppvärmningssystem (Environmental effect of housing heating systems), 2001, p. 38.

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14.1.1 What Counts as Durable Goods?

What should be classified as durable goods is not self-evident. Eurostat the European Statistical Agency, uses a three-level classification of goods for individual consumption (COICOP-HBS)[2]: not durable, partly durable and durable goods.[3] However, this chapter places app. half of the items listed as partly durable goods according to that nomenclature under fully durable goods, since they cause the type of energy use being discussed. Household expenses for durable goods are dominated by cars and furnishings, such as furniture. Even white goods are included. Items that have been transferred from the partly durable category include smaller household devices, kitchen tools, smaller tools and sports articles, while cloth, clothing, shoes, spare parts, film and video cassettes, toys and books are not included in this analysis.

14.2 Passive Energy Use

The difference between active and passive energy use is not whether an item needs energy to operate or not. The passive energy use is most closely tied to the temperature regulation necessary for the space the item commands in heated premises. In other words, passive energy use can apply both to goods that use energy actively, including cars, freezers and cooling devices, as well as ones that do not, such as furniture. Thus the variation in the passive energy use depends heavily on the size of the item and where it is stored. Washing, maintenance and moving use relatively little energy if compared to heating and have consequently not been studied. Car wash is the exception. The electrical energy used to maintain devices like TVs, video players, computers and similar products in stand-by position are considered an active energy use, as this is a comfort level each device supplies.[4]

The household consumption habits indirectly described above are deciding factors for the passive energy use of durable goods. The more devices are found in the households, the more space is needed for storage and logically more energy for temperature control. It seems our consumption habits have gradually changed starting in the early 1970s and leading up to today's postmodern lifestyle consumption with an increased interest in design. One way this is expressed is that the actual

[2]COICOP-HBS Rev. Dec 1999. This definition is used in the Swedish national accounts.

[3]The exact classification can be found in the EU Regulation n31749/1999, Appendix 1, HIKP's subindex (Rev. Dec. 1999).

[4]In Boudewijn, W. H. "SAVE activities to reduce stand-by losses in consumer electronics and office equipment", 2000, p. 13. The energy used to hold TVs and videos in stand-by in all of the EU-zone has been estimated at 14 TWh 1995. An organization for voluntary labeling of low-energy products called Group for Energy Efficient Appliances (GEEA) was formed in 2000 to propagate for reducing stand-by energy use. GEEA is linked to the European Energy Network (EnR).

function the device is designed for is replaced by interest in play with colors, forms and materials, functions rather of the surface and symbolic charge of the object. However, this play is not as inexpensive as the supply of goods seems to indicate.

The goods range from wallpaper to car tires and are used as life style markers on a very strict pattern. The consumer may be playful, but the possibilities for digressions are limited by the life style s/he consciously or subconsciously has identified with. Life style or taste are linked to price awareness so that that the latter is reduced as the former becomes more sophisticated.

Most of the knowledge regarding taste is passed on via interior decoration journals, fashion magazines, catalogs, advertising and newspapers for various special interests aimed directly at the consumer. However, film, TV and other visual media also contribute strongly to carving out and conveying different tastes and fashion trends. At different stages of this information chain special trademark creators, as well as sales persons play central roles.

It would seem reasonable to assume that because of constant shifts in the ruling fashion trends, households acquire more things than they would have if functional thinking had ruled their consumption habits rather than life style. However, it has proven rather difficult to separate function from fashion. While the basic function of a bathroom would seem to be to keep clean, the design of the same room adds another function, namely to reflect the household's chosen taste to its members and any guests. It confirms the identity of the individual and the family, an identity that is supported and accepted in the public space through the media, shops and the like. Eliminating this second function in durable goods is probably impossible.

Still, design and life style interest need not lead to higher consumption. When it comes to cars, the trend during the late 1990s–early 2000 was that the households placed priority on buying factory-new cars instead of previously owned ones, as had been the case. The households also tended to replace their car less often, thus keeping the one they had longer. It is hard to explain the reason for this change in behavior, though one reason might be that modern cars tend to hold a higher, more even quality over a long period. This higher quality has led to longer life cycles for the cars, something the households have learned. Thus they change cars less often, in spite of the fact that interest for design and of 'having the latest' has shown a parallel increase. The economic crisis that began in 2008 affected the car industry heavily causing big changes in the car manufacturing industry. It is still too early to evaluate the long-term effects of this.

The passive energy use is not affected by the frequency by which new goods replace the old. The decisive factor is if the old items are kept and stored in temperature-regulated facilities and if the collective storage surface grows. Obviously it is possible that households lacking interest in fashion shifts, but having an awareness of the basic functions of things, choose to save a number of things that might possibly become useful. This illustrates that the relationship between life style and passive energy use caused by owning things is more complicated than it might seem at first glance.

It is difficult to forecast the extent to which interest for fashion swings when it comes to consumption goods will be a consistent part of future societies.

Some researchers think it likely that inside 50 years questions about the meaning of life and of spiritual self-fulfillment will command a growing share of our time.[5] Should these presentiments come true today's interest for the consumption of energy and material demanding life style markers could be replaced by a focus on life's spiritual aspects. This would perhaps open up an opportunity for a consumption with lower demands on material and energy.

14.2.1 Passive Energy Use in Cars

Cars call for a considerable passive energy use through the energy needed to build, repair and operate the entire road network, as well as for heating garage place, washing and maintenance of the vehicle.

In 2002 there were app. 60,000 garage spaces in multi-family homes and car park buildings in Greater Stockholm.[6] If, as is usual, preheated air is used for heating the garages, between 2,000 and 4,000 kWh is needed annually for each parking place depending on the heating and distribution technology.[7] Due to more active use and regulations regarding CO levels in garages, heated commercial garages use about double the energy. In comparison a normal-sized detached house uses between 15,000 and 20,000 kWh annually for heating, including garage space if it exists. The garages in Stockholm's multi-family houses use an average total of 200–250 MWh per year for heating and ventilation.

One way to reduce the demand for parking garages is to reduce the number of cars needing the space. In the future, new ownership forms and new ways to use the cars could lead to multi-person use patterns, such as through car pools. A report from the National Road Administration estimates the potential for car pool users at as high as 10% of the population.[8] According to the report those participating in car pools tend to reduce their car use, making an increased car pool activity one typical item in reducing energy use.

Car washing is another area where cars use energy passively as related to their function. However, as compared to garage heating, this energy use is relatively small. Each car in Sweden is washed on an average of 17 times each year in automatic

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[5] Fogel, R. The fourth great awakening and the future of egalitarianism, 2000.

[6] Statistics Sweden, Intäkts- och kostnadsundersökningen för flerbostadshus, 2004.

[7] Commercial garages use 3,938 kWh/car and year, calculated on an airflow of 10,800 m^3/h for every 100 parking spaces and a fan effect of 5 kW per 100 parking spaces, and 8,760 operating hours per year. Housing garages use 1,969 kWh/car and year, calculated on an airflow of 5,400 m^3/h for every 100 parking spaces and a fan effect of 2.5 kW per 100 parking spaces, and 8,760 operating hours per year.

[8] Swedish Road Administration, Gör plats för svenska bilpooler (Make way for Swedish carpools), 2003, p. 88.

washes using an average energy of 5kWh/wash.[9] Thus each car uses an average of 85kWh/year. Washing a car once uses as much energy as for five clothes washings.

14.2.2 Passive Energy Use in the Home

According to author Ludvig Rasmusson, as much as 20% of the living space can be saved with new, less space-demanding technology.[10] But the fact that the average body weight is steadily increasing makes it difficult to shrink housing space that much. Beds, sofas, easy chairs, other chairs and pieces of furniture adapted to our body size will hardly shrink without breaking that growth trend. But Rasmussen may still be on to something. Wall-mounted, flat TVs take much less space than the old, rather bulky TVs, portable computers replace work stations and movies and music are now to a high degree stored on various hard discs instead of in furniture-like CD holders. However, these developments are not controlled to any great extent by the household energy use, but by the rapid development of electronic products. Even so, a reduced space demand can still be seen as something positive, especially since the energy use tends to shrink as the devices get smaller. In order for the reduced demand for space to result in smaller living spaces and not simply to more spacious apartments, something more than just smaller products is called for.

14.2.3 Trends in Passive Energy Use

It is difficult to say anything about trends in the question of passive energy use. One conclusion is that the link is weak between product life/quality and passive energy use when it comes to durable goods that do not need energy to function. The determining factor in this is simply whether the households throw or otherwise dispose of the items at the same rate as new purchases are made or if they choose to store increasing amounts of items in their homes. It is also possible to state that cars parked in heated garages have a large passive energy use. This means that the passive energy use can form a large part of the car's total energy use. This share will be especially large if a fuel-efficient car, drawing no more than 0.5 l gas per 10 km (or 47mpg)[11] is parked in a residential garage where the heating system lacks thermostat, heat exchanger or other devices to reduce energy use. In such cases

[9]Swedish Standards Institute, Förstudie bilvårdsanläggningar (Preliminary study for car care facilities), SIS Environmental Certification, 1999.

[10]Rasmusson, L. Det intelligenta hemmet (The intelligent home), 2000.

[11]This number corresponds to the Swedish government's definition of 'eco cars'.

the annual fuel used corresponds to app. 7,700kWh[12] while the garage space can use up to 4,000kWh (see above), meaning that in extreme cases the passive energy use can be a third of the car's total energy consumption.

Thus the trend is that the share of the car's passive energy use will increase for fuel-efficient cars, assuming a constant energy use for garage heating. It is, however, very likely that large energy savings can be found by using more efficient heating and fan systems in garages.

14.3 Active Energy Use[13]

Approximately 40% or around 40 TWh of the energy bought by households as fuels or electricity is used for operating various types of durable goods.[14] Most of the rest is used for heating. The large energy used in the operating phase presents a major potential for reducing energy use by improving efficiency or reducing use that is greater than the potential for energy reductions through more efficient goods production.

This also means that the households have large possibilities for affecting this energy use themselves and that there are many functions that can be changed towards energy efficiency. Table 14.1 lists the annual energy use for a number of durable goods.

A comparison between fuel driven cars and electricity dependent goods can be done in several ways. Here we have chosen to present the comparison as primary energy where the energy consumption for the production of car fuel is set at 18% of the energy poured into the tank and where the electricity production efficiency is set at 100% with a 5% loss in distribution. In certain contexts a much lower efficiency coefficient is used for electricity production. If the losses in nuclear production are included, the numbers for electrically operated goods in the table should be multiplied by 1.5. These are usually estimated at a factor of 2.7 and represent around 50% of Sweden's electricity production

As the table shows, the car clearly consumes most energy. The energy use by such items as floor heating and towel driers is also large. How many people know that the convector radiator (electrical element with fan) used to heat a veranda or glazed-in balcony a few hours per day during the coldest months of the year, uses more energy than the refrigerator and freezer combined?

Comparisons of this type and this kind of table are a popular way for energy advisors to try to raise awareness in the general public about what electrical devices actually consume. The necessity illustrates that the household lacks continuous information about the energy use of their electrical devices.

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[12] See Table 14.1 for calculation details.

[13] In this chapter 'durable goods' refers only to consumer products that need energy for use.

[14] See Chap. 27.

Table 14.1 Durable goods ranked by annual energy consumption

Goods	Effect W used	Utilization time	Days/year[a]	kWh/year[b]
1. Car[c]	0.084 l/km	15,000 km/year		13,000
2. Heated garage[d]				3,000
3. A/C (central, 3 t)	3,050	11 h/day	51	1,900
4. Floor heating – 7 m^2	$100/m^2$	Thermostat		1,800
5. Convector radiator	2,000	6 h/day	120	1,500
6. Older freezer	200	Thermostat		1,100
7. Aquarium (250 l)	114	24 h/day		1,000
8. Water bed	300	Thermostat		800
9. El towel dryer	80	24 h/day		700
10. Older refrigerator	150	Thermostat		600
11. Stand-by[e]				600
12. Window A/C	1,100	11 h/day	40	500
13. Drying cabinet	2,000	4 h/week		400
14. Car, passive cost for unheated garage[f]				400
15. New freezer	120	Thermostat		400
16. Dish washer (energy class A)	1.05 kWh/time	1 time/day		400
17. Airing unit for private sewer facility	70	Timer		400
18. Hob (flat stove)	1,500	40 min/day		400
19. Coffee maker	800	1 h/day		300
20. Oven	2,500	2 h/week		300
21. El sauna unit	5,000	1 h/week		300
22. Infra heat	$2 \times 1{,}000$	4 h/day	30	300
23. Light rail	12×40	3 h/day	120	200
24. Car heater	900	2 h/day	120	200
25. Washing mach. (energy class A)	1 kWh/time	4 times/week		200

(Sources: Apple Computer, Electrolux AB, Energy Star, Hydro-Québec, Swedish Consumer Agency, Mid-Carolina Electric Cooperative, Pillai and Shin, Statistics Sweden, Swedish Standards Institute, Vattenfall AB, Öresundskraft AB, National Automobile Association)

[a] Unless otherwise noted means all days of the year

[b] Energy use for all goods except the car is multiplied by a factor of 1.05 in order to account for a loss during electricity distribution of app. 5%

[c] Average fuel consumption for new cars according to the National Automobile Association. Annual driving distance according to the Swedish Consumer Agency guidelines. Production and distribution of fuel 18% of consumption according to Johnsson 2005

[d] Heated garage in multi-family housing incl. energy for ventilation. A heated garage is not a durable goods, but included for comparison

[e] Combined stand-by consumption for a flat, 17″ computer, mobile tele-charger, printer, parabola, video, TV, laptop and stereo

[f] 500 W engine heater and 900 W car heater

When electricity is distributed the energy is allocated exactly according to the need of each device. However, when the consumption is invoiced to the household, the total use for all devices, including any electricity for heating, is listed as a single sum. This system of invoicing hides important information about the energy use and expense for each separate device and thus what it costs to use it. Thus the invoicing system makes effective savings more difficult for the households. It also prevents households from obtaining specific operating costs for individual devices in a simple, direct manner. The market signals become even more complicated for households that pay for their own electricity use, but whose landlord pays for the white goods.

Starting with the oil crisis in the mid-1970s, consumer organizations and other energy advisors have sought to solve this lack of information using information campaigns and counseling. Today even power companies inform the households on saving electricity. However, these power companies have no inherent reason for helping the households reduce their energy use. The information they supply is completely based on demand and answers only those questions actually asked. Thus their involvement goes no further than to satisfy those customers who make demands and provide them with the information they request. There is also some customer information in their company magazines.[15]

Over the most recent decades the European Union and several larger organizations have introduced both obligatory and voluntary marking of especially energy demanding goods in the shops in order to move the market towards energy efficient variants.[16] This pressure on the manufacturers has resulted in a strong development of energy efficient products. White goods have been labeled longest and their energy use has been halved since the early 1980s.

There are, however, many other durable household goods that use energy to work, but that are not energy labeled. The energy efficiency for these has improved more slowly than for the white goods. The reason is not that the consumers are uninterested in the energy use, but probably that knowledge of how to reduce it is limited. Single consumers may also feel that they cannot affect the market. Should these two factors change, there are excellent possibilities for increasing the energy efficiency of many more, common durable goods than just white goods and computers.

14.4 Energy-Efficient Durable Goods?

For many individuals consumption and consumption choice have become more important for their identity than even their job choice during the most recent decades. The links between trends for using durable goods and their energy

[15] Telephone conversation with Gert Honner, Information Director for Electricity Supply at Vattenfall, 10 Nov 2003.

[16] "Whereas the provision of accurate, relevant and comparable information on the specific energy consumption of household appliances may influence the public's choice in favor of those appliances which consume less energy, thus prompting manufacturers to take steps to reduce the consumption of the appliances which they manufacture; whereas it will also, indirectly, encourage the efficient use of these appliances; whereas, in the absence of this information, the operation of market forces alone will fail to promote the rational use of energy for these appliances." Quoted from the Council Directive 92/75/EEC 22 Sept 1992 on labeling and standardized consumer information for the energy and other resource consumption of household devices.

consumption have mainly dealt with the users' awareness of the amount of energy a product consumes and what that energy costs. Today various authorities and many energy producers clearly seek to raise the awareness level of users and consumers since this would lead to large environmental profits should the consumers choose energy-efficient alternatives. The aim is to persuade the users not only to use less energy, but also as they buy new items to affect the market in such a way that the manufacturers increase their efforts to develop devices using less energy.

The incentive for the manufacturers to increase the energy efficiency of their products and thus to reduce consumer energy consumption is informed by the profitability of such measures. However, energy use is only one of several qualities of an item and the other ones can easily gain in importance if the improvement is marginal. There is no question that the trend towards more information and labeling of electrical devices is important, since the efforts of the manufacturers to develop energy-efficient products in a market economy reflect the weight the consumer places on energy used as compared the device's other qualities.

There already exists an awareness regarding white goods and heating aggregates for detached houses. The consumers use the knowledge to affect the consumption choice. The same is true for cars where a wide-spread awareness regarding fuel consumption and energy costs affect purchasing, though until recently only to a limited extent. There is also an awareness that the exhaust emissions are an environmental threat. The other characteristics of the car dominate consumer choice and thus the producers' development and marketing strategies. With a combination of unstable price on fuel and economic instability, the importance of low fuel consumption has become a quickly growing demand on new.

14.4.1 Use of Durable Goods in the Future

There are many desirable changes when it comes to the energy use of durable goods, especially a reduced use of fossil fuels in vehicles. New solutions that promote a more efficient use of transport means should be coupled to breakthroughs in the development of new propulsion technologies with considerably lower emissions than today. When it comes to items in the home the active energy use can be reduced by using a pay-as-you-go system for electricity that provides the users with clear, continuous information about what each electrical device costs in use. One step in this direction could be a more extensive energy labeling of products in the stores.

A reduction in passive energy use would be a result of a shrinking interest in goods consumption and a development of smaller products, especially then furniture and cars. Shared goods use would also lead to reduced passive energy consumption, as well as creating the possibility of reduced active energy consumption too. The reason for the latter is that it would become increasingly financially profitable to invest in energy-efficient goods when their variable costs for energy use become a larger part of the total cost.

14.4.2 Fewer, More Compact Goods

A future scenario where the households own fewer products is desirable from some perspectives, though perhaps less so from others. On the positive side the primary plus is the fewer are owned, the less storage space is called for. Fewer and smaller items, such as smaller desks, bookcases and sofas, can lead reduction in the average size of heated living space that in turn would lead to a reduced energy use for heating.

14.5 Durable Goods in the Images of the Future

The following paragraphs provide a picture of how having and using durable goods might appear in four of the six images of the future. The discussion is limited to two of the urban structures, namely Urban Cores and Low-rise Settlements as they are extremes in this.

14.5.1 Low-Rise Settlements – Fast

In a conurbation that has spread through low-rise construction with many, local centers with a high tempo, time is in short supply. The consumption of durable goods is affected by both the sparse spatial dimension and the tempo. The restrictions on the households to acquire many large goods are weaker than in a denser urban area where the residences generally are smaller. The high tempo and time press joined to higher incomes persuade urban residents to have a comparably large interest in staying in the forefront of trends. The technological development is strong and focused on energy-efficiency and design.

In order to counteract a development towards a high-consumption society where the goals for sustainable energy use are difficult to attain, the technical development of energy-efficient goods has moved apace and a comprehensive producer responsibility for recycling durable goods has been introduced.

The conditions for shared use of small devices are affected negatively by the residential sprawl. Even the shortage of time makes shared use more difficult, since the expense of waiting quickly offsets the expense of buying the item for each of the separate households.

Public transport provides the best service in densely built-up areas and is negatively affected by sprawl. Even the shortage of time affects public transport negatively, provided of course that the traffic infrastructure is built out to an extent that makes it a good alternative. For these reasons car ownership is comparably widespread in this image of the future.

14.5.2 Low-Rise Settlements – Slow

As in the Fast alternative, the households have lots of space to fill with many, large things. However, the calmer lifestyle puts a brake on the consumption flow and makes it more possible for the households to share seldom-bought durable goods. Still, the sparse residential pattern has a negative effect on rental business opportunities, while the slower tempo does benefit local collective organized solutions.

14.5.3 Urban Cores – Fast

A dense urban structure in combination with a high tempo is the contextual situation where the residents like to show off their lifestyles in public spaces. Clothing and personal accessories will therefore be important aspects of the consumption of durable goods. In this image of the future the potential for object reductions is the greatest. The incentive is not only that the dense structure offers limited storage space, but also that the need for portable and thus presentable products is greater. A plethora of electronic products have been developed specifically designed to be fastened around the wrist, that ultimate place for presentability and accessibility. These are greatly integrated in the same unit and include computers, telephones, keys, calendars, cameras, music devices and payment means. The high-tech world and the dense urban structure open up possibilities for joint-use of seldom-bought items. Systems have been developed that can quickly localize the item geographically and the rental can be administered electronically between users without the need to go to a rental facility.

Public transport is favored by the dense urban structure. Private carpools have been replaced by companies that operate selling car services governed by need, enabling a large number of members to share the company's car fleet. Such a system can be likened to a hybrid between public transport and private car use. Each vehicle is used more and the actual cost of the trip is fully apparent to the user. Another advantage is that alternate travel means can more easily be compared. This favors both public means and other private alternatives, such as bicycles, minicars, e-meetings and e-shopping. Private car use still exists, but in a more limited scope than in the other future images.

14.5.4 Urban Cores – Slow

A dense urban structure with a comparably Slow tempo is a setting where local culture is favored over consumption. The slower tempo enables a greater range of services between people, as it does a greater involvement in nonprofit operations. One can imagine that intellectual and/or spiritual values grow in this scenario and counteract the consumption culture we know today.

In other words, in addition to the dense structure that limits consumption by offering smaller storage capacities, there are several reasons for assuming that the consumption of durable goods will be less in this image than in the others. The image also comprises advantages for public transport solutions over private car use. Time for contemplation make walking and cycling popular transport modes and the conditions are very good for sharing durable, seldom-bought goods.

14.6 Conclusions

Market mechanisms could be used more advantageously than is the case today in order to control the energy use of durable goods. A good example is that the EU market for certain white goods is regulated in that the dealers are forced to rank the products by energy-efficiency through clear labeling. This program works well and should be expanded to other product segments.

In as much as the users lack continuous information on how much energy the various household devices consume, the problem is also there. Today's invoicing system ought to be supplemented with detailed information for all of the household devices. This could call for meters directly on the devices, on the wall sockets and/or on each separate fuse and would make it much simpler for the household to obtain information about its electricity use. It would also enable it to optimize the electricity consumption by turning unused devices off and replacing older devices with newer, more energy-efficient ones.

Passive energy use is an interesting parameter in need of more study. The arguments in this chapter suggest that large pieces of furniture and cars can have significant passive energy consumption. The interrelationship between passive energy use and lifestyle consumption is complex.

Indirect energy use is another facet, also one that is not directly linked to the active vehicle use. This is the energy use for manufacturing vehicles, as well as for building and maintaining the infrastructure. A study by Jonsson shows that the indirect energy use can be as large as the energy content in the car's fuel.[17] This would mean that today's focus on discussing the energy used by cars needs to be supplemented by efforts to reduce the indirect energy use as well. Jonsson's numbers state that the energy use in fuel accounts for just over half of the total consumption for road transports. The infrastructure, mainly building new roads, accounts for a bit more than 20%. The vehicles themselves account for 15%, including both production and service, while fuel production accounts for around 10%.[18]

The car is the product that uses most energy of all household durable goods. The technical aspects of its energy use are discussed in Chap. 17. But a more efficient use of each car is also a valuable goal.

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[17] Jonsson, D. Indirekt energi för svenska väg – och järnvägstransporter (Indirect energy for Swedish road and rail transports), 2005.

[18] Ibid.

Two lines of development are desirable in order to reduce the environmental load of durable goods in the future. The first is to increase the pressure on manufacturers to focus their product development on a reduction of energy use by durable goods. The second is to develop new, simple ways to share durable goods.

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Chapter 15
Time Use in the Future*

In Chap. 10 we discussed the long-term changes in basic attitudes to time and certain aspects of time use. A key concept was the rationalization of time use, linked to the increasing experience of a shortage of time, as well as to tempo acceleration and fragmentation. These last two concepts have begun to embrace greater parts of social life, including leisure time and social relationships. At the same time there are signs of an advancing temporal pluralism. Varying social rhythms exist side by side, while the perspective on time and the handling of time differs strongly between different groups. Here the differences are large between time-poor workaholics and parents with fulltime jobs[1] on the one hand and time-wealthy time pioneers[2] and the unemployed[3] on the other. These gaps have led some debaters to talk about a growing non-simultaneity.[4] This means that more or less distinct temporal societies will develop, parallel to each other and with separate norm

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[1] For example, in Lundberg, U., Krantz, G. and Berntsson, L., "Total arbetsbörda, stress och muskelbesvär i ett genusperspektiv" (Total workload, stress and muscle problems in a gender perspective), 2003. This 2001 study of fulltime employed women and men in qualified civil servant positions gives at hand that the total work load, meaning both paid and unpaid work, for both genders of this group has grown rather than diminished since 1990. Since women were at a higher level than men even earlier, their total work load is still greater than theirs. Counted in actual hours worked, the work load increase is greatest for unpaid work. The study shows that the total work load and time for household work increases significantly when a number of children still live at home, suggesting that much of the unpaid work is for childcare, including organizing their school and leisure activities (driving, etc.). According to the authors it is probable that this increased work load is an important cause of the stress symptoms experienced and sick leave.

[2] See Hörning, K. H., Gerhard, A. and Michailow, M., "Time pioneers", 1995 and Parkins, W., "Out of time", 2004.

[3] See Øian, H., Arbeidsfri og fritidsløs (Unemployed and without leisure time), 1998 and Øian, H., "Time out and drop out", 2004.

[4] Spurk, J., "Simultaneity within non-simultaneity?", 2004; also Brose, H.-G., "An introduction towards a culture of non-simultaneity", 2004.

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systems, social institutions, temporal arrangements and natural resource use for the members of the accelerating, fast society on the one side and the slowed, slower society on the other.[5] Though such a split in society seems distant, there is reason for a closer study of the links between actual human time use and the inequality in the distribution of temporal welfare.

This chapter investigates how the actual time use in Swedish households has changed in both the short and the long perspective. Actual time use patterns and trends in the Greater Stockholm area are mapped as well, primarily using results from the two time use studies done by Statistics Sweden in 1990/91 and 2000/01.[6] The results from other time use studies carried out in Sweden and abroad are also used.[7] One result that seems to contradict several of these studies is that the general trend towards more disposable time for leisure parallels a stronger sense of time shortage and stress. Possible alternatives to today's most prevalent time use patterns are discussed below. The chapter closes with a presentation of two time ideologies, ones that are used when the images of the future are described in more detail in later chapters.

15.1 Long-Term Trends

Several long-term development trends can be discerned in the time use change in Sweden. Firstly, as an average of all workers, the time spent on earning a living has shrunk steadily since the end of the 1800s. The reduction was strong up to the 1960s and eased up during the most recent decades. Secondly, the average time spent by adults on unpaid household work has also shrunk considerably since the 1930s.

The concept of non-simulaneity is a not too elegant translation of the German "Ungleichzeitigkeit" used in the 1930s by Ernst Bloch to describe a condition where certain people live in "another time" than their contemporaries since their class has not yet completely been transformed by the capitalistic temporality, that is the capitalistic hegemonic way of understanding and handling time in terms of money and productivity. (See Bloch, E., "Nonsynchronism and the obligation to its dialectics", 1977 [1932] and Bloch, E., Erbschaft dieser Zeit, 1985 [1935], pp. 111–122) Today the concept is used without its Marxistic links to an economically determined linear development. The focus is more on trying to describe the mix of different social and cultural temporalities.

[5] In this discussion Peter Glotz warns for a future culture battle between the 'accelerators' and the 'brakers', where the former support a fast living style with ideals such as efficiency and technological development, while the latter emphasize the importance of once again integrating humans and their actions with natural rhythms. See Glotz, P., Die beschleunigte Gesellschaft (The accelerated society), 1999.

[6] This chapter reports and analyzes data both from Sweden as a whole and more specifically for the Stockholm region.

[7] Examples include Åkerman, B., Familjen som växte ur sitt hem (The family that grew too large), 1941; Offe, C. and Heinze, R. G., Beyond employment, 1992 and Gershuny, J. and Fisher, K., "Leisure", 2000.

However, these trends are far from uniform for different population groups and the most noticeable being the question of female versus male time use during the 1900s. The main difference is that women extended their paid employment and thus as a group increased their time earning a living and simultaneously gradually reduced their unpaid work time. For men the reverse is true, with the time earning a living steadily shrinking since the end of the 1800s and during all of the 1900s.[8] At the same time, men have increased both their actual and relative share of the unpaid household work, even if they have yet to reach women's time investment in this area. It is clear, however, that in spite of these differences the reduction in total time for paid and unpaid work has led to an increase in leisure time for both sexes.

The average time for an individual to earn a living has nearly halved during the 1900s, while productivity per work hour has increased strongly.[9] Add to this the fact that the number of employed persons has nearly doubled since the number of persons of working age has grown strongly and a larger share of this group is employed, mainly among women. At the same time the total time worked by a person over his or her lifetime has shrunk as a result of such trends as longer educational periods, earlier retirement ages, greater number of early retirements and the right to parental leave.

Still, in spite of generally reduced work time and increased time for recreation, more people feel that they have less control over the time available. This is probably linked to the fact that the members of the household work outside the home more than earlier. As opposed to earning a living, household work is characterized by the fact that time use can to some extent be adapted to other activities and needs of the household. This possibility for adaptation of a part of the total work disappears or is reduced when the members work more to earn a living, thus making the experience of stress and time shortage more common. The experience of reduced flexibility and control can to some extent explain why the feeling of being stressed is generally higher among women than men and especially strong in mothers of small children who have to earn a living.[10]

The increasing rationalization of recreational time also contributes to the feeling of time shortage and stress many people experience. The users themselves organize fewer and fewer leisure activities. Most of material and service-heavy recreational activities are bought and consumed on the growing recreational market, either in the form of gym time, tennis hall use or as organized leisure trips. In this system, the planning and scheduling of the activities must be synchronized with the schedule of the professional supplier (factors such as accessibility and open hours), who in turn is controlled by commercial interests. This increasing incorporation of recreational

[8]This development holds for Sweden as well. See our analysis of the change in time use in Stockholm between 1991 and 2000 farther on in this chapter.

[9]See Ausubel, J. H. and Grübler, A., "Working less and living longer", 1995.

[10]See Statistics Sweden, Barnens tid med föräldrarna (Children's time with their parents), 2004a and Socialförsäkringsboken (National insurance book) 2003, 2003, pp. 63f, pp. 73f.

activities into the monetary economy also means that the experience of temporal welfare on the part of the household members becomes dependent on household income to a greater degree. This favors the rich households, not least as the bought recreational activities are linked to high social status.[11] Yet another result is that a larger part of the recreational time is subordinated to the pressure to maximize the benefit of recreational consumption over a given time period. When leisure time costs money, it is important to use it as efficiently as possible, something that also affects how still non-commercialized recreational time is handled.

15.1.1 Earning a Living

Even if the individual time needed to earn a living has shrunk considerably since the beginning of the 1900s, the total time use for the majority of the able-bodied population is still defined by their gainful occupation and the rhythms of working life. This is in turn regulated and controlled by such factors as statutory work hours, including both day length and pauses between shifts, statutory holidays, seasonal variations and open hours. While these rules and standards have clearly been loosened by increased demands on 24-h service and accessibility in the form of such factors as longer open hours on weekdays and weekends and the reduced importance of the industrial holiday, the traditional workday rhythm with work from morning to late afternoon is still the basic standard for how time is to be used. This also holds for all who are not working to earn a living, such as students and unemployed.[12]

A look at the scope of work from a historic perspective shows that the time needed to meet the demands of residence, food and other necessities increased greatly as the agrarian society was transformed into a capitalistic, industrial one. Spread over 12 months, the average time used for work in Europe's medieval societies totaled around 2,100 h annually, as compared to the around 2,950 effective hours worked in France, Germany, the USA and Japan in 1870.[13] Since then this figure has gradually shortened in most industrial countries; in Sweden alone the average amount of annual work hours has gone down from around 2,680 in 1910 to around 1,560 in 2000.[14] Most of this reduction occurred between 1920 and 1970 and in Sweden the average annual work time for all gainfully employed individuals

[11] See Offe 1992, pp. 36f.

[12] Both earlier and current investigations of the perspective and handling of time by unemployed persons shows that many of them value and handle time within this conception of a normal morning-afternoon work day, thus setting a lower value on the free time that unemployment brings. Jahoda, M., Lazarsfeld, P. F. and Zeisel, H., Die Arbeitslosen von Marienthal (Unemployed in Marienthal), 1960 [1933]; Øian 2004 and 1998; Mårtensson, M. and Fuehrer, P., Hushållet och arbetslöshet (The household and unemployment), 2003.

[13] Ausubel and Grübler 1995, p. 201.

[14] Swedish Government Official Reports, Arbetstiden – internationell jämförelse av arbetstid (Work hours – an international comparison), 2002, p.27; Gershuny, J,. Changing times, 2000, pp. 52ff; plus Ausubel and Grübler 1995, p. 201.

has been relatively constant since then. The pattern is the same in the USA and England, even though time used for gainful employment in these countries shows a slight increasing tendency during the 1980s and 1990s.[15]

However, these average numbers hide large differences between different individuals and groups in the working-age population, such as by an uneven distribution of hours worked per year between genders, classes or birth cohorts. Still, a number of investigations indicate that these differences are being leveled both in industrial countries and globally. According to the British sociologist Gershuny, there are three distinct, convergence tendencies in the time use area. Firstly, more women work to earn a living and therefore do less unpaid work in the home than before, while men work less to earn a living and do somewhat more unpaid work. Secondly, high status groups work more today and have less recreational time than the low status groups. Only 50-years ago the reverse was true. Thirdly, time use patterns for nearly all industrial nations studied show that recreational time is growing steadily, while time spent on paid and unpaid work is shrinking.[16]

15.1.2 Unpaid Work in the Home

Whether in the long term unpaid work in the home has decreased or remained at about the same level as around 50-years ago is still under debate. This work includes cleaning, clothes and dish washing, maintenance work and repairs, care for the family's children and others, purchasing and trips in connection with household work. Some researches would have it that the rationalization of household work has not meant a comparable reduction in the amount of work, but rather raised the standard and ambition level for a well-run household.[17] However, most time use investigations in recent years suggest that the time spent on unpaid household work has shrunk.[18]

The more time spent on earning a living, the less is spent on unpaid work in the home. Still, for many women who start paid work outside the home, the reduction of time available for work at home is not as large as the increased time for outside work. This means that the total work time for both paid and unpaid work usually increases when they start to work for pay.[19]

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[15]Gershuny 2000, pp. 53f.

[16]Ibid., pp. 4ff.

[17]Ibid., pp. 54ff. for a short presentation of the debate regarding the possible reduction of unpaid household work. See also Chap. 21 concerning the rationalization of the recreational time in households.

[18]Statistics Sweden, Tid för vardagsliv (Time for everyday living), 2003, pp. 30ff.

[19]Gershuny 2000, pp. 55f, 65ff. The elasticity in household work was described as early as 1937 in Brita Åkerman's study (See Åkerman 1941, pp. 96ff). Then, as now, it is primarily on an individual level that women increase/decrease their work input in the household dependent on the scope of the paid work. Men who draw down on their paid work time, such as during unemployment, are not as likely as women to increase their household work.

It is possible to make comparisons in time use over longer periods for several central components of household work, including cleaning, washing, cooking and dishwashing.[20] In Sweden in 1931, housewives who did not work could spend between 10 and 16 h doing wash, cleaning, caring for children and cooking.[21] In all households, including those where women worked for pay, the unpaid household work took on an average 7 h 43 min per day.[22] Since the 1930s time for household work has steadily shortened[23] and in 2001 Swedish women spent an average of 4 h 8 min/day on unpaid household work.[24] The reduction comprises all components of unpaid household work, but cleaning, dish washing and cooking account for the greatest reductions. For women, time for cleaning and maintenance has shrunk by more than an hour per day, the same for cooking and some 40 min per day for dish washing.

15.1.3 Spare Time

One simple way to define spare time is to say that it comprises the time remaining when all other need categories are satisfied, including earning a living and sleeping. However, this view of spare time is problematic since it is difficult to separate certain parts of unpaid work and spare time. For that matter, the dichotomy work/spare time fits on the whole much better for men than for women, since it is still usual for women to bear the responsibility for most of the unpaid work that happens in the home or for the household. The spare time women do have has been described as fragmentary and seen as a type of 'on-call' situation. Women must be ready to step in and carry out necessary household tasks at any time during their spare time, such as taking care of the children.[25] This causes the spare time to overlap with the

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[20] Primarily Åkerman (1941) who presents the results of a diary-based survey of everyday life and time use in 210 Stockholm households carried out in 1937 and Boalt, C., (Tid för Hemarbete [Time for work in the home], 1983) who analyses a number of time use studies done in Swedish households between 1937 and 1976. The results of such a comparison must be interpreted very carefully since, due to differences in measurement methods and difficulties in clearly defining certain activities, the results are not directly comparable (See Statistics Sweden 2003, p. 127, and even Boalt 1983, p. 42). A comparison in 2000/2001 is further complicated since Statistics Sweden 2003 only provides information divided by gender, not for everyone.

[21] Åkerman 1941, pp. 94–100.

[22] Boalt 1983, p. 42, and Åkerman 1941, p. 93. Cleaning and residence care took the most time at 2 h 13 min per day, followed by cooking (1 h 42 min), dish washing (1 h 2min); sewing, mending and darning (55 min); purchasing (45 min); washing (43 min) and baking/preserving (23 min).

[23] See Boalt 1983, pp. 59ff.

[24] Statistics Sweden 2003, p. 136 (Appendix 5, Table B:1).

[25] See Statistics Sweden, I tid och otid (At all times of the day), 1992a, pp. 89ff.; and Swedish Government Official Reports, Fria val? (Free choice?), 1995, p. 45.

time for household work.[26] When everything is said, what is classified as spare time depends on the emphasis placed on various aspects of spare time, including spare, disposable time, activity level, results focus and degree of freedom, as well as elements of personal reward or relaxation.[27] According to Gershuny and Fisher, the difference between spare time and leisure/recreation time is mostly experiential, meaning the extent to which the time in question is seen as free of responsibilities.[28]

For a large segment of the population, the gradual reduction in the time spent on paid or unpaid work over the last century has led to a corresponding increase in time not devoted to the responsibilities linked to those forms of work. The increase has gone hand-in-hand with a strongly increased availability of both leisure activities as a result of the income growth and the general improvement of societal standards. The share of persons involved in the different age categories has increased for many recreational activities. The largest share is for 16–24-year old; the activity level for older persons has also steadily increased between 1976 and 2002.[29] Still, in spite of or maybe precisely because of the increased amount of spare time, investigations show that time shortage is seen as an increasing problem in certain population groups, especially among parents with children living at home.[30] These groups report a high level of experienced stress as a result of time shortage, but even due to other factors in the household economy. Between 35% and 40% of single mothers with small children report stress, while those cohabiting only experience stress around 23% of the time. Younger persons seem to experience stress to a greater extent than older.[31]

One explanation for these numbers is that parents of small children and then especially the mothers have very little spare time, as compared to the other population groups, since they spend a large part of their day with their children. In this gender differences loom large. Swedish mothers do twice as much work in the home with the children as do the fathers.[32]

Another explanation for the experience of time shortage and stress is that the boundary between work and spare time has become increasingly fluid for many occupational groups, perhaps primarily professional and academic occupations

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[26]See Gordon, L. and Koplov, E., Man after work, 1975, pp. 60f.

[27]See Harrington, M. and Dawson, D., "Who has it best?", 1995, pp. 11ff.; as well as the discussion of the temporal welfare concept in Chap. 10.

[28]Gershuny and Fisher 2000, p. 626. In this context Gershuny and Fisher brings in Hawrylyshn's 'third person criterion': "Leisure, in this view, is 'activity that could not be undertaken by someone else without loosing the essential intrinsic benefit accruing from it.' " (ibid.); see also Statistics Sweden, Fritid (Leisure time) 1976–2002, 2004b, pp. 21f.

[29]Statistics Sweden 2004b, pp. 53ff.

[30]Statistics Sweden 2003, pp. 106ff.

[31]Ibid.

[32]Ibid., p. 105.

such as lawyers, doctors and teachers. The demands for accessibility and rapid response have increased as technological developments in the communications area have advanced. Cell phones, e-mail and various communication tools have created a culture of constant availability and fast replies so that many feel that their spare time no longer is theirs, but partly claimed by the demands of working life.[33]

A third possible explanation for the increasing experience of stress is that spare time for both the parent and the children has become an important project linked to personal development and social status. The opportunities for experiences and recreation offered in the spare time can easily be transformed into experiential coercion and start to appear as results-oriented work demanding regular scheduling and evaluation. Given this, it is not surprising that newer studies show that today many people do not want more recreational time, but more actually free time to spend on what in their eyes are meaningful activities.[34]

This survey of both long and more short-term changes in time use shows that the development seems to be towards greater space for individual decisions regarding time use, ones where the external demands from the paid and unpaid work are reduced. In spite of this trend, today many people feel that their decision possibilities actually shrink since recreational activities are increasingly subjected to the same demands as work time, namely increased time efficiency and greater production of useful results during one and the same time period.[35] The appearance of the 24-h society where recreational activities can be carried out at any time of the day comes with the explicit promise of rational time use and maximum benefit in the form of experiential density, network construction and spare time relaxation. Thus the spare time that once was primarily a temporal venue for reawakening social relationships, for resting and for consideration available mainly to a few members of a leisurely idle upper class, has been transformed between the early 1900s and today into an arena for identity production and status struggle for many people and groups.[36] There is some reason to claim that the commercialization and rationalization of spare time has led to a tempo increase in an area that in reality should need more time for contemplation.

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[33]See Statistics Sweden 2004b, pp. 24f.

[34]Reisch, L. A., Time and wealth, 2001, pp. 367–385; See also Parkins 2004.

[35]In spite of today's attempts at effectivization it is naturally hard to increase the number of theatre performances or operas to view during a given period (See Burenstam Linder, S. The harried leisure class, 1970).

[36]See Veblen, T., The theory of the leisure class, 1970 [1899].

15.2 Time Use in Stockholm Households 1991–2001

Here, we will do a more thorough analysis of the changes in time use for people living in the Stockholm region[37] between 1991 and 2001.[38] The point of departure is a division of household functions, defined as Personal, Residence, Food, Care and Support.[39,40] Since in spite of a recent convergence, there remain large differences in time use based between men and women, the information is reported by gender.[41] A closer look at the division into varying types of activities and the time used for specific activities is found in Appendix B.

The 24 h of a day can be used in different ways. The classic demand of the working-class movement is to divide the day into 8-h blocks for work, sleep and spare time respectively.[42] This ideal is hardly in concurrence with the time use of the majority of people neither in the Western World nor in Sweden, not least because the time use patterns during the last 50 years have become increasingly individual.[43] This individualization has paralleled the appearance of the non-stop society. One important contributing factor for this individualization is that traditional social tone setters have been weakened or wiped out. Such social factors include institutions or players who exert influence on individual time use patterns, such as the hours of authorities, shops closed on Sundays, the industry holidays, newspaper publishing schemes and the radio/TV program schedules, though the last two have lost much of

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[37]Stockholm's H-region. For a definition of H regions see Statistics Sweden, Geography in statistics, 2005.

[38]This and the section that follows concerning the development during the 1900s use the results of time use surveys 1990/91 and 2000/01 (See SCB 1992b and SCB 2003). The earlier study was done over a 9-month period (September–May 1991) and the later over 12 months. In the interest of simplicity, the results of these surveys are called 'time use 1991' and 'time use 2001'.

[39]Statistics Sweden's time use studies provide no time use information for the category 'common' and is thus the category left out of our survey of information.

[40]The data is for 1990/91, Statistics Sweden 1992b, pp. 72f. The data for Greater Stockholm and other H-regions for 2000/2001 are unpublished and have been provided by Statistics Sweden at our request. For a comparison of the studies a subset of the data gather in 2000/01, specifically those for the comparable 9-month period as for 1990/91. The populations compared comprise the residents between the ages of 20–64 living in H-region Greater Stockholm. The data on Statistics Sweden's time use study 2000/01 and the data on national level can be found in Statistics Sweden 2003.

[41]Gershuny 2000, pp. 4ff. In addition there are indications that the total work load and experience of time shortage and stress increases more among higher civil servants than among lower categories and workers. This is especially true for higher civil servants with small children and with both parents working (See Lundberg et al. 2003). A more thorough review of the gender differences regarding time, time use and stress experience is found in Chap. 30. The links between social group affiliation and life phase are also discussed.

[42]Swedish Government Official Reports, Fritid i förändring (Changing spare time), Stockholm, 1996, p. 24.

[43]Unfortunately these individual variations in time use have a tendency to become invisible when the aggregate data of human time use is studied.

their importance in Sweden lately as the diversity of media times has increased.[44] The individualization tendencies are also reinforced by today's growing secularization and commercialization, both leading in turn to dissolve the special quality of traditional time preserves such as work-free holidays.[45]

The time pattern of the industrial age has recently also lost its meaning as its fixed work hours and pattern of activity, spare time and rest sequence that held large population groups in its thrall, due to the increasingly common occurrence of home and distance work, longer shop hours and 24-h authorities. In spite of the fact that long established standards for time use have lost importance, how people dispose of their weekday time is still rather fixed. The individual time allocation is still embedded in and affected by external social structures and institutions with fixed social rhythms that include work hours, shop hours, preschools, schools and authorities. To top it off, many households need to synchronize time use with other household members work and recreational activities. With an increasing number of divorced parents whose children live part time with each, synchronization is also needed with people outside the immediate household. Thus aspects such as sleep or paid versus unpaid work, as well as recreational activities such as exercise or hobby activities are relatively fixed in terms of length and placement in the daily rhythm, even if large individual differences and variation exist.[46]

Table 15.1 illustrates the average time use in Greater Stockholm in 1991 distributed over five household activities and as to gender. The report is also divided

Table 15.1 Average time for household functions by gender and time during weekdays and weekends. Stockholm (H-region). Population 20–64 years old, September 1990 to May 1991[a]

	Women		Men	
	Weekdays	Weekends	Weekdays	Weekends
Personal	12:27	16:11	12:11	17:19
Residence	01:44	02:30	01:01	02:22
Food	02:33	03:12	01:35	02:33
Care	01:22	01:02	00:33	00:48
Support	05:50	00:48	08:33	00:56
Totals[b]	23:56	23:43	23:53	23:58

Source: *Tidsanvändningsstudien (*Time use study) *1990/91, tables*; Living conditions report 80, SCB Örebro 1992b.

[a] A more detailed description of the various activities included under each category in Appendix C

[b] The totals do not add up to 24 h as the category 'Other, uncodeable' is not included in the data

[44] Eberling, M. and Henckel, D., Kommunale Zeitpolitik, 1998, pp. 160f.

[45] See Hohn, H.-W., Die Zerstörung der Zeit, 1984.

[46] Routine activities that occur over a longer time period, such as sleep or earning a living, are easier to estimate in time use studies with some accuracy, since these are most often based on personal time diaries, while regular, short-term activities, such as putting dishes away or brushing teeth, can be more difficult to estimate. Another difficult area includes activities carried out at the same time as other ones. Many routine activities are also elastic, meaning that they are sensitive to the time available (see Statistics Sweden 1992a; Scheuch, E. K., "The Time-budget Interview", 1972, pp. 71f; and Swedish Consumer Agency, Tiden bara rinner förbi (Time simply passes), 1993.

according to weekdays and weekends, since in spite of a tendency for a general blurring of the line between weekday and weekend, there is still a marked difference in the time use patterns.

The largest part of the day's hours was used for the Personal category, with the most used for sleep, rest and various leisure activities. On the weekends, men spent an average of around 15 min less than women on personal needs and recreation, while the relationship between the sexes was the reverse on the weekends when the men spent an hour more on Personal things than women. Time for earning a living and business travel in the Support category varied strongly between weekdays and weekends. The gender difference was greatest on weekdays, where men used approximately 2.5 h more than women. On the weekends the time was about the same. Women spent more time than men on unpaid household work on both weekdays and weekend (the Residence category includes household and maintenance work, but not cooking). Both women and men spent more time on household work and the like on weekends – around 45 min more per day for women and 80 min more for men. The pattern was the same for the Food category. Here both men and women spent more time on the weekends than on weekdays. The time for the Care category was larger on weekdays than on weekends, women spending an average of 82 min on caring for her own children, for others and on studies, while the men's average time was about 50 min less. The difference shrank over the weekends. The results showed that the average time use distributed over the five functions differed considerably between weekdays and weekends. During the latter, the differences between women and men also shrank and the residence, care, personal and food had higher priority than support.

The relatively large difference between how women and men spent time earning a living (Support) is due to the fact that more women take parental leave and that it is still more common for women to work part-time than men. If you add up the time that women, respectively men spent on paid and unpaid work (household and maintenance work, but even cooking) on weekdays, men spent on an average about 1 h more time than women on paid and unpaid work. On weekends it is especially clear that men place a much higher priority on their personal leisure time than they do on household functions, even if the time spent on unpaid work was proportionally higher, though still lower than the time spent by women. Still, in absolute numbers the time men spent on unpaid work was still lower than the contribution from the women. During the workweek the time of both sexes was dominated by earning a living, though much more so for men than for women who on the whole spent more time on unpaid work in the Residence, Care and Food categories. The differences between women's and men's time use on the weekends can also be interpreted as an expression of a male preference for more connected and distinct periods of time use that, as a unit, could be set aside for various recreational activities. During the week the men did not have the same temporal space for these activities as they were earning a living, a lack they made up for by taking longer periods during the 2-day weekend. Women's time use on weekdays was, to a greater extent than for men, marked by the elastic household work leaving them somewhat more time for recreation during the weekdays. However, this time was considerably more fragmented than the men's. On the weekends, women had a greater responsibility for unpaid household work leaving them less time for recreation than the men had.

To a greater degree than for men, an average day for women was marked by unpaid work that had a potentially fragmenting affect on spare time with its many, constant and importunate demands so common and frustrating for families with working adults.[47] This shadow of unpaid work over the women's spare time did not disappear on the weekends, rather becoming even stronger as the men grasped the opportunity for increasing their individual spare time. Thus many women see the home as a worse work place than on a job. A study conducted by Hochschild showed that many parents in the US and then especially women with higher civil servant positions, see the unpaid work as more trying and stressful than a paid job. For many families where both parents work, home life was reduced to an involved puzzle with time as the stressed parents try to organize the children's activities after preschool and school as efficiently as possible. The home was increasingly seen as a more and more demanding work site, a place with rapid time use, many external demands and minimal thanks for the work done. In many ways the paid work site was seen as home where there was time for a leisurely time use with reflection and concentration on a few tasks with clearly delineated boundaries, reward systems and encouragement from bosses and colleagues.[48]

The Swedish time use study from 1991 was done just at the end of a high business cycle that had seen low unemployment and a rather pressed working life, especially in the larger cities. The situation on the labor market was somewhat different when the study was repeated in 2001. In spite of the early signs of a high business cycle towards the close of the 1990s, employment in 2001 had not yet reached the same levels as 10 years earlier.[49] Table 15.2 shows the average time use in Greater Stockholm in 2001 distributed over household activities, gender, weekdays and weekend.

Time spent on personal needs and recreation still use most of the disposable time. On weekdays women and men use about the same amount of time on the Personal category, while on the weekends, men spend around an hour more on Personal than the women, just as a decade earlier. Time use in the Support category is still unevenly divided between weekdays and weekends, as well as between the sexes.

Changes in the average time use by Stockholm residents between 1991 and 2001 seem at first not to have been especially revolutionary. Women still spent their weekdays on unpaid work to a much greater extent than the men, while the latter's average time use on weekdays focused on earning a living. During the weekends

[47]Swedish Consumer Agency 1993, pp. 16ff.

[48]Hochschild, A., The time bind, 1997, pp. 198ff, 214ff.

[49]A comparison between Statistics Sweden's results from the Time Use Study 2000/2001, Statistics Sweden 2003, and Statistics Sweden's Labour Force Studies (AKU) reveals surprising agreement regarding working life, in spite of the fact that the AKU and Time Use Study measure working life and time use in highly varied ways – specific weeks in AKU; randomly chosen days in the Time Use Study, Statistics Sweden 2003, pp. 21ff.

Table 15.2 Average time for household functions by gender and time during weekdays and weekends. Stockholm (H-region). Population 20–64 years old, September 2000 to May 2001[a]

	Women		Men	
	Weekdays	Weekends	Weekdays	Weekends
Personal	12:39	16:01	12:35	17:08
Residence	01:45	02:23	01:00	02:02
Food	02:24	03:28	01:38	02:40
Care	01:30	01:09	00:50	00:38
Support	05:31	00:55	07:47	01:23
Totals[b]	23:49	23:56	23:50	23:51

Source: *Tidsanvändningsstudien* (Time use study) *2000/01,* unpublished results.

[a]A more detailed description of the various activities included under each category in Appendix C

[b]The totals do not add up to 24 h as the category 'Other, uncodeable' is not included in the data

Table 15.3 Comparison of time used for household functions as averages for activities by gender and time per day during weekdays and weekends Stockholm (H-region). Population 20–64 years old, September to May. Differences between 2000/01 and 1990/91, with the latter as reference point[a]

	Women		Men	
	Weekdays	Weekends	Weekdays	Weekends
Personal[b]	+0:12	–0:10	+0:24	–0:11
Residence	–0:01	–0:07	–0:01	–0:20
Food	–0:09	+0:16	+0:03	+0:07
Care	+0:08	+0:07	+0:17	+0:10
Support	–0:19	+0:07	–0:46	+0:27

See Tables 15.1 and 15.2

[a]A more detailed description of the various activities included under each category in Appendix C

[b]Since many studies have shown that the time use for personal needs (sleep, hygiene, etc.) is relatively constant (see Gershuny 2000), only time use for recreation and spare time are included here

the pattern from 1991 repeated itself. Men used more time than women on personal recreation, while women spent more time than the men on unpaid work. However, a closer examination of the differences in time use between 1991 and 2001 points to some interesting trends similar to tendencies in several current time use studies in other countries. Table 15.3 presents a summary of the changes in time use between the two test years.

The numbers show that work time has lost some of its dominance in the time use of the study group during weekdays, at the same time as it has begun to be more frequent on the weekends. It is important to note, however, that increasing unemployment and early retirements mean that the average work time can shrink at the same time as the actual time spent by employed individuals remains constant or even increases. The fact that the numbers do not indicate a general reduction in working time is confirmed by the fact that the share of persons working in Stockholm County shrank by 6.1% between 1990/91 and 2000/01.[50]

Thus the average weekday of the Stockholm households offers somewhat more space for recreational activities, while this space has been somewhat reduced on weekends. It is possible to see an urban convergence tendency in this with the weekdays and weekends becoming more alike as the weekend loses its status as a time preserve relieved of the demands of earning a living and the market economy.[51] More job opportunities in the service sector, including weekend shop hours and various types of on-call assignments in personal care, mean that more people must work on the weekends. This increase is much larger for men. One can suspect that there is a societal development at work with a lower degree of social simultaneity that enables individual time use patterns for some like service consumers, and creates uncomfortable work hours and less family time for those who need to work nights and weekends to implement the 24-h society.[52]

Keeping in mind the relatively large reduction in time that men spend on earning a living on weekdays, the time available for men to participate in unpaid household work seems far greater than their willingness to take part in shared household activities.

More recreational activities are being moved from weekends to weekdays, something that can be seen as a sign that the weekend is losing some of its earlier status as a domain for recreation and social relationships. Whatever the reason, the clear tendency is that recreational activities are spreading out over the whole week.

As to the Food category, the results for women are somewhat contradictory. The average time spent on buying, cooking and meals has shrunk by 9 min on weekdays, but increased by 16 min on weekends. For men the same times increased by 3 min on weekdays and 7 min on weekends. The more detailed report on time use in Appendix B shows that the time for cooking has gone down for both weekdays and weekends, completely in accord with other results that indicate a continuous reduction in time used for cooking during the 1980s and 1990s.[53] The increase on weekends consists of more time for the actual meals and, for the women, of more time for buying. It is clear that even in this area, men do not invest any of the time released by the reduction in the time spent working for a living. The information on time use suggests that in 2001 Stockholm residents place priority on mealtimes, an event that takes significantly more time on weekends than a decade earlier. It is also possible to suspect that the increased time use for buying food is the result of

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[50]Author's calculations using AKU Average Annual Numbers for 1990, 1991, 2000, 2001. Table 37A in all editions.

[51]See Hohn 1984.

[52]This tendency for social non-simultaneity is actually reinforced by certain attempts to establish new work hours, such as the 3/3 model that completely ignores the usual division into a 5-day week and a 2-day weekend. See more about the 3/3 model later in this chapter.

[53]Carlsson-Kanyama, A., "Changing food consumption patterns", 1999, pp. 23ff.

the expansion of the bargain stores that seek their customer base over large areas and focus on weekly shopping.

Studies of time use in other countries have identified a tendency towards more uniform time use patterns over the gender divide.[54] This tendency is only partially reflected in the data for Stockholm households, since the men reduce the time used for both paid and unpaid work. Another Scandinavian study points to the same change in Danish households.[55] One possible explanation for this difference is that after the comprehensive influx of women on the labor market in the 1950s and 1960s time use in the Scandinavian countries seems more equal at the start. However, since gender-based work division, as time use patterns, is an exceedingly sluggish structure it will probably take a long time before the remaining differences in gender-based time-use patterns have been erased.

It is not possible to study the convergence tendencies in time use between status groups using the aggregate data for the Stockholm households. In addition, the results from an interview survey of Stockholm households rather suggest that time use constitutes an increasingly important dividing line between various life phases and status groups.[56] It is possible to see a development towards a more divided society as an alternative to Gershuny's thesis of an increasing leveling of time use patterns in the whole society. Certainly the time use patterns would be leveled for the active population majority that works for a living, but the time use pattern of this group would be significantly different from the large, rather heterogeneous group with marginal status on the labor market, as from the growing commercial leisure and experience sphere.

15.3 Possible Alternatives to Today's Time Use

At the same time as the Stockholm household's spare time has increased, their time use overall has become more fragmented as more paid work is done on weekends. This section offers examples of different reactions both to this fragmentation and to other problems linked to the modern time structure, such as the increasing feeling of time shortage. The understanding that time and time use are central to the general and personal welfare has been expressed in a number of political time-related projects with varying scope and reach. In spite of the fact that the projects are run by

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[54]Gershuny 2000, pp. 7ff.

[55]See Lausten, M. och Sjørup, K. Hvad kvinder og mænd bruger tiden till (What women and men use time for), 2003.

[56]In our material, life form is more meaningful for explaining the observed differences in perspectives on time and actual time use than social status. Examples include entrepreneurs and higher civil servants work for a living in a much larger extent than other groups. However, it is important to remember that we studied a rather homogenous group when it comes to activity level as our target group was urban households in Greater Stockholm in a very active age category (38–58-years). See also Chap. 30.

varied actors and organizations, they all have their base in the existing dissatisfaction with today's time handling and try to formulate alternatives to today's growing time commercialization. The projects own varied levels and their degree of local basis is varied, ranging from international and national social movements against time shortage, municipal time offices, visions about an alternate time use in working life such as the so called 3/3 model, activities in smaller groups, the growing plethora of self-help literature and Città Slow cities. These visions share a belief that less time shortage and a less stressed, fragmented spare time will increase the general welfare in the long term due to improvements in health and the creation of better social relationships.

In spite of the shared points of departure, a closer study reveals one basic difference between these attempts to formulate alternatives to today's time use. At one end of the spectrum stand the attempts to structure today's time use based on the given limitations of the 24-h day. Advocates of such projects as municipal time planning and the 3/3 model believe that time related welfare can be achieved if a limited resource is used as rationally as possible. In some cases this is in stated opposition to leading social temporal institutions, such as the work-free weekend or limited shop hours. Faith in a rational solution of the time use problems permeates even the growing flora of self-help literature for persons seeking to alter their current time use. These movements and projects aimed at time rationalizations focus primarily on the quantitative dimension of time. They seek to alleviate time shortage mainly by optimizing daily time use patterns using better planning and co-ordination, as well as with technical aids.

The antithesis of these attempts to rationalize and modernize time use comprises advocates of a return to a time use that offers more space for contemplation and takes natural rhythms into greater consideration. One example is the Città Slow movement. The focus is on the qualitative dimension of time and the advocates would like to see a more contemplative way of looking at the value of time and to handle the actual time use. This includes recreational time, social intercourse and working life. Special emphasis is placed on creating connected time periods for reflection and contemplation, as well as on protecting the temporal space for some activities that are seen as humankind's strongest links to nature and its rhythms, namely cooking and eating, resting and sleeping.[57]

Some people consciously oppose the acceleration trend and have chosen different ways to escape today's intensive time us. These time pioneers fall between the rationalization and quality extremes, since the concept "time pioneers" is used as a collective name for individuals seeking to implement an alternative time use for rather apart reasons and in different ways. These can be rational or quality oriented, but even mixed forms occur.

[57]Some authors feel that this vision is based on a too idealized picture of earlier time use. See for example Glotz 1999.

15.3.1 Municipal Time Planning

Some Italian and German cities, such Milan, Bremen and Hamburg, have carried out trials with municipal time politics. The trials are focused on improving the temporal welfare of the citizens and to create a better municipal time culture through a number of concrete measures, including a municipal time office.[58] These time offices are intended to identify and correct time conflicts that increase general stress. Such might include to change open hours and work times, as well as to consider time dimensions as early as in the planning stages, such as questions of school beginning times for school clusters.

Mapping municipal time structures derive from an analysis of the balance between the various urban time indicators, especially if there is a dominant one such as a large employer or if diversity rules. Conflict can arise between various time indicators and time receivers in the form of cross-purposes between the company's demands for work hours and worker presence as against the time planning of the employees or between time receivers in the form of tension between the wishes of parents and daycare personnel regarding hours. The development of a diversity of individualized time structures also creates problems. Flextimes and individual time use patterns make it increasingly difficult to co-ordinate the social time rhythms of families and various organizations. It is important for families with children to have predictable work hours with a mostly continuous rhythm and the possibility for being co-ordinated with the family's time planning.[59]

The hours of authorities and shops are very important time indicators that can be influenced by municipal and regional time planning. In recent years the development towards longer hours has continued in most European cities. More and more authorities and shops have open longer, both in the morning and the evening. Such schedules change traffic patterns and deliveries to the shop, as well as for travelers and public transport. In Germany at the beginning of the 1990s most stores were still obliged by federal law to close at 6 p.m. on weekdays, 2 p.m. on Saturdays and almost all stores were closed on Sundays. In the second half of the 1990s these ordinances were gradually loosened up with such changes as allowing stores to stay open to 8 p.m., though the demands for 24-h accessibility met strong opposition from the personnel, the unions and the church against commercializing the entire day. In the early years of the 2000s the regulation of shop opening hours was further liberalized and since 2006 each German state can decide on opening hours on its own, except for Sundays that are still protected by federal law. Many states have since implemented a 24/6 regulation according to which shops may be open as desired at any hour (day or night) Monday through Saturday. Even these changes have met strong opposition from both unions and religious organisations and in some German states, such as Bayern, the old federal law is still in place.

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[58] Mückenberger, U. (ed.), Zeiten der Stadt (City time), 2000.

[59] Eberling and Henckel 1998, pp. 120–128.

The emphasis in the vision of better synchronized municipal time structures is on facilitating the weekday life of its citizens through improved planning, co-ordination and rationalization. According to this perspective, the modern time shortage depends in much on obsolete temporal institutions like shops closings on Sundays, which present a hinder for an optimal time use. A similar way of looking at time is also behind the visions of another time use in working life.

15.3.2 Visions of Another Time Use in Working Life: Flextime and the 3/3 Model

Investigations of work time development in several OECD countries have revealed a clear tendency in many administrative and service professions towards flexible work time between 7 a.m. and 7 p.m. The same tendency exists even in industrial and other manufacturing segments. This increased work time flexibility includes not only the daily schedule, but also seasonal differences in demand for working hours. At Volkswagen in the German city of Wolfsburg an attempt has been made to adapt the work hours of the employees to seasonal differences by using annual work time accounts. One reason for this trial was to avoid time stress due to overtime, another to avoid overtime pay expenses. Such increase in the distribution of work time over the day calls for partly new time structures for stores, authorities and daycare hours, as well as for scheduling public transport.[60] Making the work hours more flexible and individualized in this way makes it more difficult for employees to plan and participate in various types of association activities.[61] These different initiatives all contain a belief that it is possible to unite increased temporal welfare for the employees with a higher productivity attained through a more rational use of facilities and machinery.

A similar argument is also behind a Swedish proposal for change in the traditional workweek with 5 weekdays and a 2-day weekend. A number of employees work according to the so called 3/3 system. According to the system's homepage more than 5,000 are in the system in Sweden, Denmark and Norway. They work primarily in eldercare, primary health care and various companies. This system calls for 3 days of work alternating with 3 days off. The system also includes 18 vacation days, corresponding to the around 25 days allotted in the current 5-2 system defined as working daytime from Monday through Friday, plus 10 public holidays. The 3/3-system also includes 20 extra workdays serving as a flexible buffer or time account the employer controls. The total annual work time is 1,530 h, meaning a work time reduction by 15% as compared to today's average time used in a full-time job.[62]

[60]Ibid., pp. 67–75.

[61]Ibid., pp. 88–103.

[62]See www.tretre.se (January 3, 2011) plus Lexén, L. and Svensson, A., Abrakadabra, 2003. An in-depth discussion of an earlier, failed attempt to rationalize the work week following the French Revolution can be studied in Zerubavel, E., "The French Republican Calendar", 1977.

The basic idea with the 3/3-system is that all days are the same, regardless of day of the week. The result is that hours, service level, resource utilization and production are all the same whatever the day. Advocates of the model claim that the 3/3-system enables a more efficient use of work facilities, including machinery and other factors, by abolishing the uniform work time and work-free weekends. One result is that authorities and stores are no longer closed when the clients or customers are off work. Another important part of the 3/3-system is the greater flexibility it provides for household time planning and activity co-ordination. One example is that working parents with small children can choose for both to be off work 1 day of 6 and thus minimize the need for childcare. Other households might choose to be off work at the same time or to have two free days of six together.

Among all visions of a better temporal organization of working life the 3/3-system stands out as the most far-reaching example of faith the engineering skills can fix today's time shortage experience. The break with the traditional workweek is as radical as the French Revolution's attempt to introduce a new calendar based on the decimal system, even if the workload is less than the French attempt with a 9-day workweek.[63] But the 3/3-system goes one step farther by abolishing the weekend as a social institution. Each household is left to synchronize the work time of its members in order to create shared time-off periods on one or more weekdays. Several studies have shown that the system has been received positively in occupations that already call for worker presence on all days of the week, such as in care institutions.[64] While the total work time is reduced in the 3/3-system, it also leads to a more individualistic, fragmented time use. In spite of the fact that the paid work time shrinks overall, it becomes more determining for the entire time use, in a way subordinating it to rationalization demands and incorporating it in the economic sphere. As with many other projects whose goal is to rationalize time use, the 3/3-system is characterized by a belief that increased temporal welfare can be combined with economic growth, in much created by an increase in the well-being of the labor force and a greater production efficiency.

15.3.3 Self-Help Literature

The generally increased experience of stress and time shortage is also reflected in the publication of self-help literature on daily time planning. The flora of material has grown rapidly in recent years, primarily in the US, but also in Sweden. In an examination of seven self-help books Sanne and Larsson identify five overall types of advice for avoiding time shortage and increasing well-being in everyday life, namely:

- rationalize your everyday activities;
- think about your basic needs;

[63]See Zerubavel 1977 and Zerubavel, E., "The standardization of time", 1982.

[64]Lexén och Svensson, 2003.

- set limits in your relationships with others;
- question wishes that require much time; and
- use effective methods for achieving change.[65]

The authors note that the literature concentrates on individual solutions of problems that actually have social causes, such as increasing pace in working life or highly stated expectations on recreational activities.[66] Another repeated conviction is that there are rational solutions to people's problems with stress and time shortage. The concept is that these problems ought to be solved or at least palliated using a rational inventory of everyday time use and a just as rational prioritizing of activities, goods or service not necessarily requiring time. Instead of cleaning, washing dishes or shopping, the advice to the reader is to use machines or persons (home help).[67] Even personal dreams should be studied rationally, since 'inner beauty' and voluntary simplicity calls for less time than external beauty and extravagant consumerism. It is obvious that the target audiences for self-help advice are middle class families and persons who feel that they have a high level of control over their everyday lives and thus can handle the shortage of time on their own.[68]

According to Sanne and Larsson the advice to self-help readers has some possibilities for reducing stress and the experience of time shortage, especially in the suggestion to set limits in relation to others and to question and revalue time consuming desires. The advice can also point the way to a less energy demanding everyday life with fewer expensive or energy consuming activities, fewer transports and reduced consumption.[69] However, in spite of repeated suggestions of a more reflexive attitude towards time use, it is doubtful if the self-help literature by itself can bring about a breakthrough in today's accelerating time use pattern and consequent increased stress. This literature places all too strong an emphasis on the quantitative dimension.

15.4 Time Conventionalists and Pioneers

The growing dissatisfaction with a working and everyday life marked by rush, stress and time shortage has moved many persons to action in an attempt to shape concrete changes in their own time use. These attempts focus primarily on the time used for paid work and can take the form of reduced work time or part-time work. In a German study of 36 persons who reduced their paid work time voluntarily by as much as 50% the authors define two different ways of handling the work time

[65] Sanne, C. and Larsson, J., Is avoiding time shortage a feasible drive towards sustainable consumption? 2003.

[66] Ibid., p. 10.

[67] Ibid., p. 12.

[68] Ibid., 2003, pp. 14ff.

[69] Ibid., pp. 22ff.

reduction.[70] The time conventionalists use the regained spare time in about the same way as previously. The difference is that they have more time for recreation or household work. The time remains inseparable from specific activities and neither the time handling nor the perspective on time changes to any great extent. In the conventional time user's eyes time remains mostly a means to special ends.[71]

For the time pioneers, however, it is not only the work time and the day rhythm that is changed, but also how time is seen; access to and the experience of time becomes the goal in itself.[72] As opposed to the time conventionalists, the pioneers do not give more time to household work, consumption work (such as comparing prices) or undeclared work in order to compensate for the loss of income caused by cutting back on work time. Rather their increased awareness of the importance of the temporal dimension brings with it a scrutiny and a revaluation of the meaning of consumption and money in modern society. A too high material prosperity is seen as irreconcilable with temporal welfare and the time pioneers have chosen the latter.[73] Thus they value the qualitative side of time and the experiential dimension, seeing these as the main profit of their work time reduction. The time conventionalists have a more pragmatic perspective on the time won.

15.4.1 Città Slow and Slow Food

The European Città Slow movement was started in the 1990s in Italy as an extension of the Slow Food movement that developed in the late 1980s. The Slow Food movement advocates a contemplative attitude towards the allocation of time in everyday life. The thought is that each specific action is given greater meaning if you invest in it consciously. Even a rather commonplace action such as preparing food can, according to the advocates of a calm everyday life, be transformed from a rational if soulless nutritional intake (fast food) to a spiritualized, inspiring activity (slow food) by focusing on the temporal dimension of the action. This will follow if you actually take the time to prepare and enjoy the meal.

In slow cities should not only the foodstuffs production and consumption be marked by a slow tempo, but the entire way of living as well. Only cities with a population below 50,000 and limited traffic flows can be certified as slow cities. The certification means that the city consciously departs from the rhythms of modern life, trying

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[70] Hörning et al. 1995. The team interviewed 36 persons who worked between 20 and 32 h per week (pp. 37–45). The 16 men and 20 women who were interviewed were chosen from among respondents to a newspaper advertisement. The selection was made so as to represent a broad spectrum of ages, occupations and incomes (ibid., p. 41).

[71] Ibid., pp. 41f, 122ff.

[72] "...time becomes endowed with a quality of its own right which transcends its purely functional character. It becomes de-objectified and exposed, and recognized and developed as a subjective structural principle of life" (Ibid., p. 41).

[73] Ibid., pp. 4f.

as much as is possible to become a type of time preserve. More space will be given to pedestrians and plant life in the urban spaces of the inner city, while cars, billboards, neon signs and TV antennas are anathema. In many cities that have obtained certification or sought it, the tourist industry has been the driving force behind the move. In 2008, the city of Falköping became the first Swedish city to become certified and there are certified cities in about fifteen other European countries and seven countries in other parts of the world, e.g. the US, South Korea and New Zealand.[74]

The ideal for the Città Slow movement can be described as a return to a partially romanticized image of the temporal and social institutions in a medieval village. The mainstay of both the Slow Food and the Città Slow movements is the qualitative dimension of time in general and its recreative power specifically, a principle that is jeopardized by the thoughtless stress of modern living. However, this rushing is not seen as unconditionally connected to working life, rather focusing attention on small-scale thinking. In this vision everyday life slows up helped by more or less apparent structures and institutions, such as the infrasystem or stores, which force a more reflexive attitude towards time.

15.5 In Closing – Two Time Ideologies and Regimes

There is a clear dividing line in both ideology and application between advocates of a more rational, optimized time handling focusing on the quantitative dimension of time use on the one hand and champions of a revaluation upwards of the qualitative dimension of time and time use on the other.

The advocates of a more rational use of time hold the view that time is a scarce resource in modern society, but believe that it is possible to release time by organizing and administering both work and spare time better. The emphasis is on the quantitative and practical dimensions of time and the improvement can be accomplished by departing from the traditional temporal institutions such as the workday, workweek or weekend. Most time rational movements are characterized by a belief that the daily time shortage can be cured by modernizing the society's temporal structures and the time use of individuals. However, there is no attempt to break totally with the modern life and its consumption patterns or work situations. Nor is the temporal renewal intended to replace the capitalistic perspective on time as a scarce resource whose value primarily is set in money in the form of salary. These are the kinds of solutions that are most compatible with the stated stagnation in the development towards a shorter work time introduced around 1970 after nearly a century of trials. One of the two polarities in the tempo dimension of the images for the future is based on these types of strategies and trends. We have named it Fast.

[74] www.cittaslow.net (January 3, 2011).

Fast

The advocates of a qualitative shift in time use propose instead a comprehensive break with the perspective on time as an economic resource. They believe that the experiential dimension of time has been put on the back burner as it has increasingly been pulled into the economic sphere. The objectification of time has even left marks on the social dimension of time. Today various forms of sociability are controlled by the needs of work, rather than by social needs. One example is the gradual intrusion of work into the weekends. In order to vouchsafe certain time periods and time uses, as well as placing them outside the demands of the economy, these advocates call for a more radical system shift. This could include such directions as changing or reducing everyday consumption radically or breaking with the view that a job is the normal way of earning a living or keeping busy on weekdays. This type of program can be seen as being in agreement with the long line of work time reductions that have been progressing during most of the 1900s, only to be brought up short during recent decades. The other polarity in the tempo dimension of the images of the future is based on these tendencies. We have named it Slow.

Slow

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Chapter 16
Production*

When we discuss resource use in the future city, the main point of departure for this book is household consumption. That consumption also becomes our focus. This means that we concentrate on the effects of the consumption choices made by the households to a greater extent than the effects of pure efficiency gains in the production process. However, a large part of the resource use is obviously affected by how those goods and services are produced. So we have chosen to discuss even this area, if only summarily. This chapter discusses energy use that is not directly affected by household choices, that is the potential in the actual agricultural, industrial and service sector production.

The industrial sector alone accounts for 40% of Sweden's final energy use, excluding losses.[1] However, if you isolate the energy used for personal consumption, the picture is totally different from the Swedish industrial use. When using a household perspective it is no longer meaningful to study the total industrial energy use. What is interesting, however, is how various industries have succeeded in making their production more effective and in seeing what remaining potential can be sensed. Described as kWh/SEK, production value in fixed monetary value the industrial sector's energy intensity has shrunk by two-thirds over the 1970–2003 period, because its production value has increased more rapidly than its energy use. This reduction is less than the average for the pulp and paper industry and somewhat larger for other industries (see Fig. 16.1). Many, widely different operations are included within what we have chosen to call 'Production'. Below we will look more closely at one production system – the food production system, as well as at one kind of production namely that for durable goods. The purpose is to investigate the potential for reducing such energy intensities that production system might have.

*Chapter written by Mattias Höjer. Section on "Foodstuffs Production" written with Christine Wallgren and Ronny Pettersson. Section on "Durable Goods" is written by Björn Granberg.

[1] Swedish Energy Agency, Energy in Sweden 2009, 2009.

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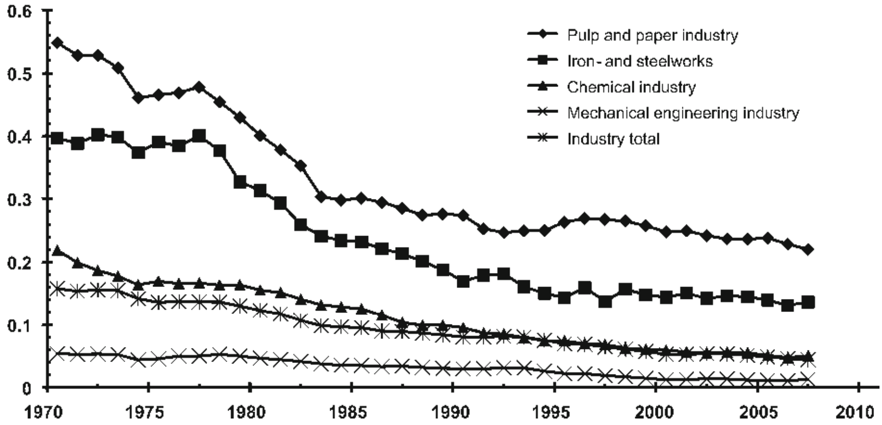

Fig. 16.1 Industry specific electricity and oil use 1970–2007, kWh/SEK production value. 2,000 prices (Source: Energy in Sweden – Facts and Figures, 2008, table to Fig. 19)

16.1 Foodstuffs Production

We will use the foodstuffs system as a framework for describing how a production system has developed recently. There will obviously be certain differences between food and other goods, such as that food is more sensitive to hygiene and storage variables than many other goods. Another important difference for our purposes is that the energy intensity of agricultural production has not gone down as quickly as for industry (see Table 16.1).

Today's foodstuffs system is a result of the societal development over the most recent decades towards effectivization and large scale. The development is based on the advantages with large-scale, standardized systems for production, transports and logistics, as well as for such functions as packaging, handling orders and sales. This effectivization has provided us with greater access to food from everywhere in the world than was possible earlier in history.

In addition to transportation, there are four segments in the foodstuffs system, namely agricultural production, foodstuffs industry, trade and the household. In this chapter we discuss the first two, while the other two were discussed in Chap. 12 above. Effectivization of vehicles for goods transport is discussed in the next chapter.

As was demonstrated in Chap. 12, Swedish energy use for food is about 42 TWh. This is divided into sectors as follows:

Agriculture and fishing 16%
Foodstuffs industry 13%
Packaging and the like 10%
Trade, Transport and Households 43%
Other food related sectors 18%

Table 16.1 Energy intensity in 1970 prices MJ/SEK

	1800	1870	1913	1970	1998
Agriculture	9.2	5.5	4.7	4.5	3.9
Industry	29	15	14	9.4	5.6
Service	4.5	3.4	3.1	3.1	1.7
Transport	27	39	55	8.2	6.8

Source: Kander, A. Economic growth, energy consumption and CO_2 emissions in Sweden 1800–2000, 2002.

The discussion that follows will mostly deal with agriculture and fishing, as well as the foodstuffs industry as a whole. Since the other related sectors comprise various industries, this discussion affects these as well.

16.2 Agricultural Production

The first stop in the foodstuffs system is agricultural production comprising plant cultivation and animal husbandry, gardening, including fruit, berry and kitchen plant cultivation in fields and greenhouses, as well as fishing. Over the most recent decades, the production system has been changed to something increasingly like the manufacturing industry. The final products are no longer ready food items, but rather input products in an industrial refinement chain. Production chains that increasingly integrate farming with the foodstuffs industry have developed for different foods. Intense production methods have become more important using large amounts of fertilization and pesticides. The production has developed into a system for mass production and mass consumption.[2]

The industrialization of farming is most clear in the modern rearing of pigs and chickens, as well as in some parts of beef production and the greenhouse-based cultivation. This development area is characterized by intensification using growing inputs of purchased production means, such as machines, pesticides and fertilization products, as well as greater acreage yields. This intensification has carried with it replacement of labor with machines and purchased goods.[3] A closely related factor has been the consolidation of farming acreage into fewer, but larger companies, while small and medium sized companies decreased in number. The structural transformation in the agricultural sector after WW2 has been very rapid. Between 1940 and 1990 the number of farmers shrank at a great pace, at the same time as tractors replaced horses. Even during the most recent 20 years, the reduction has been noticeable – between 1990 and 2007 the number of farms shrank by 28%.

[2] Atkins, P. and Bowler, I. Food in society: economy, culture, geography, 2001, pp. 27–29.

[3] Atkins and Bowler 2001.

It is the smaller farms with less than 50 ha that have disappeared. The number of larger farms, that is those with more than 50 ha, has grown.[4] One way to attain economies of scale and thus improve ones competitive position is to limit production to one or a few plants or animal species; thus specialization has been yet another characteristic. In the long run this development will remove smaller production units and impoverish the Swedish countryside, both as to cultural and biological values.

16.3 Foodstuffs Industries

After agricultural production comes the foodstuffs industries that refine and transform the raw materials. This industry includes such segments as butchers, bakers, brewers and dairies, as well as ones that refine, preserve or produce semi-products and ready-to-eat food.

The foodstuffs industries have become an increasingly important step between the farmer's agricultural products and those foodstuffs the consumers buy and cook. The share of the foodstuffs value that comprises the costs for the treatment these receive in various industrial processes, including mechanical techniques and scientific knowledge, is rising. Thus the foodstuffs have become more heterogeneous, displaying specific qualities created via refinement techniques, product differentiation and marketing. Innovations that have increased shelf-life have had great effect, including preserving, deep freezing, freeze drying, cooling and drying. New products have also come along, including a large number of ready-to-eat meals and various kinds of fast food. High incomes among important population groups have created and increasingly diversified demand. This has been satisfied through the creation of standardized base products that then are customized for different niche markets. Foodstuffs consumption has become more experiential as opposed nutritionally oriented, especially in the affluent middle class.[5] This substitution process has not gone as equally far in all types of food.[6] During the latter part of the 1900s the foodstuffs industry has gone through a strong structural rationalization. The larger companies in the dairy segment have invested in a knowledge intense strategy with low-fat products and additives of different active ingredients such as calcium or health-promoting bacteria. This means that the integration between agriculture and industry grows since such production requires a closer monitoring of the production chain on the part of the dairy companies.[7]

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[4] Statistisk årsbok (Statistics annual) 2009.

[5] Atkins and Bowler 2001, pp. 29–32.

[6] Ibid., pp. 74–75.

[7] Molin, L. Mejerisektorn och den nya biotekniken (The dairy sector and the new biotechnology), 2002, pp. 37–39.

16.3.1 Trends

In the postwar period energy use per agricultural hectare has doubled, while the cultivated land has shrunk by 20%.[8] It can be said that high-yield farming is based on transforming auxiliary energy to food and that energy in its final form is oil. Producing food uses approximately 12% of the energy used by Swedes – that is how much is used to produce the raw materials, refine them, store and prepare the food we eat and finally to wash up afterwards.[9] A large part of the energy used is in the form of fossil fuels used to operate farming machines and transporting materials. A similar development has occurred in other production systems. In forestry the production companies have grown much larger, at the same time as the manufactured products have become increasingly sophisticated. The specialization within the manufacturing industry has in part happened via more specialized products and in part through a greater use of subcontractors. In the same way as a highly specialized agriculture threatens to empty the country-side, a highly specialized industry can do the same to small town culture, seconded by an increasing exposure to global business cycles and production conditions in smaller towns.

16.4 Production of Durable Goods

The production of durable goods requires approximately 20 TWh energy annually, representing about 7% of the total energy use by the households, not counting investments.[10] This then is the range within which the possibilities for reducing Swedish energy use via a reduction and consumption of durable goods exist. There is in truth some potential in seeking a reduction of consumption of cars and furniture, the two categories that together account for around 40% of the energy used to produce durable goods.[11] However, for some of the most important goods energy for production is not the dominating energy use. More is consumed when they are in use.

In order to identify the type of energy use changes in production can cause, we will discuss product innovations and process innovations next.

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[8]Björklund, J., Limburg, K., Rydberg, T. "Impact of production intensity on the ability of the agricultural landscape to generate ecosystem service", 1999.

[9]See Chap. 12 and Chap. 28.

[10]See Chap. 28.

[11]Categories according to COICOP; Energy according to NR: Category 0511(Furniture, lighting, etc.): 8791 TWh; Category 07111 (cars, new): 6542 TWh; Category 07112 (Cars, used): 4624 TWh.

16.4.1 Product Innovations and Process Innovations

When an item is produced energy is used, often in a process that involves several industrial facilities. Two main parameters influence the amount of energy used. The first is the manufacturing volume. The more units are made, the more energy is usually required for the whole production. At the same time the amount of energy used per unit produced is generally lower. The second is the energy efficiency, meaning how much energy is actually used per unit produced. Since the energy use in the production phase is volume dependent, it can vary as to demand, consolidation/collaboration with other manufacturers, business cycles and the like. So called process innovations, meaning effectivization of the production processes, can lower the energy consumed per unit produced regardless of production volume and thus be especially interesting.

The foremost benefit for a manufacturer found in effectivization of the manufacturing process is a reduction in production costs. This is the reason that process innovation is a strong argument for manufacturers selling a technologically mature product on a saturated, highly competitive market. This is true for such goods as cars and most white wares. The result of the manufacturing process is a product that will use less energy when put into use. While process innovations aim at making a given product to a lower price, product innovations seek to improve the product itself. Thus product innovations are most frequent among manufacturers of products with a rapid, technological development and that are sold on growth markets, such as computers, mobile telephony and digital cameras.

Both process and product innovations are normally most frequent in the early parts of the product life cycle,[12] while process innovations tend to dominate as the product market approaches maturity. If the purpose is to find ways to reduce household energy use, one problematic factor can be that manufacturing companies' spending on product innovations tends to be less the older and more established the product is. Demands for more energy efficient goods can be seen as a threat. One clear example of this the first reactions from the makers of white wares is when the demands for freon-free refrigerators and freezers were made. The manufacturers claimed that there were no reasonable alternatives and argued that the societal demands on them were impossible to satisfy. Not until 1992, when a small, German maker of special cooling facilities with support from Greenpeace developed a fridge with hydrocarbons as cooling agent, did the larger manufacturers get up to speed with their own product development.[13] When it comes to just the white ware sector, the European Law on energy labeling of white wares is an example of an outside initiative aimed at increasing investments in product innovations in a mature market.

[12] Product life cycle is the time a product exists on the market, which in many cases can be a rather long time. The internal combustion engine and the refrigerator compressor have been on the market for the most part of a century, while the radio tube and slide rule have been replaced by other products.

[13] See for example www.web.mit.edu/dusp/etpp/content/projects/pen.html#Greenfreeze.

These examples demonstrate that other initiatives than those from inside the companies themselves can be very important for optimizing innovation efforts in mature industries from an environmental point of view. Technological changes tend to happen in blocks where various technologies affect each other. Technology also tends to be 'track-bound' in the sense that once the development has been initiated, it moves in a predictable direction. The American economist Nathan Rosenberg also points out that the funds needed for a company to acquire knowledge about new technologies often form a strong hinder to innovative activities.[14]

From an energy use perspective the automotive industry is as mature a sector as the white ware sector. Data regarding energy use by cars from a life cycle perspective shows that around 14% of the total energy use is during the production phase, around 75% in the use phase and a bit more than 10% in the production of the needed fuel. Table 16.2 shows that it is possible to win some energy in the vehicle destruction phase.

In this case, process innovation could reduce the 14% of the energy used in production, while product innovations could lead to a reduction in the 75% consumed during the vehicle's use. The other 12% are outside the automotive industry, but shrinks in absolute numbers with fuel efficient cars, though it will rise as more stringent demands are made on the fuel.[15]

Note that in both cases it says 'could', since obviously neither process nor product innovations need necessarily be focused on just energy use. Companies must prioritize making a car that is attractive to buyers and to as low a price as possible. Thus it is factor prices that decide in the one case and buyer preferences the other. If the factor prices do not lead to a priority for energy savings and the buyers accept the car's energy cost and environmental impact, there is little possibility that a reduction in the car's total energy use will be implemented. This emphasizes further the importance of external pressure on a mature sector in order to reduce its energy use.

One question that is worth discussing is whether a more rapid implementation of new technology could lead to lower energy use. In a Swedish investigation with

Table 16.2 Energy use over a car's useful life

	Share (%)
Production	14
Maintenance	7
Use	58
Fuel production	12
Destruction	–1

Source: Jonsson, D., Indirekt energi för svenska väg- och järnvägstransporter (Indirect energy for Swedish road and rail transports) 2005.

[14] Rosenberg, N. Exploring the black box, 1994.

[15] See Keller, M. et al. Intermodal comparisons of atmospheric pollutant emissions, 1998.

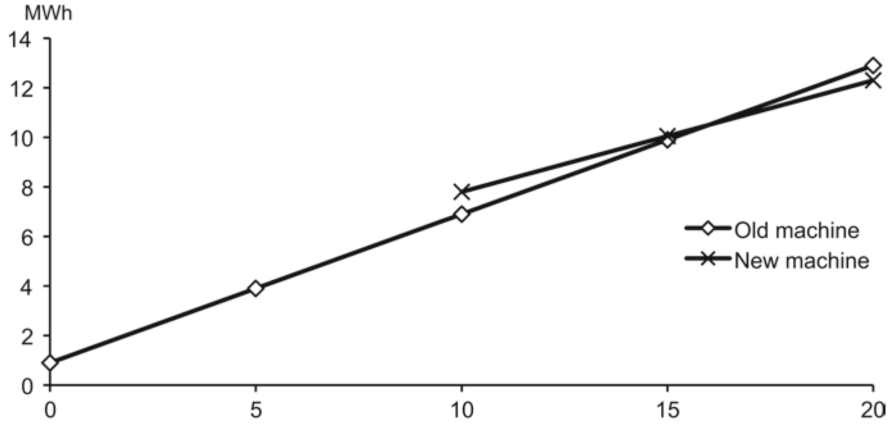

Fig. 16.2 Comparison of the cumulative energy consumption for use of a washing machine over a 20-year life cycle, with the replacement of the machine after 10-years of use (Source: Heiskanen E Conditions for Product Life Extension, Heiskanen 1996, p. 12 (Figure redrawn to MWh))

focus on just this question a model was developed that studied the consequences of a forced car retirement after 10 years of use. The end result was that a quicker pace for replacing gasoline driven cars would not lead to reduction in energy use, since the benefits with having a larger number of energy-efficient cars on the road would be eaten up by the higher energy use during the manufacturing phase.[16]

In 1996 the Finnish Consumer Research Institute investigated the benefits possible in extending the life cycle of durable goods. The study included such parameters as which age would be the most effective for replacing washing machines keeping in mind that each new product generation tends to be more energy efficient than the previous one. The period studied was 1973–1993. The example in Fig. 16.2 assumes that the production of a washing machine calls for 0.9 MWh and that a machine made in 1973 needs 12 MWh for function over the 20 year period (200 washes annually at an average of 3 kWh per wash). The total energy use for 20 years becomes 12.9 MWh. If, after 10 years, the washing machine were to be replaced by a new one drawing only 2.2 kWh per wash, the total consumption is somewhat less or 12.3 MWh. Thus from an energy point of view it is beneficial to replace the machine after 10 years. However, the point of equilibrium comes rather late – it is only in the last years that replacement shows an energy gain.[17]

Figure 16.3 presents the comparable situation for automobiles. We have calculated that car fuel consumption shrinks from today's average of 8.4 l/100 km (28 US MPG) to a level close to today's most efficient cars or 3 l/100 km (78 US MPG)

[16]Pädam, S et al. Rapid replacement of passenger cars – a pathway to sustainable mobility? 2003. The scenario supposes a completely new car park every 10 years.

[17]The information on the energy use of washing machines in 1973 and 1993 is taken from GEA 1995 and represent the more energy efficient of the machines then in use. See Heiskanen, E. Conditions for product life extension, 1996, Fig. 1.

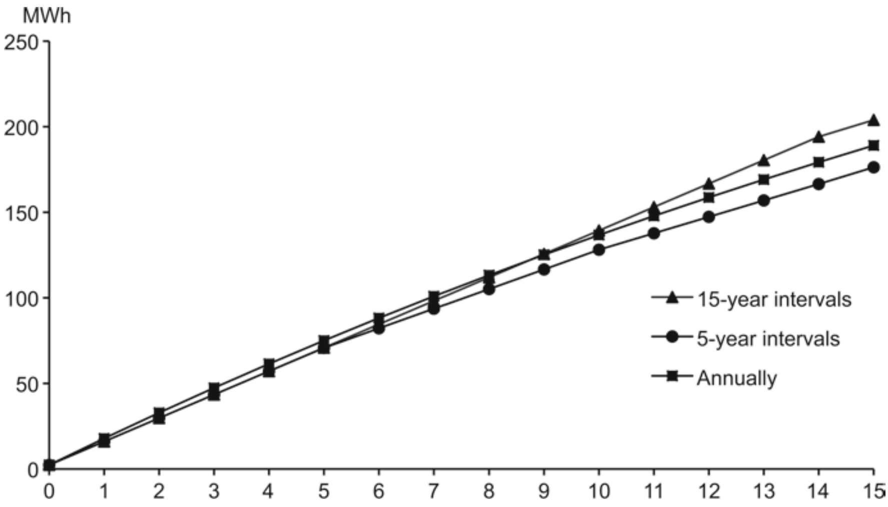

Fig. 16.3 Accumulated energy use by a car over 15 years if replaced by a new one at 15 or 10 year intervals or each year

Table 16.3 Energy intensity in 1970 prices MJ/SEK, plus annual change 1970–1998

	1800	1870	1913	1970	1998	Annual change 1970–1998 (%)
Agriculture	9.2	5.5	4.7	4.5	3.9	0.5
Industry	29	15	14	9.4	5.6	1.8
Service	4.5	3.4	3.1	3.1	1.7	2.1
Transport	27	39	55	8.2	6.8	0.7

Source: Kander, A. Economic growth, energy consumption and CO2-emissions in Sweden 1800–2000, 2002, p. 82.

over 20 years. This would mean an improvement of about 3.5% per year. We have also assumed that the energy needed to make a car today is 18% of the average energy use for the car's fuel and that the production will be made more efficient by 1.8% annually or the average for industry in general from 1970 to 1998 according to Table 16.3. The energy plus shown in Table 16.2 does not include the destruction process. The result shows that from an energy point of view it would be best to replace the car every 5 years and worst would be not to replace it at all. The difference between the best and the worst cases is 17%. The share of the production energy is significant for the differences between the various alternatives. If the share in the initial phase is 10% and the other numbers are the similar, the difference between the best and worst cases is 22%, showing that it is worthwhile to change car each year, though the economy of such a strategy is another issue.

The examples described above illustrate how process and product innovations are linked to each other and to the manufacturer. They also show that product innovations have great importance for the household energy use. Product innovations at the manufacturing companies are crucial when it comes to such products as white wares where it can be expected that implementation of a radical reduction in energy use can be problematical.

16.4.2 Trends

In principle, the entire manufacturing industry has a motivation to reduce its energy use since they pay for the energy. In practice, however, this motivation depends on the factor prices and how these shift. As one example, if the energy price goes up, the motivation to save energy increases only if the price of other factors (labor force and the like) remains constant or increase at a slower pace. Still, most companies feel pressure to reduce their energy use for environmental reasons. In combination these two forces can have a great effect on single companies, and especially on companies that are active on mature markets.

The most serious environmental impact of cars is from the energy used in operation. An average Swedish car uses fuel equivalent to around 13 MWh annually.[18] Given a life cycle of 14 years, the average fuel consumption of each car is around 180 MWh. Add to this around 20% or 30 MWh to cover the energy used in production.[19]

There are two definable theories concerning how much of manufacturing trends can be traced to changed consumer preferences, such as for larger cars or stronger vacuum cleaners. One is that the market range increases, meaning that the number of models in a single category grows. The other is that the product life cycles tend to be shorter, meaning that each new model makes and sells over a shorter period. Both of these trends are partly due to a changed organization and partly to new technology at the producers. However, the basic reason is that an increased range and shorter product life cycles lead to increased profitability for separate producers and that it benefits their competitive situation. It is worth noting that these trends are a reality even in many markets where the manufacturing companies are few or are becoming fewer, as in the car and white ware sectors.

16.5 Potential

In order to illustrate energy use in the images of the future in this book it is necessary to make assumptions regarding how much more efficient technology can be made. In this chapter we have drawn a picture of the agricultural production system and we have described some ways it can reduce its energy use. We have done the same thing for durable goods. Other projects about future energy use, such as Energy Foresight – Sweden in Europe[20] are often restrictive with indications of technological potential. The companies are satisfied with simply describing energy

[18] See Table 13.1.

[19] Jonsson, D. Indirekt energi för svenska väg- och järnvägstransporter (Indirect energy for Swedish road and rail transports), 2005.

[20] See www.iva.se/159/Projekt/Energiframsyn/Om-projektet/ for a description of energy foresight Sweden in Europe.

efficient technology for such products as industrial compressed air equipment, motors, pumps, lighting and heating, without indicating potential.[21] Other reports provide technological potential without motivating why. In such projects as Toolsust a 30% technological potential was assumed up to 2040.[22] Examples of changes that could lead to considerably higher energy efficiency in production include products with longer life cycles, though this could also lead to a slower shift to more energy efficient products, and dematerialization, that is the products grow smaller without losing functionality.

A backward glance at energy intensities shows that all sectors have experienced a strong effectivization during industrialization and forwards. As table 16.3 shows, the annual reduction of energy intensity 1970–1998 was between 0.5% and 2.1% depending on the sector studied. This pace would mean reduction in the 25–67% range over 50 years or 15–50% over 30 years. We have chosen to assume an effectivization pace close to these data and to let it vary in relation to the tempo applied to the future image. Therefore we use a general energy effectivization potential of 30% in our calculations for Slow images and 40% for Fast.

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[21] Energianvändning i industrin (Industrial energy use), 2002.

[22] Carlsson-Kanyama A. et al. Possibilities for long-term change of city life: experiences of backcasting with stakeholders, 2003, Appendix 7.

Chapter 17
Vehicles*

17.1 Introduction

This chapter contains a quantitative description of energy use in the transport system with focus on the energy efficiency of the various transport types. The purpose of the trips, meaning their distribution over various activities, is discussed in Chap. 13.

The chapter has two sections. The first describes the current situation for vehicles and their specific energy consumption measured in energy/tonne-km and energy/passenger-km. This part also contains some historical perspectives on changes in the means of travel, their relative share of the total and their specific energy use, including some current development tendencies. The second section discusses how technology for propelling various vehicles could develop towards greater energy efficiency. Each section discusses goods and passenger transport separately.

The focus here is partly to show the purely technological possibilities for reducing energy use for conventional transport means and partly to suggest some conceivable technological innovations.

17.2 Current Situation and Development Tendencies

17.2.1 Goods Transport

About 22% of the total transport work generated by the consumption by people living in Sweden is performed by truck and measured in tonne-km. Transport by rail accounts for 12% and by water 65%.[1] These shares are uncertain due to insufficient data documentation.

Figure 17.1 illustrates how much energy is used per tonne-km for each transport means. In addition to truck, train, ship and airplane, private cars could also have

*Chapter written by Jonas Åkerman

[1] Åkerman, J. and Höjer, M. "How much transport can the climate stand?", 2006.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*,
DOI 10.1007/978-94-007-0653-8_17,

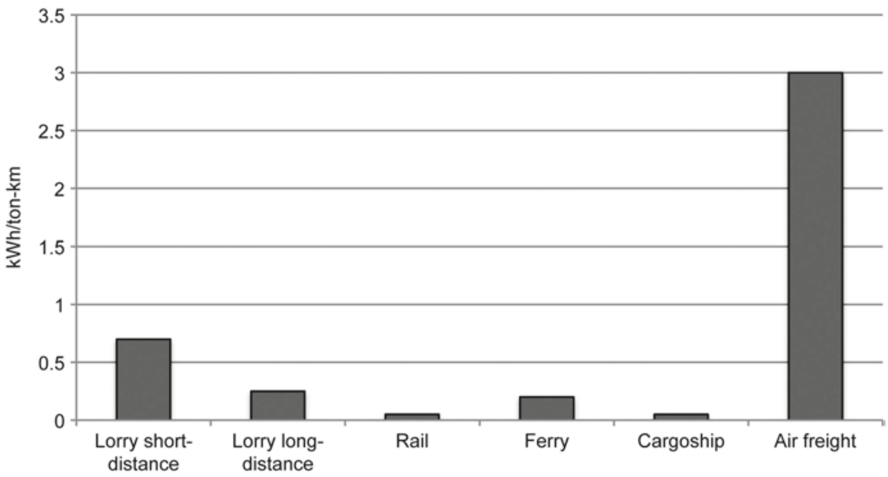

Fig. 17.1 Specific energy use for goods transport in 2000 (Source: Åkerman and Höjer 2006)

Table 17.1 Energy use for goods transport in 2000. For transport by ferry that carry both goods and passengers, 25% of the energy used is allocated to the former

	Truck (<100 km)	Truck (>100 km)	Railroad	Ferry (25%)	Cargo ship	Air freight	Light truck
TWH	4.5	7.4	1.0	0.8	5.3	1.0	4.2
%	18	31	4	4	22	4	17

Source: Åkerman and Höjer (2006).

been included, especially for non-durables. The purpose of using a private car for shopping is the same as for traditional goods transport. However, the specific energy use for these private car transport is in a class by itself. If you assume that a private car consumes 10 l/100 km and that 60 kg (132 lbs) of goods is carried, the resulting energy use is 15 kWh/tonne-km. This is five times the use by air and 20 times the use for short-distance truck transport.

Concerning the conventional transport means, the long-distance truck uses about four times as much energy as either rail or water transport. Air freight, on the other hands, uses about 15 times as much as truck transport. Thus the energy potential for choosing the 'right' transport means is great. Certainly it is important to avoid air freight; in a comparison with air freight, any other mode of transport seems efficient.

Should you wish to calculate total energy use for transport necessitated by consumption by persons living in Sweden, you must consider both the specific energy use of the transport means and the fact that all air and sea freight is for the most part done outside Sweden's borders. Such a calculation has been done by Åkerman and Höjer and the result is shown in Table 17.1. Note that goods transport with small trucks is included and that the date is for both domestic and foreign goods transport.

The table shows that long-distance truck transport accounts for half the energy use, water transport about one quarter and short-distance truck transport a fifth. The energy use for air and rail freight is considerably lower, but the amount of goods transported by air is increasing rapidly of late.

As opposed to private cars, technology developments have been used to reduce the energy used by trucks per tonne-km. The tendency for air freight is the same. However, while the statistical information for sea freight is poor, the tendency is probably the same there as the demand for rapid transport is increasing. At sea the energy use increases strongly with increased speed.

17.2.2 Passenger Transport

In 2000 car travel accounted for 43% of all travel by Stockholm residents as measured in passenger-km. Public transport accounted for 20% and air travel for 31%. The corresponding numbers for residents outside the city were 67% by car, 16% by air and 10% by public transport. The Stockholmians total distance traveled was about 20% further.[2] The specific energy use for the various transport types is shown in Fig. 17.2. Passenger travel numbers are divided by long-distance travel (one-way, <100 km) and short-distance travel (one-way, >100 km). In general, long-distance travel by air and sea uses most energy. For short-distance travel, cars use most energy. It is worth noting that the energy use for short-distance trips by car is more than double as large as for long-distance trips. This is so because the number of passengers in each car is higher for long-distance travel and because the short-distance trips are mostly done in conurbations with a lot of idling and acceleration. As is true for goods transport, changing transport means can bring significant energy use improvement.

A rough estimate of the energy use for travel by Stockholm residents is shown in Fig. 17.3. Car travel accounts for not quite 60% of the energy use and air travel for nearly 35%. Counted instead by the amount of greenhouse gas emissions (carbon dioxide equivalents), the air travel contribution is significantly larger since air plane emissions of water vapour and nitrogen oxides contribute to the greenhouse effect.[3]

The energy consumption for new private cars shrank between 1995 and 2010 by about 25%.[4] Although this is not an insignificant reduction most technological advances have been used to make private cars heavier and their engine stronger.

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[2] National travel survey (RES) annual average 1999–2001, measured by the means used on the measurement day for all travel except air, the last taken instead from the database for partial distance trips.

[3] IPCC, Aviation and the Global Atmosphere, 1999.

[4] Swedish Transport Administration, Oförändrade utsläpp från vägtrafiken trots stor minskning av nya bilars bränsleförbrukning, 2010.

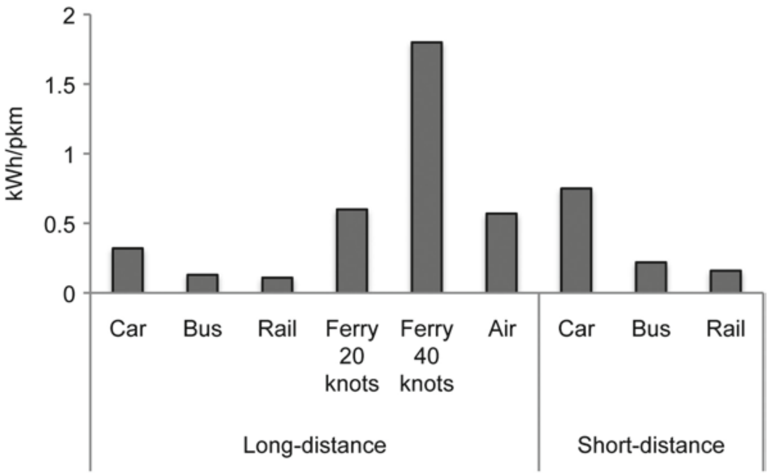

Fig. 17.2 Average specific energy use in 2000 for passenger transport. The figure differentiates between long-distance travel (<100 km) to the *left* and short-distance travel (>100 km) to the *right* (Source: Åkerman and Höjer 2006)

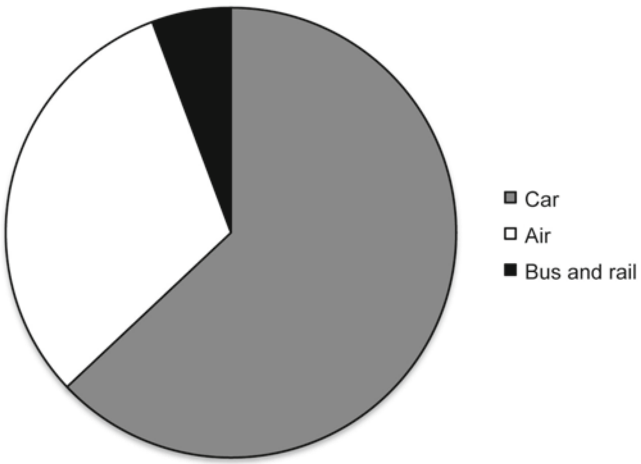

Fig. 17.3 Energy use by Stockholm residents. Other transport means, such as ferry, are excluded, but in all likelihood accounts for less than 5% of the total use. In kWh/passenger-km (Source: National travel survey (RES), annual average 1999–2001; Åkerman and Höjer 2006, and our own calculations)

Today technological advances have been used to reduce airplane fuel consumption. Relatively large gains have been made even though the improvement rate is slowing.

The occupation rate for air travel is high today as compared with almost all other transport means. In 2005 the rate on a global basis was about 75%.

17.3 Possible Changes/Future Potential

17.3.1 Goods Transport

In this section we discuss the future possibilities for making the various vehicle types more energy efficient. Table 17.2 illustrates the estimated potential for more energy efficient goods transport vehicles. In the futures studies of the transport sector carried out by the Environmental Strategies Research Group (fms)[5] there is a discussion of how much the energy use might be reduced for the various transport means. The results are based on holding the load factor constant. An improved load factor would push the energy efficiency farther than is shown in Table 17.2.

The use of unchanged load factors in the calculations might be questioned, as today's trend is for increased load factors. However, if total transport volumes have to be cut back, transport of similar products in opposite directions will probably decrease most if transport cost increase.

The potential described above is consistent with the estimates of IPCC.[6]

17.3.2 Passenger Transport

Table 17.3 presents an estimate of the future technological potential for making passenger transport vehicles more energy efficient. In general the potential is somewhat larger for passenger transport than for goods transport. The largest potential is for private cars whose fuel consumption ought to be able to be reduced by around 70%. That there is so large a potential does not mean that it will be realized by itself.

In a study of energy efficient vehicles and renewable energy, Johansson and Åhman have discovered that the energy efficiency for private cars should be able to

Table 17.2 Technological potential for more efficient goods transportation up to 2040–2050. For transport by ferry that carry both goods and passengers, 25% of the energy used is allocated to the former

	Truck (<100 km)	Truck (>100 km)	Light truck	Railroad	Ferry (25%)	Cargoship	Air freight
kWh/tonne-km	0.42	0.17		0.03	0.14	0.04	1.68
Improvement (%)	40	30	45	30	30	30	44

Source: Steen et al. (1997), Åkerman and Höjer (2006).

[5] See Steen et al. Färder i framtiden (Journeys in the future), 1997 or Åkerman et al. Destination framtiden, 2000.

[6] IPCC, Climate change 1995, 1996.

Table 17.3 Energy used for passenger transport 2040. For transport by ferry that carry both goods and passengers, 75% of the energy used is allocated to the latter

	kWh/person-km	Improvement (%)
Car (<100 km)	0.25	65
Electric car	0.16	–
Small electric car	0.10	–
Car (>100 km)	0.15	60
Bus (<100 km)	0.09	60
Bus (>100 km)	0.07	40
Ferry (75%)	0.42	30
Rapid ferry	1.3	30
Rail (<100 km)	0.08	50
Rail (>100 km)	0.05	50
Air	0.24	45

Source: Steen et al. (1997), Åkerman and Höjer (2006) and own calculations.

increase by 80–130%.[7] This would mean a reduction of energy use per tonne-km by 45–55% as compared to today's use. Their numbers are rather well in agreement with those calculated by Steen et al.[8] Johansson and Åhman compared a number of different vehicle types, including electric and fuel cell vehicles, as well as calculating with primary energy from fossil fuels, bio fuels and alternative power sources. One of their conclusions is that the efficiency losses inherent in going from electricity to hydrogen and then back to electricity are considerable in a fuel cell.

In many cases, the levels of potential future energy use reported above can be attained via various technological solutions. In order to reach a 70% reduction in energy used for private cars, the vehicles must be lighter (such as aluminum or carbon fiber), have better aerodynamics and more efficient power trains. The last can be accomplished through such systems as fuel cells or diesel hybrid in combination with methanol or DME. The Toyota Prius is an example of vehicle marketed with a hybrid system, this one with a gasoline engine. Its energy use is a low 4.3 l/100 km. However, it is likely that the absolutely lowest energy use will be battery driven cars, even in the future.

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Chapter 18
Buildings*

18.1 Today's Energy Use in Buildings

Energy is used in buildings mainly to create a pleasant indoor climate, heat water and to run various devices. Three-fourths of the energy assigned to buildings is used residentially and the rest in commercial premises.

The dominating post in the former is for heating rooms and water. Over the most recent 30 years household energy use has changed in that an increasing amount is used to operate various devices, at the same time, as these have become increasingly energy efficient. In all the use of electricity for household devices has doubled. The total energy used for heating has remained almost the same, even though the space has increased drastically. However, the methods used for heating have changed a lot. Oil use has shrunk to a fourth of the level in 1970, while electricity and district heating are more common.[1] One result of this is that there is less heat loss in buildings through oil furnaces. The corresponding losses in nuclear power stations is reported separately relevant official statistics. If the part buildings own of nuclear energy losses in the housing statistics is included, this sector's energy use has increased by 42% since 1970 (see also Fig. 18.1).

An indication of the effective use of energy in various buildings can be arrived at by comparing the energy use per square meter. Counting only the residential areas, the specific energy use for heating and hot water is somewhat higher in single-family houses (189 kWh/m^2) than in multi-family housing (162 kWh/m^2) and sharply lower than in summer houses (65 kWh/m^2) as they are used less frequently than other housing. Table 18.1 reports comparable numbers for the gross surfaces.

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*Chapter written by Anders Gullberg, Leif Hedberg and Mattias Höjer.

[1] Swedish Energy Agency, Energy in Sweden, 2008.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*, DOI 10.1007/978-94-007-0653-8_18,

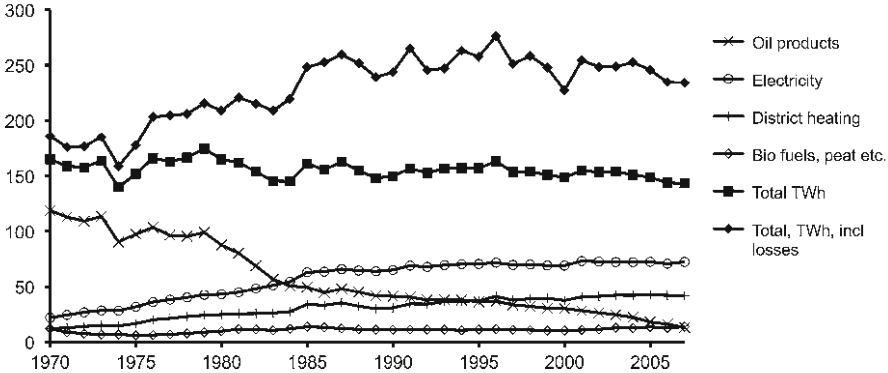

Fig. 18.1 Final energy use in the sector "Residential, services etc.". 1970–2002 in TWh. Total energy use is reported in two ways: first total wholly according to approved statistics and the second total including housing share of nuclear power losses in the official statistics (Source: Energy in Sweden, 2008)

Table 18.1 Specific energy use 2000 and potential for 2050 in kWh/m^2, gross

	2000 Heating	2000 Operating, premises and households	2050 Heating new	2050 Heating renovated	2050 Other	2050 Operating premises and households
Single-family	155	46	40	80	100	20
Multi-family	162	63	40	90	110	20
Summer houses	65	18	35	45	45	10
Premises	144	107	30	70	90	50

Source: Hedberg et al. 2003, Table 4:3.

The situation is the reverse for operational and household electricity where single-family houses accounts for 53 kWh/m^2 and multifamily housing uses 63 kWh/m^2. On the average, summer houses use 18 kWh/m^2. Eating, including dish washing, storage and cooking accounts for two-fifths of the household electricity. The remaining electricity use is distributed rather evenly between lighting, washing/drying and electrical devices. One explanation for why the electricity use is greater in the multi-family housing is that the number of residents is higher per square meter (see Table 10.1).

Three-fifths of the total household energy use comes from single-family houses and two-fifths from multi-family housing. The energy used by summer housing is small in this context.

The character of the energy use differs between residential housing and other premises. Less energy is used for heating in the latter and more for lighting and operation, such as for fans and refrigerated counters. More energy is also used for cooling indoor air, in part from the surplus heat from the devices used. The electricity used for household purposes doubled between 1970 and 2006, while that used for common purposes almost quadrupled during the same period of time.[2]

The premises sector comprises housing used in highly varied ways. The difference in use of electricity for operations is large, such as between the heavy use in food stores and the relatively low use in schools. Generally, however, at 107 kWh/m^2 the electricity use is considerably larger in premises than in housing. The calculations available for the average specific energy consumption for heating in premises point to an approximate parity with that in residential housing or 144 kWh/m^2.

18.2 Potential

The technical potential for reducing building energy use, based on a number of other studies is published in Hedberg et al. (2003) (see Table 18.1).[3] The report separates the potential for specific energy consumption in new buildings and in older stock, as well as for operating and household electricity. The older stock is further subdivided into two categories, namely renovated and other, corresponding to the different levels of energy effectivization measures carried out (see Table 18.1).

The reason for separating new construction from renovations is that the technological possibilities for reducing energy use in new buildings are very large, while the building stock as a whole changes very slowly. However, there is no reason to separate out the operating electricity in the two building types since all devices are likely to have been replaced over a 50-year period.

The most important measures needed to reduce energy use in existing housing is window replacement, supplementary insulation, control systems and replacement of heating systems. In new buildings it is also necessary to have an energy efficient way of thinking right from the start of the construction process.

In Lindås outside Göteborg some single-family houses have been built entirely without heating systems. Their total bought energy use is around 68 kWh/m^2. The houses are well insulated, use solar heat and heat exchangers and are carefully built. To a great extent the houses are heated using waste heat from devices and humans. The values provided for multi-family housing can be compared with the goal for 60 kWh/m^2 indicated for the new construction in Hammarby Sjöstad south of Stockholm.[4]

The urban structure plays a certain role in the system chosen for energy supply to new construction. In other words, it is not enough to state that buildings should be designed for maximal energy efficiency. The localization and activities included

[2] Ibid., Fig. 13.

[3] Hedberg, L. et al. Rum för framtiden (Space for the future), 2003.

[4] Green, A. Hållbar energianvändning i svensk stadsplanering, 2006 (Sustainable energy use in Swedish city planning).

are also important. Buildings farther from each other can make better use of solar energy, while those with less distance between could use district heating to a greater extent. In the Hedberg study all new construction in the alternative called 'Dense'[5] would be connected to district heating combined with solar panels. The same study argued that solar panels and bio-fuel were better suited to the alternative called 'Spread', but that district heating could be an important ingredient in this future image as well.

The same study blended energy systems and various mixes of new, renovated and other buildings in the two alternatives Dense and Spread. The average total specific energy use in both alternatives was 80 kWh/m^2, which is the value we use in this study as well. This means a reduction of just over 60% as compared to today's 217 kWh/m^2.

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[5] The Hedberg study used Dense and Spread, standing approximately for this study's Urban Core and Suburban Centers.

Chapter 19
Summary of Technical Potential

In the three previous chapters the potential for using technology to reduce energy consumption in food, durable goods, vehicles and housing is described. For the first two it is a question of how production can be done with less energy input, while for the latter two the focus is on how energy use can be reduced while in use.

Thus the potential for energy reductions in the production process is exemplified via discussions around production of food and durable goods. Even if there are significant differences between various production sequences, our examples still show how good production contains many different segments where energy efficiencies of rather different character can join to build up a total potential for energy effectivization. Chapter 16 concludes with a claim that there is a large potential for effectivization using technological development and that it is seen as somewhat larger in Fast than in Slow. The calculations use a technology effectivization of 30% in Slow and 40% in Slow.

Much more has been written about the potential for reducing energy consumption in vehicular use, at least in quantitative terms, than about the same in production. In much this is because 'vehicle' is a considerably narrower concept than 'production'. When discussing vehicular technology it is possible to list the most important techniques and vehicles, something that is not possible for the production complex. Chapter 17 on vehicles is based on futures studies carried out at Environmental Strategies Research (fms)[1] over the 15 years just past. The results have been used as energy effectivization factors for vehicles, passenger transports and goods transports.[2,3] These numbers suggest effectivizations between 30% and 75% for passenger transport and 30% and 45% for goods. The range depends on the fact that different vehicles have different potentials. For more exact figures, see Tables 17.2 and 17.3. Moreover, the various types of vehicles start out with different specific energy use, meaning that in addition to the technological potential,

[1] fms = forskningsgruppen för miljöstrategiska studier (Environmental Strategies Research Group)

[2] Steen et al. Färder i framtiden: transporter i ett bärkraftigt samhälle, 1997; Åkerman et al. Destination framtiden (Destination future), 2000.

[3] Åkerman, J. and Höjer, M. "How much transport can the climate stand?", 2006.

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there could be much to win by changing travel and transport means. One such example is a shift from truck to railroad for interurban goods transports.

The estimates of potential for technological reductions of energy use in housing are also based on a study carried out at fms.[4] In this case housing was divided into three categories, namely new construction, renovation and other. This method points out that the potential differs for the energy use in new construction, in renovated construction and in buildings where only maintenance has been carried out. The average potential used in this book is the same as that in the study or 60% less energy use per square meter heated surface. In addition to the actual technological development, this figure is affected by how much new construction there is in the Stockholm region. Large population growth means that there will be a larger share of new construction and thus on the average lower energy use per square meter. On the other hand, the possibility for reduction in space use is discussed elsewhere in this book. A strong development in that direction would reduce the need for new construction and thus lower the average potential for effectivization somewhat. The possibility for reducing operating electricity use is not as dependent on new construction, since most devices are replaced within the 50 year span. Thus Table 18.1 does not take any difference between the age or the renovation condition of various buildings into account. It shows that the general potential stands around 60%.

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[4] Hedberg et al. Rum för framtiden 2003.

Part III
Images of the Future

The previous parts titled Points of Departure and Building Blocks described the conditions for developing future images of sustainable cities. In this part, the actual images are described. They are a product of a large number of smaller project meetings and some workshops with more participants. In this work, we have defined six images of the future that are separated by the dimensions urban structure and tempo. There are three structures – Urban Cores, Suburban Centers and Low-rise settlements, and two tempi – Fast and Slow.

Chapter 20
Introduction

In the following chapters, we describe the images of the future in words and numbers. Chapters 21–24 show the urban function and localization patterns from a bird's eye view. The written descriptions are accompanied by city silhouettes and regional maps where the physical additions are positioned for each of the three urban structures. The six images of the future describe six different scenarios of the city and for urban life in the middle of the twenty-first century. In all scenarios the energy consumption per capita has been reduced to two-fifths of today's and all of them use Stockholm as the base example. The images differ one from the other in dimensions of time and space.

Three different urban structures and ways to develop the city have been combined with two ways for people and households to dispose of their time for work, care, pleasure, trips and the like. In the first case the focus is on housing height, density, localization and center developments, as well as traffic systems and recreational surfaces. The three structures we describe are called Urban Cores, Suburban Centers and Low-rise Settlements. In the second case we look at two ways to attain a temporal welfare – either by working hard and buying services to make the daily schedule possible or by shortening the working hours, doing more of the surrounding work within the household and spending more time for social contacts and recreation.

With the population mainly oriented towards one or the other way of handling work and leisure time, we can describe two alternatives with different social and societal consequences, namely Fast and Slow.

Chapters 25–28 describe the images of the future in numbers. They offer detailed, quantitative descriptions of each image. It is important to remember that the numbers are illustrations that supplement the textual descriptions, not calculations of "how it will be" for each of the six images. The chapters are a supplement to the previous presentations in words and picture by adding quantitative information. The basis for these number illustrations includes certain energy calculations where today's energy use is quantified for the household functions.

The illustrations are not based on specific assumptions, but are descriptions of how the future images are manifested in quantitative terms. The number material

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provided here can be said to be based on the interface between the requirements to reduce energy use to a low level and attempts to make the future images attractive and thus possible. The numbers can serve as points of departure for a discussion about how energy use can shrink by placing the technical changes alongside the changes in activity patterns. Anyone who thinks that a particular future image goes too far in some way can try to find alternate ways to reduce energy use in that specific future image. It is also possible to draw the conclusion that a certain future image is less implementable than one of the others.

The four chapters, are each rather unlike each other. The first Chap. 25, describes the three urban structures in detail. It concentrates mainly on providing a picture of the exploitation levels in the various new areas that have appeared in the three structures. Chapter 26 deals with the average time uses for household functions year 2000 and compares them with the time use in Fast and Slow.

In order to be able to estimate which changes can lead to reduced energy use, it is necessary to have a concept of which activities and actions actually call for high energy use today. A new calculation of household energy use for consumption is presented in Chap. 27. Both private and public consumption is broken down to individual level. The chapter contains a rather detailed reporting of how the energy use calculation has been done. The total energy use results are presented for Stockholm residents and Swedes as a whole and then broken down by household function.

In Chap. 28 we take the breakdown of the new date from the previous chapter even further. We present a detailed report over energy use in the six different future images. The chapter shows how and how much the energy use has shrunk in segments of each household function. In addition, there are descriptions of how energy use is reduced in business travel, goods transports and premises use in the future images.

Chapter 21
Six Images of the Future – Introduction and Definitions*

The six images of the future are defined by combining one of two tempi with one of the three urban structures. The tempo describes the pace at which people lead their lives and thus how they spend their daily 24 h. The time regimes as described here are a bit extreme, but they are developed to illustrate two different possible directions of time use, either Fast or Slow. These directions that have important though different implications for how energy use can be reduced in society.

21.1 Fast

Fast

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In Fast the average workday is about as long as it is today. Continued economic growth has brought with it a significant increase in household income that is used to pay for household and care work and services related to education, personal well-being, culture and travel. The worksite spaces are somewhat reduced in spite of the relatively long workday. Most persons eat one or more meals outside the home or use ready-to-eat food, thus spending less time on household work. Much of the time not occupied with household chores and work is spent on activities operated commercially. This time has grown as compared to today as more household services are bought.

The average and per capita residence size is smaller than today, but with better technical equipment. Consumption is oriented towards technologically advanced and energy efficient lifestyle goods, as well as personal services and advice. The comparable development on an institutional level is towards flexible annual and lifetime work time, longer hours for institutions and shops, and more frequent public transport on a 24-h basis.

Long-distance commuting is somewhat more common than today, but focuses on train and car use to the detriment of flying. Commuting trips per capita are considerably fewer and then especially using cars, as bicycling has grown apace.

21.2 Slow

Slow

In Slow most people have shorter workdays than what is usual today and with the material standard for the most part unchanged. The worksites are less spacious. Spare time is used for hobbies, continuing education, association life, excursions, entertainment and time at home alone or with children, relations and friends.

The average residence is somewhat smaller per capita and the work places are smaller per capita than what is true today. All types of privately started activities such as care, handicrafts and home rehab stretch the household budget, but also provide personal satisfaction.

On the whole the time pressure is less than today. Commuting per person shrinks both by car and public transport, while the spare time travel within the region with public transport increases somewhat. Attractiveness and use of bicycles increases strongly. Long-distance spare time travel is also greater, but with a drastic reduction in flying and a comparable increase for cars and trains.

The urban structure, by which we mean the spatial dimension that informs the images of the future, comprises localization and dimensioning of housing, functions and connecting support and communication systems such as tracks and roads. Naturally new housing is needed in all parts of a region. At the same time it is possible to concentrate financial and physical investment to specific points, areas and segments. This is how the new housing and traffic investments that can be expected in the Stockholm region over the next 50 years have been hypothetically defined in the three alternatives.

The aim is to make space for another 700,000 persons to live here and for 300,000 to work here as well. Most of this new construction has been placed so that it clearly supports one of the three defined tendencies and advocated models for urban development, namely a polycentric, multi-core urban structure, a mainly mono-centric structure with some regional and many local centers and a decentralization through new single-family and low-rise housing without larger centers. We call these urban structures Urban Cores, Suburban Centers and Low-rise Settlements.

The density and disposition of the added housing for each alternative has been shown schematically using plans and cross-sections (see Figs. 21.1–21.4). The localization of the added facilities in each of the three alternatives can be described as follows.

21.3 Urban Cores

Urban Cores

The additional work places and residences are placed in partly new, very dense and very large housing concentrations at the strategic nodes for track and road systems. The public transport system is expanded with regional tracks even between points that lack parallel road connections. Monorails serve the local traffic in the new, very dense urban cores.

Fig. 21.1 Urban housing according to Urban Cores with most of the new housing collected in new nodes and city cores between existing housing

21.4 Suburban Centers

Fig. 21.2 Urban housing according to Suburban centers with most of the new housing as concentration or extension of existing areas

The additions are localized in existing residential, work and trade areas that lie close to the existing and extended track-bound public transport system. The capacity will be increase through such measures as a comprehensive construction of crosstown lines.

21.5 Low-Rise Settlements

Low-rise Settlements

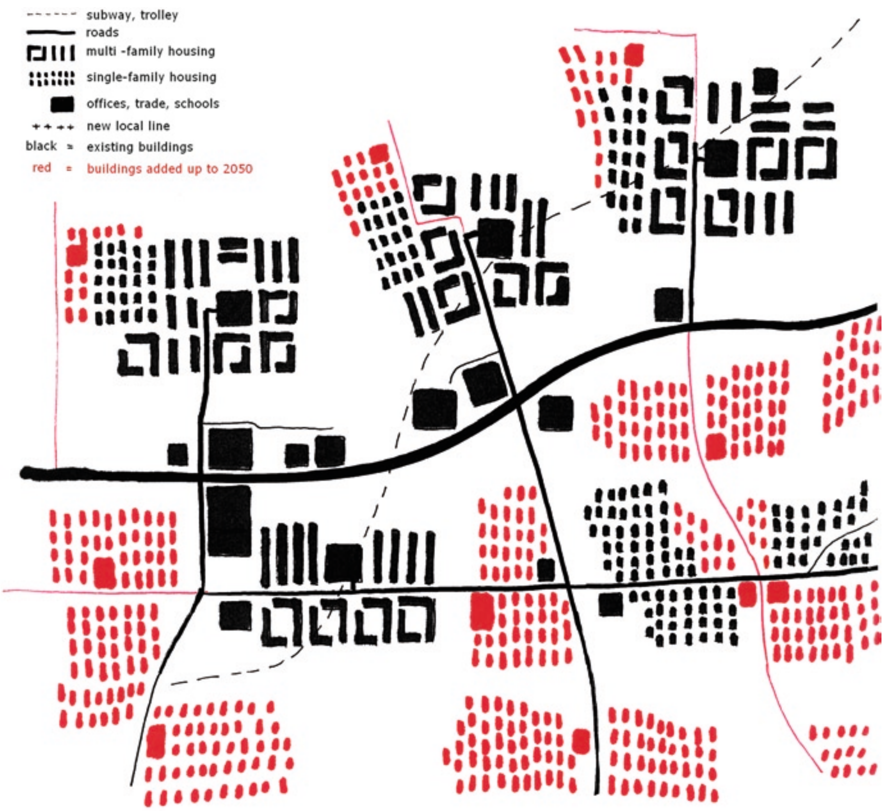

Fig. 21.3 Urban housing according to Low-rise Settlements with most of the new housing in new areas

The additions are grouped in rather small, low-rise areas mainly localized on unexploited ground near existing housing and traffic routes. Larger work sites and institutions are mostly placed in existing centers. For the most part travel is accomplished by a combination of bus and bicycle in the sparser parts of the region and the existing, but improved track system.

The sketches in Figs. 21.1–21.4 and the maps at the beginning of Chaps. 22–24 are combined to show how the three localization patterns for housing additions can be projected on the Stockholm region. The presentation of the three images of the future is done in these three chapters, each of which begins with a description of the transformation of the cityscape and of the urban settings created by the housing addition. This is followed by a comparison of the life in each according to the

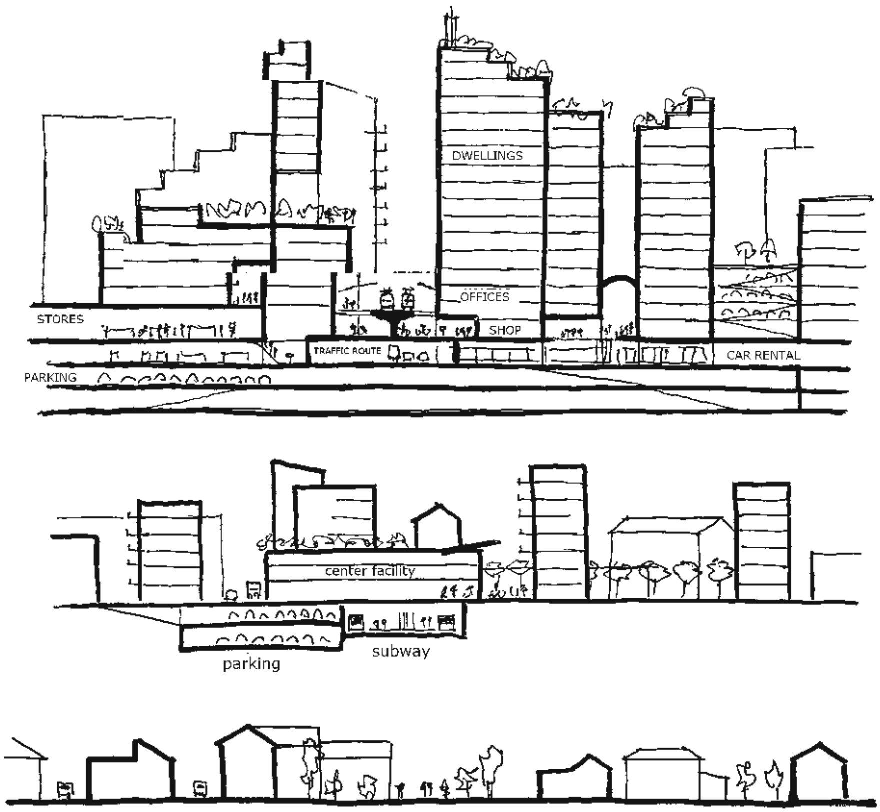

Fig. 21.4 Section through the housing in alternatives Urban Cores, Suburban Centers and Low-rise Settlements

tempo choices Fast and Slow. In other words, it is the new housing and the life in them that is the focus of the descriptions of the images of the future.

At the same time it is vital to remember that nearly all of today's houses, housing and areas remain. In all three images their presence and their use affect and are affected not only by their own extensions and the new additions, new centers and trolley lines, but also by the two tempo dimensions, with more or fewer persons in the residences, on the streets and in local activities. The existing housing mass and its use in 2050 also has a given place in the calculations carried out, the arguments presented and the conclusions reached. Tables 21.1–21.2 show how the average time use changes in the two tempo regimes. This is discussed further in Chap. 26.

Table 21.1 Time use in Fast and Slow compared to the average time (hours/minutes/day) allocated to the six household functions in Greater Stockholm 2001. WEEKDAYS. See also Chap. 26

	Today (2000/2001)			Percentage change (in %)	
	Women	Men	Average	Fast[a]	Slow[a]
Personal[b]	4:13	4:01	4:07	+15	+15
Residence	1:45	1:00	1:22	−40	0
Food	2:24	1:38	2:01	0	+30
Care	1:30	0:50	1:10	0	+35
Support	5:31	7:47	6:39	0	−25
Sleep, etc	8:37	9:48	8:41	0	0

Sources: The information on time use today comes from unpublished results of the SCB time use study; average time by activities and gender, H-region Stockholm, population 20–64, September 2000 to May 2001

[a] The percent states reduction/increase 2000/2001 with the average for both sexes as reference point

[b] Since the time used for personal needs such as nightly sleep and hygiene has been shown to be mostly unchanged in many studies (Gershuny, J. Changing times, 2000), only the time used for recreation and spare time is shown in this item. Sleep etc. is thus a remainder post dominated by sleep

Table 21.2 Time use in Fast and Slow compared to the average time (hours/minutes/day) allocated to the six household functions in Greater Stockholm 2001. WEEKENDS. See also Chap. 26

	Today (2000/2001)			Percentage change	
	Women	Men	Average	Fast[a]	Slow[a]
Personal[b]	6:12	7:29	6:50	+10	0
Residence	2:23	2:02	2:12	−15	0
Food	3:28	2:40	3:04	0	+5
Care	1:09	0:38	0:53	−35	+20
Support	0:55	1:23	1:09	0	−25
Sleep, etc	6:53	9:48	9:52	0	0

Sources: The information on time use today comes from unpublished results of the SCB time use study; average time by activities and gender, H-region Stockholm, population 20–64, September 2000 to May 2001

[a] The percent states reduction/increase 2000/2001 with the average for both sexes as reference point

[b] Since the time used for personal needs such as nightly sleep and hygiene has been shown to be mostly unchanged in many studies (cross-sections, 2000), only the time used for recreation and spare time is shown in this item. Sleep etc. is thus a remainder post dominated by sleep

Chapter 22
Urban Cores 2050 – Fast and Slow*

Some 50 years ago, around year 2000, the parole was that only tourists could find the old city. This is even more true now when we arrive at Flemingsberg 15 km south of Stockholm on the morning commuter and more than half of the passengers get off in one of the city's new urban cores. These creations have succeeded well as independent urban establishments in the Mälardalen Valley. More than 100,000 persons live and work there, served by a diverse commercial and cultural center.

The station is a center in itself. Here the local commuter track meets monorails for internal trips, buses and rental cars, as well as a number of choices for continuing on, either to the inner city or with the rapid regional rail line to one of the outer urban cores. With some of its tracks on columns along the road system, the regional line lets us see the cityscape's radical transformation best.

Nearly all new construction during the last 50 years has been concentrated to and around 40 new and expanded older centers in the region. This includes the new urban cores. Their tall, compact housing complexes are the most obvious landmarks in the urban landscape outside the city limits. Travelers towards the inner city meet the new cores well outside the old city limits, which itself is surrounded by similar hubs, administratively part of the expanded inner city (Fig. 22.1).

Six of the new concentrations are regional urban cores, many times larger than the other 20 or so new hubs and the dozen older, sub-regional centers. All are well connected with each other and in many cases also directly to the inner city via the public transport network and, to a lesser degree, the road system. While the inner city is still the strongest core, its dominance is challenged by the appearance of a polycentric urban structure whose new, dense concentration draws the orientation of much of the region's work and life. There has been a relocation of companies and institutions to the new hubs in preference to the old urban core. In the latter a certain reduction in office location has happened, replaced by more residences. As the relationship between the old inner city and the periphery has changed, the term 'suburb' has become an anachronism.

At the same time the cityscape between the new concentrations and the areas they connect is much the same as before. The green areas are actually more

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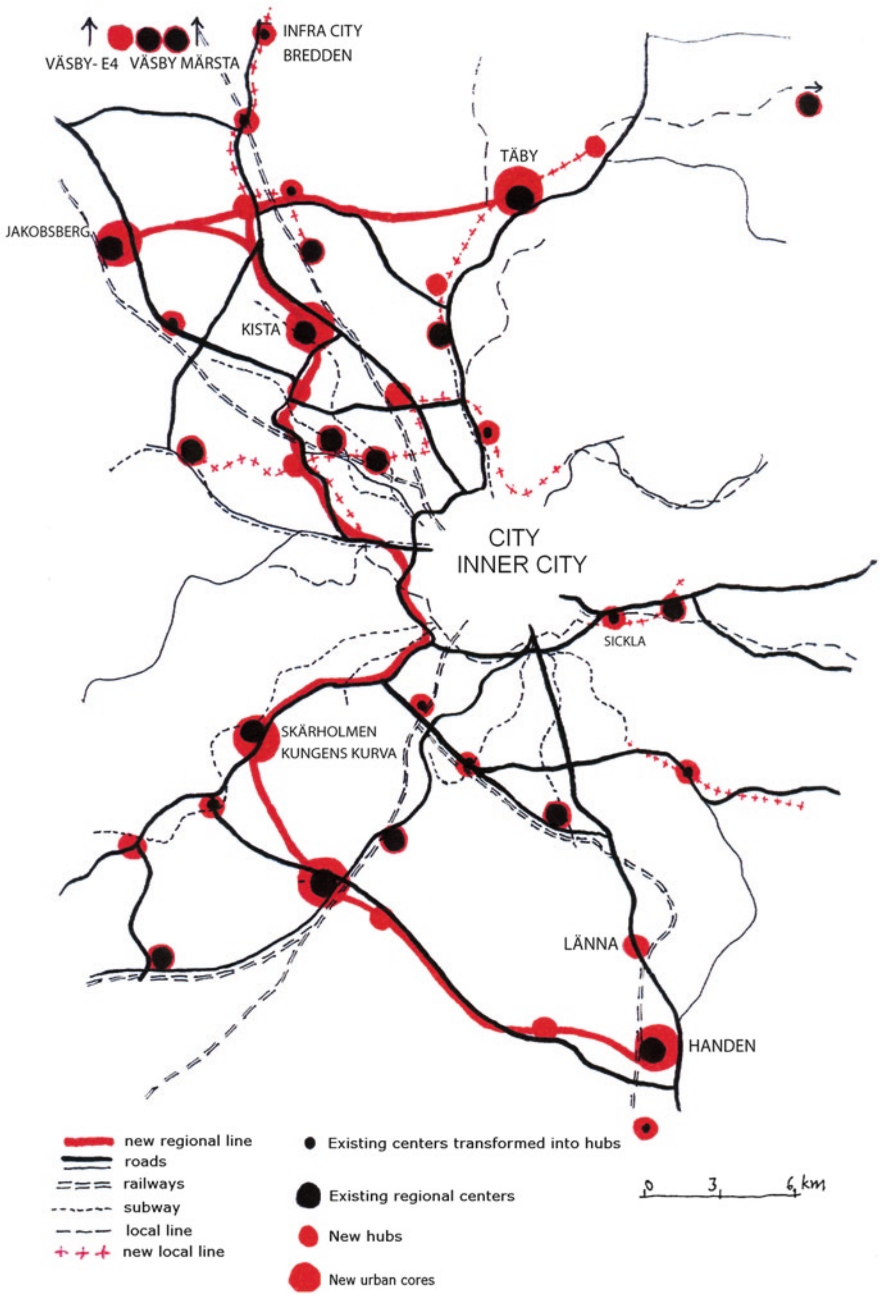

Fig. 22.1 The Stockholm Region 2050 with new housing mainly localized at: six new urban cores, each with 300 ha, 50–60,000 residents and 38,000 jobs. Twenty-two new centers (hubs), each with 200 ha, 8–10,000 residents and 8,000 jobs. Twelve older regional centers, with 13,000 residents and 3–5,500 jobs. See Chap. 25 for degree of exploitation; see Appendix D for regional distribution of living and working

coherent and many traffic routes are relieved of the once so spread out shops and facilities that now have moved into or next to the new cores and hubs.

It is not surprising that the six new regional urban cores draw attention. Together with the regional markets, the concentration of up to 100,000 residents and workers on a surface with a radius of 1 km and at least half as many within walking and bicycling distance in the immediate neighborhood has created a catchment area for centers that in many ways manages both to supplement and compete with the traditional inner city. Each of these cores is home to some company cluster or larger research, education or administration unit, as well as one or more cultural, entertainment or sports venue. Almost all operations and sectors that exist in the inner city are represented, though most offer a narrower, shallower range when it comes to specialist shops, antique bookstores, art and culture. However, some of them boast a broader and deeper range as a result of the specialization between the cores that has occurred on a regional scale in such areas as education, research, sports, high volume and low price trade.

A central travel center has been created in each urban core where users of public transport can easily change between subway, rapid regional line, railroad and more local means. This, together with direct-connecting bus stations, car rentals and parking has formed an efficient traffic hub with a well-equipped terminal facility as a 24-h center around which the downtown area of each core spreads out on different levels and along various byways. One of these byways serves as through routes on the lower level that form boulevards with hotels, restaurants and department stores along their walks and access for car-borne shoppers. The densely located, high-rise construction around the terminal is joined by open streets, arcades and indoor public spaces, as well as a subterranean level for transport, garages, utilities and other supply systems. With the exception of a few office complexes and institutions, the cores comprise only 4–6-story residential buildings with the same density as earlier inner cities. Receptions and service offices are found in the lobbies of most apartment houses and are shared by several stairwells or an inner yard, all open most hours of the day. These shared facilities serve to manage the apartments, to receive goods and to arrange for various services, such as booking meeting rooms and car rentals, loaning or hiring machines, equipment, tools or janitorial services.

A few hundred meters from the public transport stations with their connecting traffic routes, the new, smaller hubs house just under 10,000 job places and a few thousand more residents. With links to nearby older areas, each hub forms a catchment area for both shops and service, municipal center with police, health center and meeting rooms, and an IT house for distance work, library, school and educational units. The hub usually offers an urban setting that is at least as dense as the urban cores, but with open spaces close by. With but few exceptions, the street level is car-free with rather narrow streets and supplements in the form of covered passageways, galleries and urban interiors. The vertical leveling is clear. Traffic and supply systems with their storage and operational functions are at the bottom, followed by two or three levels for retail, service, exercise, culture and entertainment, several stories for offices and finally a larger number for apartments.

As in the central parts of urban cores, the buildings are frequently stepped with setbacks, creating places for roof terraces and sun panels, as well as compensating for the lack of yards. The apartments on offer range from mini units that can be connected and rented by the week to completely fitted penthouses, all serviced in common with the office complexes in the same stairwell by the 24-h service offices at street level. Together with restaurants, shops and meeting facilities, the service offices ensure continuous monitoring of the streets and the permanently open indoor passages.

Facilities like daycare, schools, service houses and group residencies for older persons are placed in the outer edge of the dense housing center. In addition to ensuring a generous edge zone of open spaces, parks, cultivations and squares, the new housing has helped create excellent connection to the nearby older work and residential areas. While the latter have seen their city district center replaced by the cultural and commercial offerings of the hub, their various venues for sports, associations and religion serve the residents of the hub. The result is a tight weave of areas, such as also has happened around the urban cores.

22.1 Fast and Slow in Urban Cores

In both Fast and Slow the very dense construction in the new urban cores and hubs contain an easily accessible and well-used supply of service and goods. The public communications with new regional trains and local monorail in the cores provide excellent opportunities for easy access to specialized labor markets, retail areas, culture venues and entertainment centers.

The conditions for residential life is pretty much the same in the large buildings of the urban cores and hubs, both largely lacking yards and housing many apartments in each stairwell. The mental step from the private residence to the public street is short, making the choice of proximity and intimacy with the neighbors easy to handle. The common service office is the only natural link between the property and its tenants, forming thus a diffuse local unit. The primary tenants in the newly built areas are young families and singles, but because of the excellent, diverse service, accessibility to the traffic system and the lively urban setting many well-established families and retirees has moved in as well.

Fast

In Fast more adults and students are gone large parts of the day than would be the case in Slow, while the children spend their day in daycare or at schools near the home in both tempo scenarios. The urban life in the cores is not much affected by this structure since there are many jobs on offer and the shops, service, entertainment and institutions attract a flow of visitors from various parts of the region. In the hubs, however, the local rhythm with long workdays is more noticeable. A lot happens in the evening when those coming home meet workers leaving for their jobs, when the first pleasure seekers head for the evening's entertainment in the cores and small children must be picked up, various errands and purchases occur and many eat dinner out. All this is possible since the shops and many restaurants are open in the evening, serving residents in surrounding areas as well. While the evening life in the hubs gains a more local touch through visits to local entertainment venues, educational opportunities and various commercially operated associations, the intensity differs from life in the urban cores. These house more large public facilities, including movie houses, entertainment venues or dance halls, some have sports and music arenas, as well as theaters – all of which pull in visitors from the metropolitan area as a whole.

The area outside the dense center serves the residents mainly as a well-equipped leisure and promenade area, during weekdays most often used by children and those at work there, while on the weekends the whole family will come. However, the training and exercise designed for workers is more scheduled and time efficient. In the urban cores the larger distances to recreational areas is compensated for by a rich commercial supply of training facilities in the dense settlement and by small parks frequently visited by children and older residents.

Work, meals, studies, hobbies and social contacts happen rather often outside the residencies. These are in turn considerably smaller then today, though well equipped for recreation, distance work and efficient household work. The nearby property and service offices also have an important task, not least as suppliers of extra living and temporary spaces, but also of the increasingly important order service.

Security and safety in both the urban cores and the hubs are in much the responsibility of formal institutional arrangements, such as security companies, area hosts and local police. All three of these enjoy considerable support from the properties' manned service office.

Travel per capita in the region using public transport has shrunk a bit and that of car traffic, considerably, especially when it comes to commuting and other, shorter journeys. Shopping, working and pleasure are increasingly in or near to home. At the same time, however, the bicycle has become an attractive way of getting around and is used for moving between and in the old and new areas of the suburban zone. Many with good finances are drawn to long distance and often long lasting tourist trips where train and car are more frequent than the increasingly expensive air travel.

Slow

In Slow the residents spend considerably more time in their residential areas than in Fast. Thus city life gains a certain lightly fluctuating intensity during every hour of the day. Purchases are done at another pace, both when it comes to consumables and other bits and pieces in local shops and market stalls and in other parts of town. Due to its shorter, more flexible work time structure, people have more time to study the local offerings of restaurants, shops and culture that are supplemented by a more informal service supply and a differentiated second-hand market.

Evening life has another quality than in Fast since most people fix their own food and choose different and less regular time on their hobbies, sports, studies and association life. These frequently are scheduled in venues administered by non-profit organizations in the core, the hub, the areas nearby or in their own homes. There are fewer restaurants and the shops close earlier than in Fast, though around the terminal in the urban core there is a wide range with generous hours. Sports and association life are for the most part supported by the residents in the vicinity, with meetings and activities often scheduled there as well. In Fast such connections are more one-way as the residents in the neighboring areas are more clearly oriented to the availabilities in the new central formations.

Many adults spend more of their free time with their children or older relations, preferably using the recreational area where the facilities have more clearly defined uses – for different special sports and hobbies, as well as animal enclosures and cultivations rub along well together. In this edge and connection zone the social intercourse in Slow seems like a permanent human crossroad where even the schools and institutional facilities nearby are well utilized in the evenings. This is especially true around the hubs.

In Slow residents spend rather many hours each day in their homes working, being with the family or for social life. The properties or parts thereof are often administered co-operatively and through associations. The apartments are larger than in Fast, but still somewhat smaller than today. It is quite the reverse with the work sites in Slow – one reason is that less time is spent there on the whole, thus requiring less space. As so many use the common space and the service offices, contacts between neighbors is reinforced. This fact, together with the greater presence on the part of the resident in the city setting during the day, means that the informal control of street life is greater than in Fast.

The rapid transit between the various denser conurbations are important to many and have led to a rise in the use of public transport and a reduction in car use. At the same time connections between the new centers and other city districts are more often by bicycle. A tighter household budget and more time to use the region's recreational and nature areas lead to less long-distance travel than in Fast. In addition, many residents in the urban cores and hubs work and study within cycling distance of their homes.

The differences between Fast and Slow are perhaps even clearer in the older, existing residential areas lacking close contact with one of the cores or hubs. With jobs and many of the attractions and activities concentrated elsewhere in the centers and hubs, the common spaces and facilities in the residential areas will still see a large variation in activities in Slow, while in Fast the same areas will be mainly residential with small service centers.

Figure 22.2 presents the number of residents and workers in 2000, as well as in the Urban Core images for Fast and Slow.

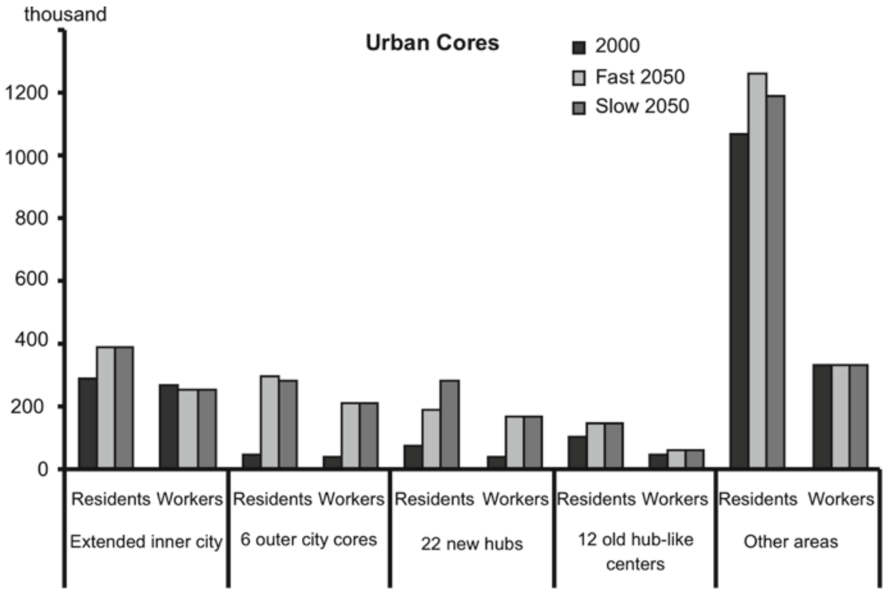

Fig. 22.2 Number of residents and workers in 2000 and in Urban Cores Fast and Urban Cores Slow in characteristic city areas

Chapter 23
Suburban Centers – Fast and Slow*

What impresses most in Stockholm around 2050 is the multifaceted cityscape spread all the way to the end stations of subway and the commuter trains. While some are talking about the disappearance of the suburbs, others speak about the awakening of the bedroom city, though that label never referred to sleeping cities, but cities where people only slept. Regardless of which, by 2050 Stockholm is mostly urban districts or suburbs, nearly all of them linked to the inner city via the radiating subway and commuting lines whose stations still retain the old names. There are some 130 urban districts in the region, most of them with around 10,000 residents with a diverse housing structure with several thousand work sites, such as offices, shops, workshops, institutions and schools. Purely residential sections have been supplemented with work sites and the reverse. Wherever we step off the subway or commuter train we meet first the older extended and renewed urban district center with rather tall high-rise apartment and office buildings, student housing, service facilities, bachelor and regular hotels, shops and various types of restaurants. Included as well are district office complexes for administration, social services, police, office rentals, secondary and post-secondary educational facilities, plus libraries, primary care facilities, car and vehicular facilities for parking and rental. Some stations also boast comfortable stops to change between cross-town trolleys.

The urban character is most obvious in the older, often rather homogenous construction around the center near the stations. Whether it is a century old, with variable groups of three-story housing or younger such with eight to ten story lamella constructions, there are still many new houses, pavilions, meeting or work structures. The street network has been tied up more closely to specific zones (Fig. 23.1).

After some filling out, the older construction segues into an as dense and wide-spread, but more varied settlement with both residencies and work sites. With at least one side of the urban district open towards large recreational areas and green wedges, the new construction primarily faces the adjoining urban districts or expand out towards the regional motorway built alongside it. At least one of the

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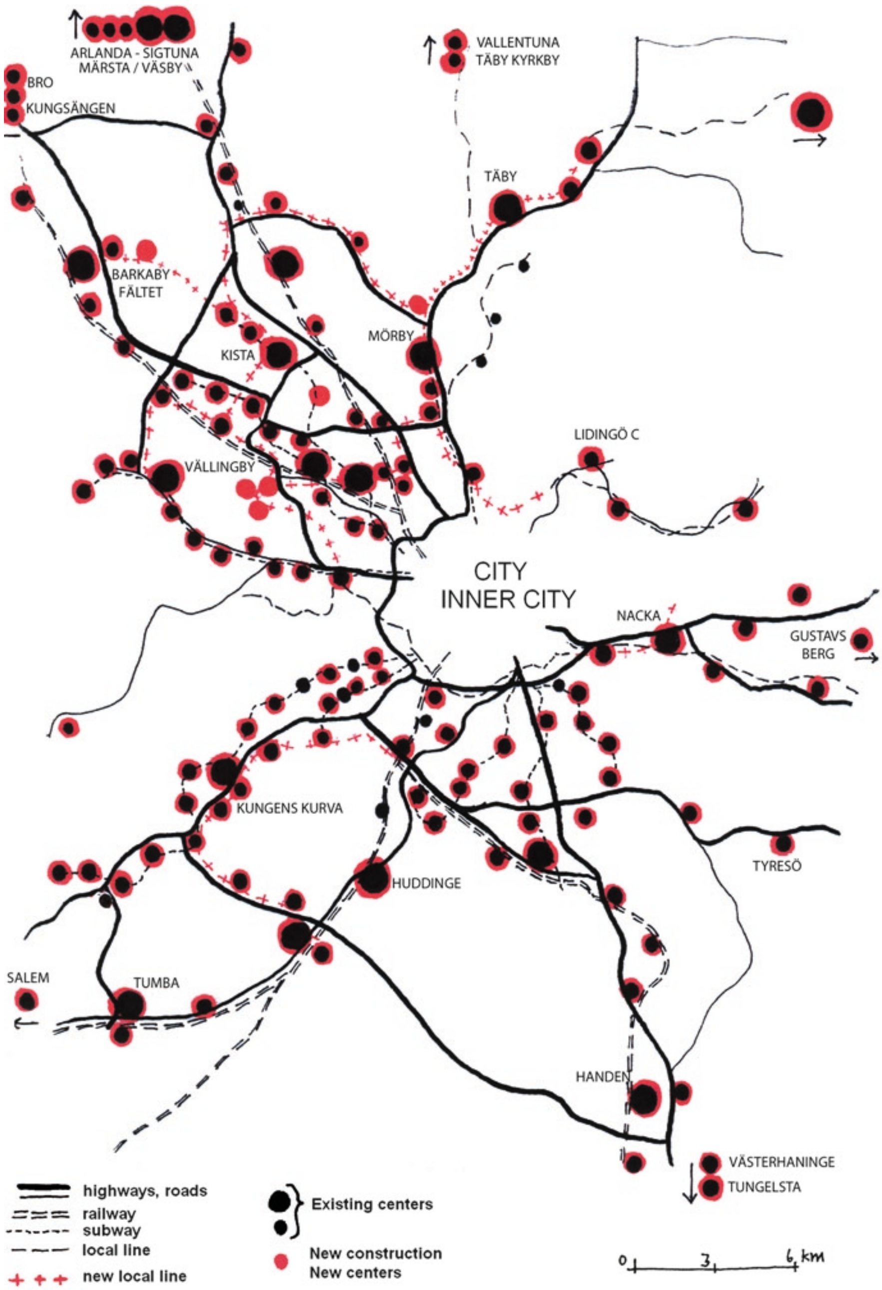

Fig. 23.1 The Stockholm Region 2050 with new housing mainly localized at: 18 regional centers, each with around 11,000 residents and 6,500 jobs. Seventy-eight large urban districts, each with around 11,000 residents and 6,500 jobs. Thirty-nine smaller urban districts, each with 6,000 residents and 2,000 jobs. See Chap. 25 for degree of exploitation; see Appendix D for regional distribution of living and working

motorway exits is like a district center as one or several larger facilities have chosen to draw on the advantages of the traffic flow. Examples include an especially large collection of retail stores, hotels, discotheques and sports arenas. All construction can be reached by supply traffic. With the exception of a few thoroughfares, motor traffic is subordinated to pedestrians and bicycles, as well as the feeder buses on circle routes through the district. Garages and car rentals are generally located next to the centers and on the feeder streets.

In some cases the urban districts have almost become one, creating new links between them. What has been created is a thoroughfare of varied length and character copying in effect those major arteries that earlier tied suburban communities together over several kilometers. These linking streets have joined the district centers as frequent addresses for small companies, and are mainly structured to serve pedestrians, cyclists and short-distance vehicular traffic. But they also serve as vital links since the availability of work sites, recreational facilities, shops and service differs from center to center. Should one urban district have a well-equipped library, perhaps the neighboring district will offer an all-round sports facility or a number of clothing stores. Still, at least one of the districts along the same subway/commuting train line has a large center serving a greater part of the region, similarly to ones built more than 50 years earlier.

The wide green wedges and recreational areas form another type of link between the districts. Sometimes these surround waterways that still follow the different districts far towards the inner city, but that have shrunk in order to give space for various facilities. These can be sports venues, smaller cultivations in the form of garden centers and festival sites. Most of the district's day care, primary schools, service houses and housing for the elderly are located along the sides of these green areas.

The older working and retail areas in the former suburban regions form a somewhat different type of district. Today several thousand residencies are partly inserted between or next to existing offices and malls, but mainly outside the older blocks. These form their own, dense urban districts. The public transport for these is in the most cases the cross-town lines whose original purpose included linking what were once areas with only busses to the regional rail lines. The centers of these new districts are often more compact, larger in scale, more efficiently supplied and easier to grasp when it comes to traffic connections, parking and the relationships between service, shops, work and leisure sites. Though there frequently is a dearth of green areas, these have been compensated for by an intensified park planning. These greenswards are even multistory leading to a nearly as dense construction as in the inner city, especially in districts whose lots were even earlier heavily utilized.

Between the urban districts and the more distant suburbs there are still older, smaller areas and widely spread single-family housing without sufficient mass to support shopping centers. In some cases these lack even public trolley lines, connected to the whole via a well-developed bus system. Thanks to the spread of the large number of reinforced urban districts, it is also possible and desirable for many residents to walk or cycle from the house to the nearest district center and station.

The inner city still plays a dominant role for the populations in all urban districts regarding such areas as politics, economics, culture and commerce. This even if they have a larger share of residencies now than before their expansion and office additions.

23.1 Fast and Slow in Suburban Centers

The localization of the large addition of work sites and residencies to existing urban districts has created catchments for a broad range of service and shops in the centers and along local thoroughfares. In both Fast and Slow these are the most used public settings in the districts. At the same time, the inner city remains the incomparably best-equipped urban setting, one that draws both adults and especially youth in spite of a large range of local recreational activities. Still, regardless of the similarity in conditions in Fast and Slow, the difference is large in how to use and live in their home districts.

Fast

In Fast more of the residents work or study full time in other parts of the region during the week than in Slow. Free time in Fast is in part oriented towards shopping and entertainment activities, mainly in the inner city and a few regional centers, and in part towards commercial and association administered range of exercise, ball sports, courses and similar activities, frequently offered in their own district or nearby. The residents tend to use their weekends for such activities more than their Slow counterparts do. Space, venues and facilities near their home are used as well, especially by children and seniors, but are administered by various companies. The service offices of the housing complexes administer these facilities and handle property management on the whole, but also deal with rentals of tools, localities and cars, as well as effecting delivery of goods for the increasing number of residents who do their purchasing of catalog and standard goods via orders and home delivery. The residences are smaller than today, but there is still space for distance work. Mechanized and outsourced household work releases time for recreation, media consumption and social intercourse.

As the public transport system is well developed, there is some reduction of car use for both commuting and short distance inter-regional pleasure trips, but the long-distance travel for holidays and the like plays a larger role. The latter traveling uses less air travel in favor of car and train, while there is a general increased role for both walking and cycling.

Slow

In Slow more adults and students stay within their own urban district during the week than in Fast. This is also true over the weekends, since there has been more time during the week to run various errands around town. Thus street and courtyard life is more evenly spread over the day, among other reasons due to the difference in scheduling for exercise, training, open-air life, activities like gardening and, time with children and for caring for elderly relatives. Compared to today, there is less commuting, be it with car or public traffic, while the inter-regional leisure travel using public transport and bicycle has increased and car use decreased. Even the long-distance leisure travel has grown, but with a strong reduction in air travel. The center settings and thoroughfares are used more than in Fast as social venues, with more facilities for meetings and association activities. These localities also offer services such as more food stores and even open-air markets, do-it-yourself stores and some separate shops in the most utilized segments and service sectors like hairdressing and drycleaners. These facilities are generally more scattered in the urban district than in Fast. In that sense, each separate center area is commercially weaker than in Fast.

Free time life is more informal and less scheduled than in Fast. The courtyards and related surface are heavily used for leisure and recreation; they are usually kept in shape by volunteers, by condominium associations or joint ownership groups linked to the buildings and properties concerned. The service offices function more as work sites and meeting places, as well as offering property management, local information, facility booking, tools, cars and goods delivery, the latter less used than in Fast. The residences are somewhat smaller than today, but are well used for working at home, household care, cooking and social intercourse.

Figure 23.2 describes how the number of residents and workers has changed between 2000 and the two variants of Suburban Centers in 2050.

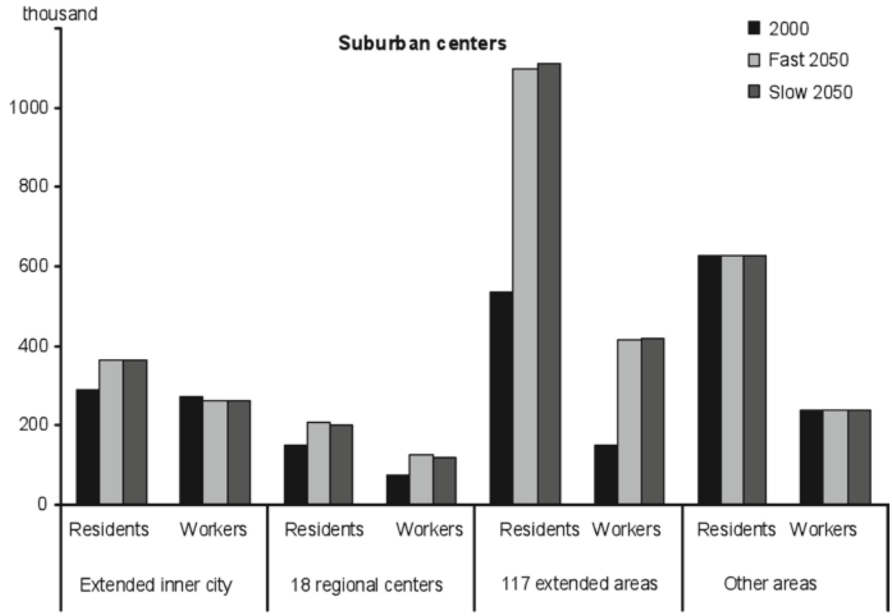

Fig. 23.2 Number of residents and workers in 2000 and in Suburban Centers Fast and Suburban Centers Slow in characteristic city areas

Chapter 24
Low-Rise Settlements – Fast and Slow*

During an air approach to Stockholm the regional transformation over the last 50 years is impressive. Everywhere lie verdant clusters of single-family homes like pearls strung along the edges of the dominating green wedges and belts. These green remnants of fields, copses and hillocks remind the observer of a once widespread countryside. The large-scale suburban enclaves and industrial areas are embedded in a softer, airier and small-meshed settlement structure. It seems to the uninitiated as if the suburban high-rise housing at one time grew out of the undulating patchwork of low-rise settlements. The transformation is obvious along the landed approach roads from outside the regions and what once were widespread vistas are now occupied by low, rather dense, town-like settlements. In addition, there are single-family and row house areas, the latter grouped together into more or less clearly defined clusters of 5–600 dwellings. These clusters abut each other via their more open greenswards, but are also always next to continuous green and recreation areas. In these or next to them stand daycare centers and primary schools shoulder to shoulder with facilities for play and spontaneous sports, as well as the many facilities for institutional sports, though the latter are rather spread out over the whole.

As we pass along the new roads that link the settlements, the similarity to many of Stockholm's older, stretched out suburbs seems surprisingly strong. However, the separation into clusters is clearer now due to the intervening green spaces. There is a greater and more planned concentration of small offices, neighborhood stores, shared facilities, car rental and the like to special points and stops along the connecting roads. Co-ordinating such shared service functions for several areas has created small centers with a food store, a café and restaurant, service office and the possibility for a more frequent public transport schedule. The large distance to different centers and the broader range in the commercial sector has led to a significant use of home delivery of goods, either to the home address or the service offices (Fig. 24.1).

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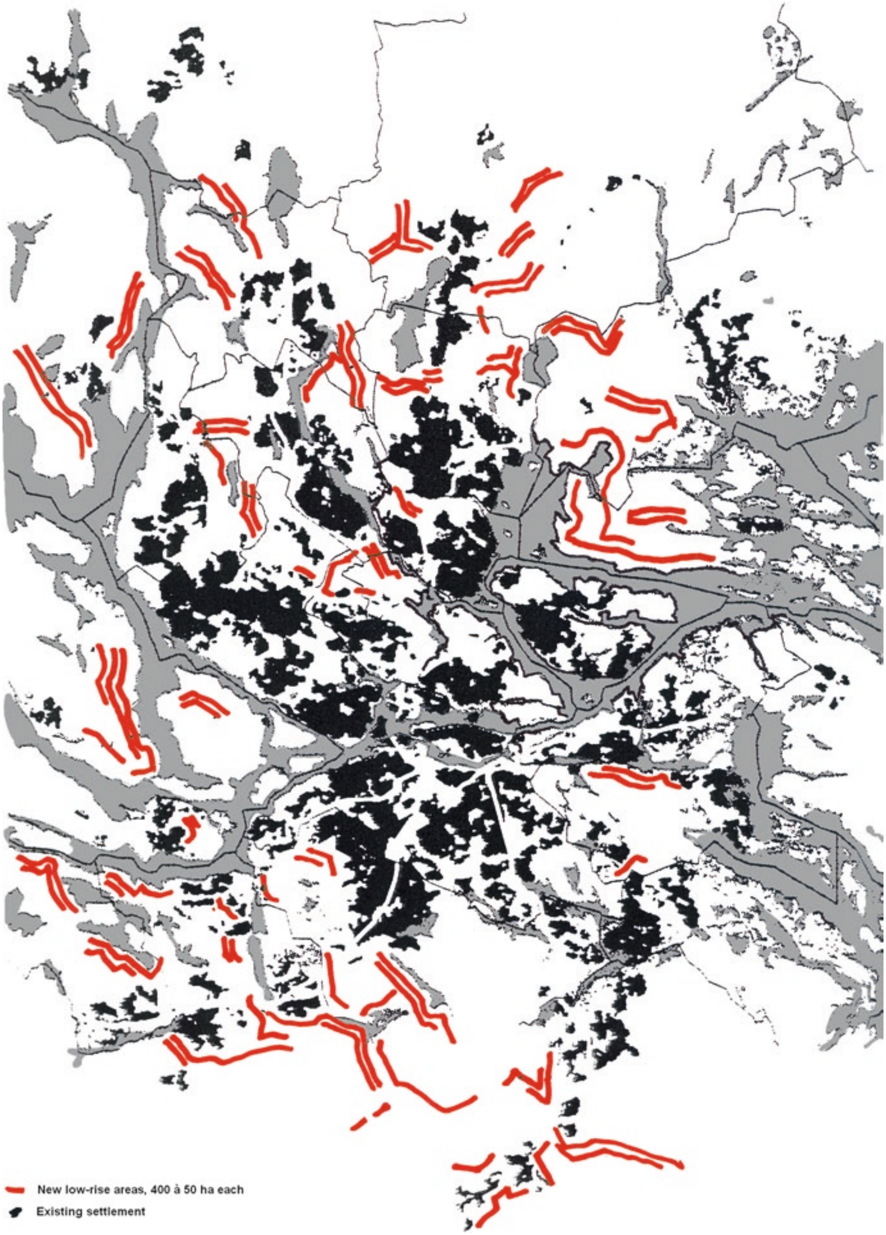

Fig. 24.1 Stockholm region 2050 with new construction mainly in 400 new low-rise areas 60 ha in size and collected in settlement strips. See Chap. 25 for degree of exploitation; see Appendix D for regional distribution of living and working

There are large variations when it comes to street network, housing patterns and building types both in and between areas. Many of them are arranged to follow the topography – following the contour lines on some slope or with a shoreline or forest fringe deciding the layout. Others take the spatial structure of a neighboring unit, village or town as their guide. All have bicycle and walking paths as the preferred link system, even if delivery vans and cars can reach all houses. Many of the new areas abut existing, older settlements, as well as suburbs dominated by single-family housing. In some cases older low-rise areas have been supplemented through extension or filling in, while several of the old summer houses have been transformed into permanent housing.

Some areas are dominated by larger villas and homes with their own gardens, other ones have semi-detached and row houses with small gardens. Still, the usual is a mix of housing types. In general the aim is for 1,500 residents and 400 work sites in small companies, public service and other operations. For this reason most of the areas have some denser, low sections intended for office and association facilities, as well as rental apartments for singles. In most of the new settlements the residents own the houses themselves, either individually or through associations and co-operatives. The alternation of building types parallels the variation in extensions, extra arrangements and decorations, such as terraces, greenhouses and sheds. Another common trait is the efficient heating systems, often seen in solar panels and insulated glassed-in verandas.

Road signs to these enclaves pop up all over the place displaying names that derive from the traditional name use or local history perspective. But while these new names are foreign to us, others are more familiar, specifically those names the local residents remember as they are about to go to work or school, go shopping or to entertainment, or visit a museum, concert or hockey match. For outside the new low-rise settlements and off the new local roads lies the older city structure and its centers, work areas and traffic system, albeit renovated and supplemented. Here you find the concentrations of cultural settings, larger companies and shops. The visiting frequency is high in these older centers and traffic hubs.

The expanded inner city still has the greatest attraction power. Many offices and other work sites have been replaced by residencies without therefore depriving the urban core of its political, financial, commercial and cultural attractiveness. New and relocated larger work sites, institutions and schools have primarily sought addresses in already well used, older hubs with track-bound public transport, placed in strategic locations not far from the sprawling new establishments, while many of the smaller companies and activities are placed in the new, low-rise areas. Some large, mostly newly developed areas of the region are an exception from the pattern just described. Here new centers have been built to provide reasonably proximate municipal and commercial services to the new low-rise areas.

In other words, Stockholm's new wardrobe has been created via a new, well structured and low completion process using previously unexploited land in the middle and peripheral spaces of the cityscape. More than half of the region's population can be found there and in the similar, older areas. The nearby larger hubs with older characteristics have been renovated in order to serve the population better, whether they live in single-family or nearby multi-family areas. The comprehensive bus system feeds its passengers into the central facilities, after which the extensive foot and bicycle paths lead their passengers either to local work, entertainment and other errands or to connections for further travel to the inner city or to other concentrations along the improved public transport systems.

24.1 Fast and Slow in Low-Rise Settlements

The separation of the new residential areas from the city's multi-faceted centers, large work sites and institutions is far developed in the low-rise city. In both Fast and Slow the trip from home to these places is mostly by bicycle or bus to the nearest trolley or commuter station and on, if necessary. Auto commuting occurs, but there are many local work sites and frequent distance work from the home. This localization pattern, with only small work sites in the residential areas, contributes to shaping the large life style differences between Fast and Slow.

Fast

In Fast with its longer work, school and study days, life in the low-rise areas and single-family homes has a more recreational aspect than in Slow. This is true even though the many who work in smaller local work sites and those working at a distance actively contribute to making the areas attractive and living even during the weekday. Free time over the weekends lend opportunities for a long presence in the residence. On an average, the home is nearly as spacious as today, though at the same time as it is just the weekends that offer the greatest amount of time for shopping, entertainment, excursions and visits drawing the population to other areas in the nearest hub and to the inner city. So even if more people are home in the suburban low-rise areas than today, especially young people are elsewhere pursuing their higher and secondary education activities in other urban districts and seeking evening pleasures and events whose venues are in different centers and the urban core.

Time shortage means work on the lot and the house, hired help is used for childcare at certain hours and care for the elderly. This also describes a significant influx of specialists, suppliers and craftsmen working side-by-side with those professionals already employed at the small, permanent worksites and companies who also command a diverse range of skills that can be utilized by the residents as necessity arises. The small center 'by the roadside' and the bus stop there is often a convenience store shared by several areas, one or two eateries and the area's service office. The last handles local matters, enabling residents to rent facilities, tools and vehicles, as well as serving as a place where deliveries can be made.

The residents get a lot out of their leisure life as long as it focuses on recreational activities, including exercise, ball games, playing outside and gardening. There is at least one indoor arena within bicycle distance, such as in the green areas or the nearest larger urban district. For more scheduled activities, commercial entertainment, culture and sports events the availability is both greater and more varied in other parts of the region, especially in the urban core and the regional centers.

Slow

Thanks to the development of distance working and local work sites, per capita commuting is reduced, especially in Slow. This process parallels a reduction in work site area, this too more in Slow than in Fast. The high recreational qualities found locally, as well as next to and inside the home, contribute actively to ensuring that travel does not grow as much as in the other two urban structures.

Since the choice of living in low-rise or single family housing can be seen as voluntary and desired, the low-rise city seems to suit the residents best in Slow in at least one way. For in this structure many spend their free time on fixing and working on their own lot and house. The possibility for exchanging services within the area is also easily utilized and saves money. Distance work, studies and the concentration of work hours to three whole days for the commuters makes a reduction in weekday travel possible and creates the opportunity for co-ordinating shopping and pleasure excursions with less stress. With a greater presence in the neighborhood comes a larger tendency to voluntary efforts and work in the areas on the initiative of various mutualities, as well as spontaneous, informal and organized activities, both indoors and out. In Slow more of the local facilities are mutually owned, as opposed to being commercial efforts. Some are in the central area along with smaller non-durables stores and where the service office owned equipment, machines and vehicles and as a goods distribution site. The is located offering a central meeting and information point, as well as serving as a center for shared and collectively adult presence outdoors forms the basis for a social control that promotes the safety of younger children without contributing to a much larger youth presence than in Fast.

The recreational life outside the home is linked to the free spaces and cultivations in the green areas. But even the urban core and other centers play a role for entertainment, culture and shopping. This has increased the short distance, intra-regional travel somewhat, though not by car. Many of these recreational and commuting trips begin on a bicycle or by bus to the nearest center or hub. Even the amount of long distance holiday and pleasure trips has gone down and is done by car or train, while flying has been considerably reduced.

The differences between Fast and Slow are also large even in most of the areas where no or little construction has occurred. In Fast the workday rhythms are much the same as today in many of the residential areas, even if many buy free time from advanced service sources. Many of the various urban district centers are more important as service settings, offering an expanded range of shops, eateries and new arrangements for service procurement. Larger properties have their own service office. In Slow, however, playing and working around the houses is common and

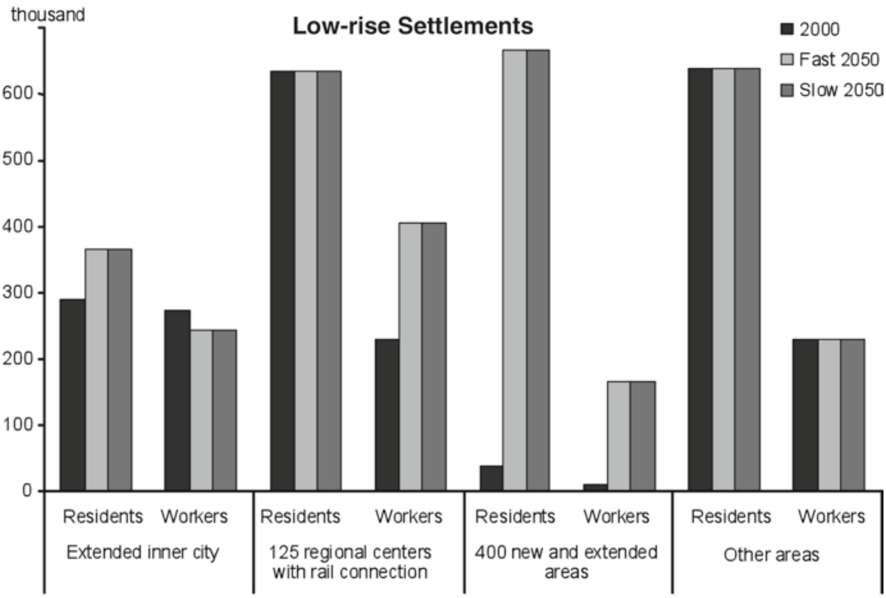

Fig. 24.2 Number of residents and workers in 2000 and in Low-rise Settlements Fast and Low-rise Settlements Slow in characteristic city areas

spread over the day. The central areas have opened up for more small companies, as well as for education and recreational activities.

Figure 24.2 illustrates the number of residents and workers in different district areas in 2000 and in Low-rise Settlements Fast and Slow 2050.

Chapter 25
Measures and Possibilities in Concentration*

The three urban structures in the images of the future represent a concentration of the Stockholm region. In Urban Cores and Suburban Centers this happens through the exploitation of land directly proximate or bits inserted in existing housing, while in Low-rise Settlements it is done by developing larger, hitherto unused areas. The intent here is to provide a simple picture of the new construction in the various cores, hubs and areas, both for residences and work sites, related to the size of the land taken into use. The question is whether the land exploitation, concentration and average height that is the result of our choices is possible, reasonable and acceptable. The answer is a reformulation of the future number of residential and occupational sites into construction surfaces based on the percentage changes in these categories indicated in each future image (see Table 10.3). The total floor surface is then related to the stipulated land surface and the result is evaluated through a comparison with existing areas in Stockholm or elsewhere.

25.1 Urban Cores

Urban Cores

*Chapter written by Bosse Bergman and Anders Gullberg.

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The six new urban cores and 22 new urban hubs are the largest change in the current urban structure seen in Urban Cores. Most of the housing supplement is placed there as shown on the map in Chap. 22 and in Appendix D.

Keeping in mind bicycle distance, as well as central and traffic functions, the urban cores are expected to use an area of just over 300 ha in a radius of 1 km. They comprise extension and concentration of areas that already have central facilities, institutions, work sites and residential housing. Even if we calculate that the construction volume could be increased somewhat with renovations and extensions, filling in empty lots, covering roads and the like, we still feel that only one half of the land area in the core would be accessible for new construction.[1]

In Urban Cores – Fast each core receives an average supplement of 1,500,000 and 1,080,000 m^2 work sites. With communications and service areas, this means that some 3,000,000 m^2 of new space is to be squeezed into 150 ha or 1,500,000 m^2. Hypothetically, if the entire area in question comprises two-story buildings, the construction ratio is 2.0. If half the area is built up, the height must be four-stories or the entire area covered with buildings similar to a typical city block in the Östermalm district of Stockholm (see Fig. 25.1).

Though the neighboring older areas contain parks, squares or wide streets, this area does not, something that seems to be a problem. This urban setting becomes even more problematic if we imagine one of the cores in Slow with a total building surface of 3,300,000 m^2. In that way 40% of the housing will have

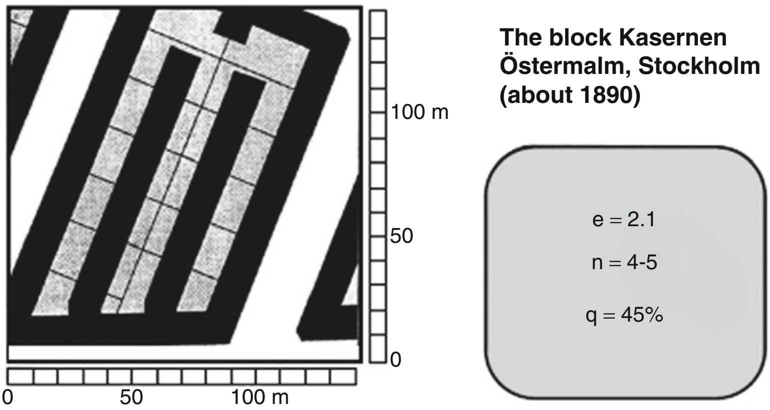

Fig. 25.1 Typical city block in the Östermalm district in Stockholm with an exploitation ratio of 2.1, four to five stories and 45% coverage (Source: Rådberg, J. and Friberg, A. Svenska stadstyper (Swedish City Types), 1996, p. 57. Johan Rådberg's next of kin could not be traced or contacted as potential copyright holders. If notified, Springer will be pleased to rectify any errors or omissions at the earliest opportunity)

[1] In some cases this new construction volume cannot be attained due to lack of exploitable land.

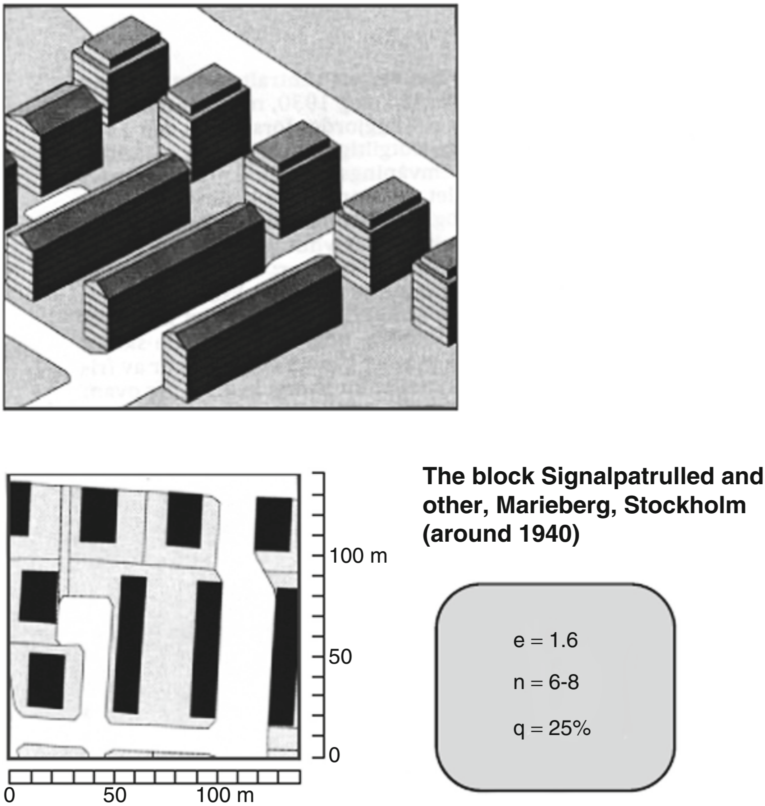

Fig. 25.2 Typical city block in the Marieberg district in Stockholm with an exploitation ratio of 1.6, six to eight stories and 25% coverage (Source: Rådberg and Friberg 1996, p. 68. Johan Rådberg's next of kin could not be traced or contacted as potential copyright holders. If notified, Springer will be pleased to rectify any errors or omissions at the earliest opportunity)

an additional story in Slow. Halving the exploitable area once again to 37.5 ha and 25% of the original built-up area provides us with 8.5 story housing and a spaciousness that could compare with other districts in Stockholm (see Fig. 25.2).[2] However, house heights can and should be varied, with taller ones in the middle and by the public transport terminals. To all this must be added traffic, parking, loading and storage areas that should not be housed on street level between the buildings.

We believe that the new, improved traffic and supply systems linked to integrated, co-ordinated urban functions and housing renovations and extensions will give a design to the new buildings that is better than traditional forms and answers more thoroughly to the functions of the cores and hubs. Through compact,

[2] Rådberg, J. and Friberg, A. Svenska stadstyper (Swedish city types), 1996, pp. 68–69.

large-scale facilities surrounding terminals and varying center facilities crowned by tall structures and linked to more efficient parking garages, both Fast and Slow have all possibilities to ensure within the urban district a variation between tall and low, as well as built and open spaces.

As shown in Appendix D, the intention for the supplemental construction in the 22 large hubs is to concentrate it to a surface with a radius of 250 m, that is within a comfortable walking distance to a traffic hub, even if part of the new construction will also be used to link the hubs to existing neighboring areas. In Fast, a total surface area of 200,000 m^2 supplemented with just over 400,000 m^2 (an average of 4,600 residents and 5,680 work sites) and half the available land built up, the hubs have an exploitation ratio of 4.2. Accepting that only half the area will be built up, the building height must be 4.2 stories or as in Urban Cores Slow where the total supplement is 459,000 m^2, in 4.7 stories, ought not be too hard as more sparse construction and green areas lie within walking distance.

However, the 22 chosen hubs in the Stockholm region occupy land with very different topographic conditions, existing construction and both conceived and existing traffic facilities. Eight of them have sufficient amounts of empty land to allow for an easy, varied supplemental construction within the calculation above. Nine can only count on having half the needed surface available and thus must build as high as 8–10 stories on half that area. As in the hubs on virgin land, the new construction must also be placed on top of parking, traffic routes, loading space and supply system. These might in part need to be in three levels and in part as podiums above ground. Seen as connected construction, some of the hubs of this type might even be denser than the urban cores. Still, by keeping the possibilities for varied house heights and light conditions, including perhaps some buildings with 15–20 stories in central locations, as well as the fact that there are open areas and green spaces nearby, it should even so be possible to ensure a functioning urban setting. In six cases the conditions are even tougher. If so necessary, a well-planned solution could include both tall buildings and green areas outside the 250 m radius.

The Urban Cores alternative also includes 12 older hub types that each will receive a supplement of 1,750 residents and 1,250 work sites in the Fast tempo and 3,660 residents and 1,000 work sites in Slow. It is possible, however, that the Slow alternative could have some problems offering good localizations for the supplement.[3]

[3] For a table illustration of the number of living and working in Urban Cores, see Appendix D.

25.2 Suburban Centers

Suburban Centers

The basic description of the Suburban Centers alternative is that the supplement of residential and work site localization is in 18 regional centers and 117 existing areas or urban districts with their own district centers located on the whole on existing or newly laid tracks for public transport. The maps in Chap. 23 and Appendix D show the locations. The new buildings are mainly placed just outside the areas, but also in their central sections and on lots between existing buildings. It is obvious on the maps that there is land to build on within the districts.

It is assumed that the regional centers will add an average of 2,400 residents and 1,800 work sites, while the other areas can be divided into two classes with varied expansion possibilities. These include about one-third of the 117 areas, primarily the 39 older areas along the subway lines that are so densely built that they can only accept a third of the supplement the others can take. The remaining 78 areas are the only ones that will be discussed here. For these we are talking about doubling the number of residents by adding some 5,500–6,000 persons, as well as a considerable addition of work sites amounting to perhaps just less than 2,700. The total area of the supplemental construction in Fast would be 340,000 m^2 and in Slow 365,000 m^2; illustrative examples would have to be calculated depending on the specific population density and surface area of the district under discussion.

Whichever existing areas are viewed, it is never an easy task to supplement an area without a concentration at the center and in the existing sections, for the most part rather sparsely grouped housing of mostly six-story buildings. Right next to the work areas there is often space that can be utilized, even if the land nearest motorways remains unused. Some of the supplemental construction might be able to occur as an extension towards neighboring areas, which would then grow together. Such meetings are also a conscious localization strategy in Suburban Centers, though without therefore undermining the attractiveness of either center. Such an intertwining is already a fact in some older areas closer to the urban core and along some subway lines, thus clearly limiting the possibilities for expansion and further concentration.

In the Suburban Centers alternative there are probably enough areas farther out in the region to handle the large supplement and still preserve significant portions of housing near woods, open fields and large green areas. Some of the areas planned in Stockholm are completely new and have grown up along new subway or cross connections over large, hitherto unexploited land.[4]

25.3 Low-Rise Settlements

Low-rise Settlements

The Low-rise Settlements alternative is the basis for a new urban structure calling for a different discussion about concentration. The actual construction is done in around 400 areas, both homogeneous and heterogeneous with, for example, single-family houses, villas and row houses with one and a half to two stories and some office and multi-family three-story houses at some hub. The maps in Chap. 24 and Appendix D show the locations. It is only natural to suggest that the new areas should be denser than many such areas today, since each area also includes an abutting 200 m cultivation and green zone with space for possible extensions. We have chosen a standard exploitation ratio of 0.4 for a section of the area with 22% of the whole built in two stories as shown in the Sofieholm district in Malmö (see Fig. 25.3). Initially the population is estimated at 1,500 and the number of work sites at 400.

In both Fast and Slow there would be just over 1,500 residents and the number of work sites around 400. The total surface space does not differ much – 74,000 m^2 in Fast and 76,500 m^2 in Slow. With around 75,000 m^2 surface space disposed according to the Sofieholm pattern, there will be 17 ha for the area's construction. Adding the app. 200 m wide zone around three sides of the area to form a square, the total land area would be app. 50 ha. While the measure of average density in Stockholm's single-family and row housing areas is 25 persons/ha,[5] this area is in the Low-rise Settlements alternative regardless of whether the calculation is for 92 at 17 ha or 31 at 50 ha.

[4] For a table illustration of the number of living and working in Suburban Centers, see Appendix D.

[5] Statistics Sweden, Markanvändningen i Sverige (Land use in Sweden) 1998, p. 91.

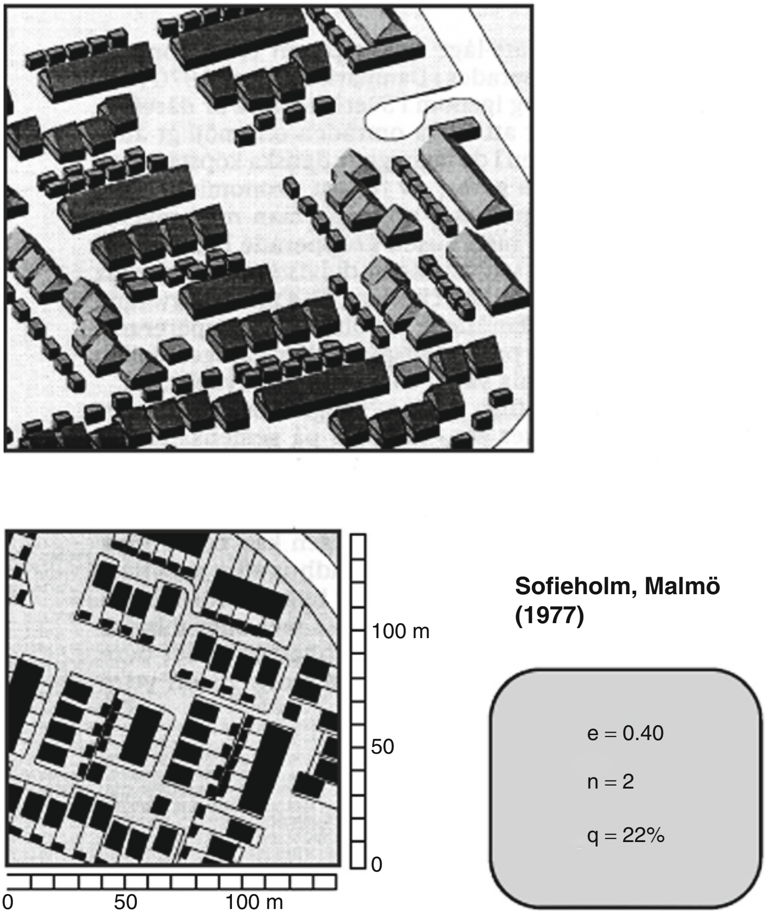

Fig. 25.3 Typical city area in the Sofieholm district in Malmö with an exploitation ratio of 0.4, 2–4stories and 22% coverage (Source: Rådberg and Friberg 1996, p. 114. Johan Rådberg's next of kin could not be traced or contacted as potential copyright holders. If notified, Springer will be pleased to rectify any errors or omissions at the earliest opportunity)

The question here is not if the area is too dense, as it holds approximately the same density as small towns, or how little of the supplemental residences and work sites can be fitted in the existing low-rise areas in order to transform these to units in a future image, nor even the proportion of current summer residences need to be transformed into permanent residences. What is important is rather which formations and what placement of the just over 400 new areas corresponding to a surface of 20,000 ha could be fitted into the Stockholm region. It is obvious that space exists, as there is unbuilt land equivalent to many times that amount in the region. However, the result would be as radical a change in the existing cityscape as in Urban Cores. In each opening between work sites, industrial facilities, trade and multi-family housing some low-rise area would grow. In actual fact the implementation of one of the most important aspects of this vision, namely that of an urban region with the biological diversity ensured along green wedges and repeated, varied natural areas, would be threatened. According to this future image, a large share of the new residents will by necessity be located in the regional periphery. In the schematic proposal in Chap. 24 we have initially sought to place them next to the existing areas and each other, usually in single or double rows. Thus the larger green wedges can be preserved, though frequently reduced by the width of at least two low-rise areas.

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Chapter 26
Time Use Today and in Images of the Future*

The changes in the actual time use by Swedes and some discernable tendencies in this change were discussed in Chap. 15. Though we have not attempted to refine today's trends, these various perspectives on temporal welfare are also reflected in our images of the future in our two temporal structures, namely Fast and Slow. In the former we find greater elements of rational handling of time using technological and economic solutions. Slow, on the other hand, places greater emphasis on social solutions to time shortage. Here there is also a stronger general tendency towards a slowing down to a less intense time use in both work and free time. Time use in Slow is generally more meditative.

The following chapter begins with a short presentation of the time dimensions in our two time use alternatives Fast and Slow. After this comes a comparison between today's time use and time use in the two alternative temporal structures.

*Chapter written by Paul Fuehrer.

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26.1 Fast – Cities with Little Time

Fast

The Fast city is recognized by an optimization of the daily time use under continued high socio-technical time pressure with its demands for synchronous activities, combined with a tendency towards paring down both temporal and material experiences and consumption patterns. The linear conception of time still rules, even if there are elements of a cyclical time conception. The prevailing time shortage has resulted in a very complex time management process whose primary goal is to create space for individual time rhythms as a counterpoint to the otherwise intense time use. This is mainly done using economic means and technological innovations designed to guarantee temporal welfare for urban residents. Another important goal for this rational time planning is to make it easier for urban dwellers to handle their insecurities when it comes to technological, economic and social cycles, including such elements as the durability, use and repair possibilities of durable goods. These cycles determine such facets as the use of energy and material intensive goods, as well as their social aging process that includes the incongruity of the fact that some durable goods (TVs and computers, for example) reach the end of their functional life long before they have ceased to function.

The increased degree of time planning is also reflected in a conscious co-ordination of the city's various time indicators, such as the municipal and regional infrastructures for traffic, hours for shops and governmental offices, as well as the schedules for national and internationally co-ordinated functions. Shaping a local time structure that is both energy and time efficient calls for a careful mapping of local conditions and needs, as well as their integration in regional, national and international systems.

The increased awareness of temporal welfare is also seen in new consumption patterns, such as when the households gain free time by utilizing private services and these in turn form a large part of the total household consumption. When it comes to material consumption, the households choose fewer, but better goods with higher value and higher service content. The value of the goods is in much decided by the know-how and time required to ensure its social appositeness and quality or put another way, its capacity for performing its functions. Thus quality not only includes the durability, precision and reliability of an item, but also how easy it is to use and repair. The interest in quality products is also seen in an upgrading of simple, original materials over composite materials, since these goods are then more durable, easier to recycle and become more attractive on a secondhand market. They are also more expensive to buy. At the same time there is a strong increase in knowledge about the authenticity of goods and of correct social consumption patterns. New standards for the aging of goods, an emphasis on quality and of the art of choosing right from the beginning combine to create a lower consumption pace at the same time as the innovation pace remains high. So instead of a one-sided focus on new technology or styles, innovation comes to mean the development of product characteristics like flexibility and upgrading capacity.

For certain items the selection, decision to buy and sometimes even the actual purchase are facilitated by consumer advice, primarily for clothing and durables. Some people choose to entrust these actions to qualified specialists, such as personal product consultants and purchasing agents. A widespread secondhand market is also tied to the services concerning taste and life-style advice. The product consultants can even help to find various style indicators to rent, something that is actually rather common.

When it comes to time consuming everyday tasks, such as buying consumables and home cleaning, these have become highly rationalized and automated using technical solutions such as ‘smart’ refrigerators and kitchen cabinets or computerized purchasing agents who keep track of need and influx of consumables into the household. Thus the buying of consumables is not handled by human, but by automated agents.

Another growing occupational area is events production and management. As time pressure and the focus on identity creation continues, free time is in part spent on ‘displaying oneself’ or using the public space as a show-off arena. However, the intent of such conspicuous consumption is not to show expensive items, but rather to indicate that one has lots of high-quality free time and knows how to enjoy this time in the right way.

26.2 Slow – The City at an Easy Pace

Slow

The design of the future image we offer with a slower time use is based on a radical departure from today's temporal culture. The socially and culturally defined time press and its socio-technical control devices, such as clocks and pocket diaries, has lost its compulsory grip as an increasingly pluralistic time culture with space for individual and local time rhythms develops.[1] In some ways this development can be viewed as an attempt to realize a somewhat idealized picture of the time use in earlier eras, when a consensus existed between work and natural or social rhythms.[2] Even if there exist new technical and economic solutions in order to increase the temporal welfare of urban residents in Slow, these are considerably more small-scale than in Fast.

The increased productivity in Slow mainly means that despite reduced work hours and a less intense work pace, the same household consumption possibilities remain. Shorter and more flexible work hours create the conditions for a stronger local co-ordination and an increased personal household production, often in collaboration with others. The new time culture also means the people become more aware of the importance of the temporal dimension to production and reproduction processes,[3] seen in the awareness of urban residents of the importance of product cycles and recycling. This reorientation is strengthened by an increased

[1]See Held, M. Alles zu seiner Zeit und an seinem Ort, 2001a (Everything in its own time and place); and Held, M., "Sustainable development from a temporal perspective", 2001b.

[2]This notion about a simpler life in harmony with natural rhythms is in many ways a modern version of the idealized view of the agrarian society that has been a frequent part of societal criticism since the Romantic period, and then especially in the critique of the modern industrial society.

[3]See Adam, B. Timescapes of modernity, 1998, pp. 24–59.

questioning of previously unquestioned, high-speed material consumption.[4] In Slow this consumption for consumption's sake has been replaced by a consumption pattern that focuses more on the practical use and benefit to the consumer, something that is also reflected in an increased awareness of how we view objects.[5] The consumers are very selective, though in another way than the typical Fast consumer. The vital criteria for buying in Slow include long working life, energy efficiency, the possibility for repairs or recycling and the potential for co-use. Naturally there will still be time to consume, but in comparison to today's market, a much more clearly indicated time to refrain.

Identity work is of central importance even in this alternative, but it is more in the form of personal work or in informal and/or local networks. Know-how and skills that take a long time to acquire are highly appreciated and the private or network competence is gradually built up and reinforced. Using new information technology, informal networks can facilitate the choices of their members regarding resource and price efficient goods and service through exchange of experiences and product reviews. Since such exchange networks overlap, information technology can even create conditions for a goods and service flow that goes beyond local contexts. Thus resources that can be shared are more frequently co-used. This is further facilitated by the recognition of personal time use rhythms, something that also is expressed in the social temporal structure. The high variety of personal time rhythms that include more flexible times for work and leisure reduces the need for personal belongings. This is true since co-ownership of resources is facilitated when fewer persons need to use the resource at the same time, such as with a co-owned car. Durable goods, tools, living space and other indoor and outdoor spaces, gardens and courtyards are other examples of co-owned resources.

Even if the selection and actual purchase is mostly done by the individuals themselves and in informal or co-operative forms, there is space for increased commercial services in the consumption field. The primary focus of such services is to strengthen the skills and capacities of individuals and groups in different fields, rather than taking over responsibility and implementation. Certain functions that function work and develop well in a centralized regime are not part of this tendency, such as water and sewage systems, public transport, district heating and production and distribution of electricity. However, for these and possible future systems it is important to strengthen the active household involvement, not only through dramatically increased possibilities for tracking private consumption and costs, but also through greater opportunities for chosen service level and in certain suitable ways become co-producers within the system. With the slower tempo and reduced time press comes the need to accept speed limitations for private car use, as well as ones within the urban area.

[4]Csikszentmihalyi, M. and Rochberg-Halton, E. The meaning of things, 1981, p. 230.

[5]See Csikszentmihalyis and Rochberg-Haltons definition of instrumental materialism, 1981, p. 230.

26.3 Summarizing Temporal Structures

Fast continues at a high tempo and an intense time use in working life. Even the free time is recognized in a multiplicity of activities that often call for special equipment that can be rented. Temporal welfare and increased free time is gained through technological advances and an increase in private service consumption. This increase is primarily in the commercial sphere, but also in public service, both financed by the continuing high work pace. In Slow there is a reduction in the demands for time in working life – people work fewer hours per day/week/month/year and overall time use at work is less intense. While it is not true that household consumption possibilities are prevented from increasing, this slowdown facilitates production of social contacts and co-operative work at home through more free time.

Tables 26.1 and 26.2 below illustrate how time use in Fast and Slow appears when compared with today's use on weekdays and weekends. It may seem paradoxical that time use for the Personal category does not increase more in Slow than in Fast, since in the former there is more time for other activities than earning a living. However, the category division of household functions is somewhat misleading. Much of the increased temporal welfare in Slow is gained in that the household duties are not as crowded to one side by the weekday stress. Rather the time spent on Residence, Food and Care have gained in value.

Table 26.1 Time use in fast and slow compared to the average time (hours/minutes/day) allocated to the six household functions in Greater Stockholm 2001 Weekdays

	Today (2000/2001)			Percentage change (in %)	
Weekdays	Women	Men	Average	Fast[a]	Slow[a]
Personal[b]	4:13	4:01	4:07	+15	+15
Residence	1:45	1:00	1:22	−40	0
Food	2:24	1:38	2:01	0	+30
Care	1:30	0:50	1:10	0	+35
Support	5:31	7:47	6:39	0	−25
Sleep, etc.	8:37	9:48	8:41	0	0

Sources: The information on time use today comes from unpublished results of the SCB time use study; average time by activities and gender, H-region Stockholm, population 20–64, September 2000 to May 2001.

[a] The percent states reduction/increase 2000/01 with the average for both sexes as reference point

[b] Since the time used for personal needs such as nightly sleep and hygiene has been shown to be mostly unchanged in many studies (Gershuny, J. Changing times, 2000), only the time used for recreation and spare time is shown in this item. Sleep etc. is thus a remainder post dominated by sleep

Table 26.2 Time use in fast and slow compared to the average time (hours/minutes/day) allocated to the six household functions in Greater Stockholm 2001. Weekends

	Today (2000/2001)			Percentage change	
Weekends	Women	Men	Average	Fast[a]	Slow[a]
Personal[b]	6:12	7:29	6:50	+10	0
Residence	2:23	2:02	2:12	−15	0
Food	3:28	2:40	3:04	0	+5
Care	1:09	0:38	0:53	−35	+20
Support	0:55	1:23	1:09	0	−25
Sleep, etc.	9:53	9:48	9:52	0	0

[a] See Table 26.1

[b] Gershuny, J (2000) *Changing Times. Work and Leisure in Postindustrial Society*. Oxford University Press, Oxford

26.3.1 Fast

Fast

The high work frequency continues and, on an aggregate level, results in about the same time use for work as today since all persons of a working age hold full-time jobs. The combined time use for household work is considerably reduced since the use of timesaving machines and consumer goods has increased along with the purchase of personal services.

The care segment displays varied development. On the one hand larger shares of care is outsourced to various entrepreneurs and institutions, while on the other more time is invested in education for both adults and children. The result is that the time spent in the care category is much the same as today.

When it comes to food, the time use for purchasing, for breakfast and for lunch shrinks. Longer dinners are preferred, though usually at restaurants as there is no time for buying and cooking food. In all it means that there are few changes in this category. In Fast much more time is spent on recreation and leisure activities than happens today, both weekdays and weekends.

26.3.2 Slow

Slow

In Slow the amount of household work is the same as today. At the same time there is a considerable reduction in working hours, though this can happen in many different ways. Many choose to reduce their daily working time, while others would rather have an additional day off during the week or a longer vacation. The work intensity can also vary to a greater extent than today throughout the working life, such as by using time banks that follows the worker when s/he changes job. This idea would enable parents with small children to choose to work less when the children are very young.

Time spent on recreation, care and food increase in Slow. However, the increased time used for food cannot be explained by suggesting that people will eat more at restaurants or elsewhere. Rather we believe that there are more, longer meals at home and with friends. As in Fast, weekday time for recreation and free time increases strongly in Slow as compared to today, but instead of commercial alternatives people will choose leisure activities that are planned and carried out personally, in informal networks or various associations such as sports clubs. On the weekends, the time used for recreation in Slow is about the same as today, but the tempo is still different in that the household activities are no longer as squeezed in between the leisure activities.

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Chapter 27
Energy Use from the Household Perspective*

In this book we argue that energy use is fundamental to how a city should be viewed in relation to ecological sustainability goals. Therefore, it is important to understand current patterns of energy use. When we focus on the private and public consumption of a given population (Stockholm residents), we cannot use the usual energy statistics, which primarily describe energy use in a specific economic sector or a geographic area, usually Sweden. For this reason, we have done completely new calculations that consider the energy content of goods and services that are exported and imported, which will allow us to estimate the total direct and indirect energy use of the given population.

In this chapter, we describe in fair detail how we conducted the calculations. Towards the end of the chapter we also give some results, including a comparison between energy use among Stockholm residents as compared with the rest of Sweden. Readers who are only interested in the results can skip to the end and readers who are not interested in the quantitative aspects of energy use can go on to the next part of the book.

27.1 Calculating Energy Use for Private and Public Consumption in Sweden

Considering the household perspective of this book, the ideal would be if all energy use could be related to the consumption of private and public goods and services. Unfortunately, this was not entirely possible. What the calculation lacks is the energy use linked to investments in infrastructure, buildings, machines and the like. With the exception of energy use for investments, we have calculated the energy use in 2000[1] distributed among the six household functions[2] for Stockholm residents as

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* Chapter written by Leif Hedberg and Mattias Höjer.

[1] In reality, the data for energy use is a mixture of the data for the years 1999, 2000 and 2001. We have chosen to call it energy use in 2000 in the rest of the presentation.

[2] See Chap. 2 for a description of the household functions.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*, DOI 10.1007/978-94-007-0653-8_27,

well as people living in the rest of the country. The calculation also includes the energy content in goods and services imported to the region.

For some purposes, it is already possible to calculate direct energy use today. One such example is energy use for home heating and household electricity, data we have retrieved from municipal energy balances from 2000.[3] These balances, calculated by Statistics Sweden, show direct energy use in households in the form of purchases of electricity and fuels.

However, direct energy use gives rise to indirect energy use from previous stages: refineries, transports, production of district heating, distribution losses and so on. We have included this indirect energy in our calculations. We calculated the energy for fuels and district heating using data generated by life-cycle analyses, LCAs.[4] For production and distribution losses in district heating and electricity, we used data from Hedberg et al.[5]

We have used two different methods to calculate energy use for travel. For car travel, households purchase the vast majority of fuel themselves. We were able to obtain the scope of these purchases from Statistics Sweden's environmental accounting.[6] These figures were augmented with the indirect energy use from LCA data[7] in the same way as for other fuels and district heating.

The total energy use for other private travel, consisting of public transit, rail, air and sea travel, was calculated using information on travel volumes in 2000 from the RES database[8] combined with energy intensities, including indirect energy use, taken from Åkerman and Höjer.[9]

The energy content in other goods and services was estimated by combining Statistics Sweden's national accounts[10] for 2000 with an input–output analysis. The national accounts provide information on private and public expenses divided up by purpose, while the input–output analysis contributes with how much energy is used per euro for each purpose.[11] Combining these two sources allows us to calculate energy use per purpose. The energy content in the public sector's activities was also calculated using input–output analyses performed by Statistics Sweden's environmental accounting department.

[3] Municipal energy balances in 2000 and 2005.

[4] Uppenberg, S. et al. *Miljöfaktabok for bränslen* (Environmental facts about fuels), 2001.

[5] Hedberg et al. *Rum for framtiden* (Space for the future), 2003.

[6] Calculations done for this book.

[7] Uppenberg (2001).

[8] The RES travel survey is conducted by Statistics Sweden on the assignment of the Swedish Institute for Transport and Communications Analysis.

[9] Åkerman, J. and Höjer, M. "How much transport can the climate stand?", 2006.

[10] www.scb.se, Databases.

[11] The input–output analysis was done by Statistics Sweden's environmental accounting department on the assignment of the research project behind this book.

All together, this calculation method results in an energy use of 297 TWh for the population nationwide.[12] These 297 TWh form the basis of the illustrations of energy use in the images of the future below. In our calculation, we have divided the total energy use of persons living in Sweden for private and public consumption into consumption categories. The energy content in the consumption of imported goods is included. The energy content in goods exported from Sweden is not included in the consumption by persons living in Sweden and is therefore not included in this calculation. According to Statistics Sweden's environmental accounting department, the energy content in investments can be estimated to 10–20% of the energy for private and public consumption, or 30–60 TWh. This makes energy use nationwide, including investments, about 350 TWh per year.

Remember, these 350 TWh are the consumption by persons living in Sweden, not Sweden's energy use. This is an unusual perspective on energy use; usually statistics are based on all energy use in a country. Comparing these two methods is not an easy task, but some differences become evident in the official statistics from the Swedish Energy Agency, which show that the total energy use in Sweden was 435 TWh in 2000.[13] The difference between their figures and those we have based our calculations on is primarily that the Swedish Energy Agency measures the total energy use in Sweden. This includes the energy content in goods that are exported from Sweden, but not goods that are imported. The difference between the two calculation methods is an indication that Sweden is an industrial nation whose export energy content is much larger than the import energy content. There is no data on how large this surplus is. Table 27.1 shows the value of Sweden's imports, exports and production for several industries. It also shows energy use in Sweden for each of them. This data cannot be used to calculate how much energy is tied up in Sweden's net exports, but it does show the high energy use in the export-focused sectors such as pulp and steel, giving an indication that the energy content of exports is greater than that of imports.[14]

Statistics Sweden has done calculations on the environmental impact of Swedish trade,[15] but these calculations only consider emissions of carbon dioxide, sulfur dioxide and nitrous oxides. The figures indicate that Sweden's net import of carbon dioxide through trade is fairly large. This is an effect of the very low carbon dioxide emissions of Swedish electricity production and says nothing of the net energy balance through trade.

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[12] Includes losses except for conversion losses in nuclear power, which facilitates comparison with the Swedish Energy Agency's data below.

[13] Energy in Sweden, 2003–2004, table for Fig. 2. Total energy use not including losses in nuclear power and the "Foreign shipping and use for non-energy purposes" item.

[14] This table does not include product group 11, "Raw petroleum and natural gas", because this group primarily falls under the Swedish Energy Agency's categories: "Transport" and "Housing, service, etc."

[15] Statistics Sweden, Environmental impact of Swedish trade, 2002.

Table 27.1 Industry's trade, production value and energy use, 2000

Industry (SE-SIC92 code in parentheses)	Import	Export	Prod. value	Consumption/ production	Energy use Sweden TWh
	Billions SEK				
Pulp, paper, paper products (21)	11	80	115	40%	76
Basic metals (27)	41	53	72	84%	25
Metal goods, means of transp etc. (28–35)	333	446	714	84%	11
Chemicals and chemical products (24)	60	71	101	88%	8
Wood products, not furniture (20)	6	28	65	66%	8
Other non-metallic mineral products (26)	8	7	23	104%	7
Food, beverages, tobacco (15–16)	30	17	113	112%	6
Mines, mineral extr. (10, 12–14)	5	6	15	96%	4
Other industries	90	73	150	112%	7
Total					153

Sources: Databases on Statistics Sweden's website in July 2009: Imports and exports of goods by products by SPIN 2002, Production value according to Structural Business Statistics, classified according to SE-SIC920020 and Yearly energy balance sheets 2000–2001, EN20SM0301, table 6.6.

27.2 Calculating Stockholm Residents' Share of Energy Use

Stockholm residents' share of consumption differs per consumption category. To calculate their share of the energy used by persons living in Sweden, we must make several assumptions.

We obtained the direct energy use for heating and electricity by adding together the energy use in the 22 municipalities in the Greater Stockholm area as presented in the municipal energy balances. For transports, we took Stockholm residents' share of total private travel from the database for the RES survey on travel habits.

The calculations of energy use for other consumption are based on Greater Stockholm's share of consumption according to the expense barometer.[16] This expense barometer is published on a more aggregated level than the data we used regarding expenses and energy content for the nation. We have therefore used the share for the higher level for all subgroups as defined in the national accounts. The region definition used in the expense barometer, Stockholm's H-Region, contains all of the county's municipalities except for Norrtälje. Greater Stockholm's share of the H-Region in 1999 was about 94%, which is the figure used for all other expense

[16] Statistics Sweden, Household expenses, 2000.

categories to correct the estimated consumption figure for Stockholm residents. We also used the expense barometer to calculate Stockholm residents' energy use in summer houses.

The energy content was calculated by assuming the same energy content per Swedish krona as the national figure. One problem with this method is that it is affected by the price level, which is higher in Greater Stockholm for some products and services than in the rest of the country. For multi-family housing and low-rise housing, information is available on what percentage of the nationwide number of such apartments are located in Greater Stockholm.[17] These shares give a better idea of the energy use for maintenance, sewers, operating energy and the like that is included in the basic rent, than a simple distribution of the expenses would. That is why we chose to use them instead.

We used the percentage of the national population living in Greater Stockholm, 18.5%, as a distribution key for public energy use. Public consumption expenses are classified in the national figures, either as collective or individual.[18] Collective services, such as defense and police, belong to the first category, while goods and services for individual use fall into the other. The public sector's individual consumption expenses include health care and social welfare. Over 70% of public consumption is individual. Distributing it according to the population share is reasonable for the collective category, but a better distribution method would have been desirable for the individual expenses, which we could expect to vary significantly between regions.

27.3 Calculating Energy Use by Stockholm Residents Per Household Function

The expense categories according to the national accounts and the six household functions are not built according to the same system and they are not based on each other. This means that some expense functions need to be distributed among several different household functions. For example, the "Car" category is distributed to Personal (leisure trips), Food (shopping trips) and Support (job commutes).

The categories affecting direct energy use in the form of electricity, fuels and district heating are Housing, Food and Personal. Home heating is distributed to Housing, but heating of holiday cottages is distributed to Personal. According to the municipal energy balances, 27% of the use of wood fuel is attributed to summer houses. Other fuels and district heating are distributed to Housing. The municipal energy balances show electricity use distributed among electrically heated low-rise housing, other low-rise housing and holiday cottages. All electricity use for holiday cottages was distributed to Personal, including food handling. For low-rise housing,

[17] Annual statistics for Stockholm County and county council in 2004, p. 227.

[18] Statistics Sweden, National accounts, 1995–2000, 2001a, p. 8.

calculations of electricity for heating were based on the energy statistics for low-rise housing from Statistics Sweden.[19] The remaining electricity is used for household appliances, lighting, computers, television sets and the like. It was distributed among Food and Personal according to weighting tools for various purposes, based on statistics from the Swedish Energy Agency.[20] The same data was used to distribute the energy that can be traced to manufacturing, repairs and maintenance of household appliances.

Fuel for cars and energy use for public transit, rail and sea transports were distributed among Personal, Food, Care and Support through analyses of the RES database. Air travel was placed under Personal. Energy use tied to public expenses for transportation, including national authorities and road maintenance, was allocated half to Personal and half to Support. This is somewhat more than the share for commute trips, but is a reasonable enough estimate. All assumptions regarding how various expense categories were distributed among household functions are summarized in Appendix A.

27.4 Stockholm Residents' Energy Use 2000

At first glance, a key trend in modern consumption patterns seems to be that the material needs are losing significance while the immaterial needs are increasing. Material needs refers mainly to basic support and security: food to eat, a roof over our heads and clothes to keep us warm. Immaterial needs in this case would be more about social processes than objects, about our need for participation, emotional relationships, understanding and so on. In principle, these needs could be met with low requirements for material resources. However, modern society has not developed in that direction; rather, meeting immaterial needs has increasingly come to require material items. There is much evidence that a growing proportion of disposable incomes is spent to meet immaterial needs in a way that requires the use of energy and other natural resources. One example is the rapidly growing leisure activity industry and particularly the transports related to it.[21]

A review of household energy use in Stockholm can indicate which activities are particularly significant from an energy standpoint and which are less important. A survey such as this could form the basis of an analysis of the importance of households to collective energy use, and the opportunities to reduce this usage in various ways. Stockholm household energy use is described roughly here using the energy use of the six household functions used earlier.

[19] Statistics Sweden, Energy statistics for low-rise housing 2000, 2001b.

[20] Swedish Energy Agency, Cut energy costs in your house, 2001.

[21] Jackson, T. and Marks, N. "Consumption, sustainable welfare and human needs", 1999, pp. 436–439.

Table 27.2 shows energy use in Greater Stockholm at the turn of this millennium, which was calculated as 35 MWh per capita. In these calculations, the residents of Greater Stockholm have somewhat higher energy use per capita than people in the rest of the country, mainly due to greater air travel and greater energy use for housing purposes.

Personal and Housing represent about one-third each of energy use by Stockholm residents. Food and Care represent one-eighth each and Common and Support use 1/20th each (see Fig. 27.1).

The review of household energy use shows that household actions are of great importance. The collective services – Care (healthcare, schools, childcare and care of the elderly) and Common – represent 17% of the collective use, while individual use represents 83%. How households choose to live, eat and spend their free time is far more important than how social services are organized and used. However, it should be noted that the majority of public consumption expenses consist of goods and services for individual consumption; over 70% of public consumption is individual. The individual consumption expenses in the public sector include health care and social welfare, which means that the size of this function depends greatly on the actions of the individual households.

Table 27.2 Distribution as a percentage of energy use in Greater Stockholm, totaling 35 MWh/capita, not including energy use for investments

Percent	Personal	Housing	Food	Care	Common	Support	Totals
Housing services	0	7	0	0	0	0	7
Durable goods	5	2	0	0	0	0	7
Transport service	8	0	0	0	0	2	10
Consumables	2	0	8	0	0	0	10
Other services	6	0	1	11	5	0	24
Purchased energy	14	23	3	0	0	2	42
Totals	34	32	13	12	5	4	100

Sources: See the text for a detailed description of how the calculation was done.

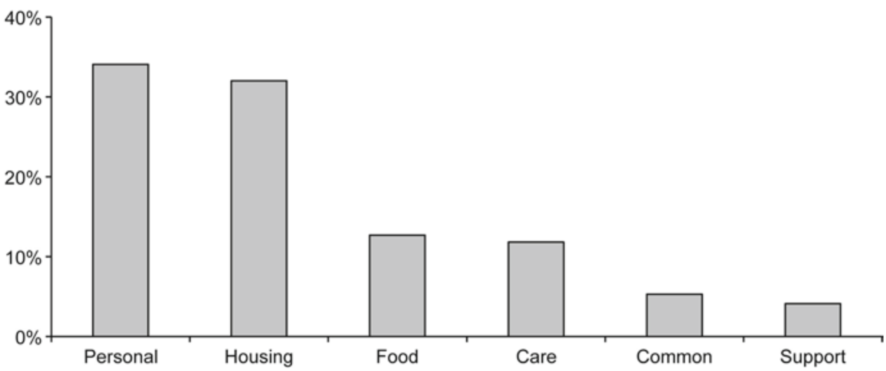

Fig. 27.1 Stockholm residents' energy use in 2000 divided up by function

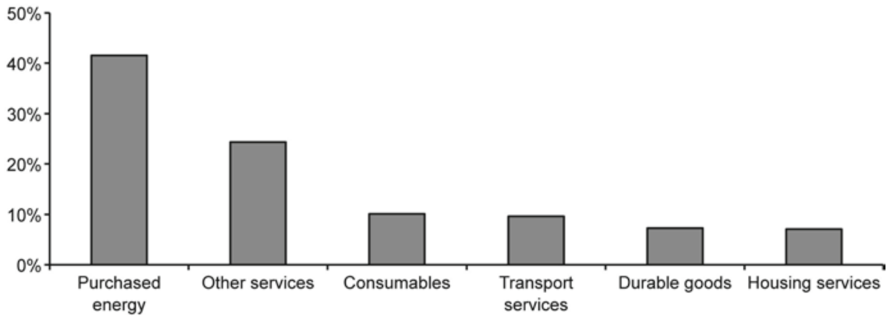

Fig. 27.2 Stockholm residents' energy use in 2000 divided into purchased energy and various types of embodied energy

Household energy use is both embodied and purchased. Purchased energy use consists of energy bearers such as electricity, oil, gasoline and district heating. Embodied energy use consists of purchases of goods and services, which in turn require energy both before and after use. Embodied and purchased energy use are about the same size. It is important to keep this relationship in mind when discussing household behaviors and the opportunities to change them towards less energy-consuming alternatives. A large part of household energy use is 'invisible' in the sense that it is difficult for individual households to know what a certain purchase means in terms of energy. It is much easier to learn the energy consequences of various actions when it comes to purchased energy. For example, operating durable goods, particularly cars and kitchen appliances, represents about 40% of this figure. A somewhat larger part goes to heating and the rest to lighting. Figure 27.2 shows that the sum of durable goods and consumables – the energy use for all goods we purchase – is about 15%. These 15% are divided up among food (about 8%), durable goods (about the same) and a small item for other consumables (a few percentage points). Other Services includes all the public energy use for health care, schools, childcare, care of the elderly and public administration, consisting mainly of heating and operating electricity in facilities (see Fig. 27.2).

Figure 27.3 shows the distribution of direct energy and various types of embodied energy for each of the household functions. For example, we can see that energy use in Personal and Housing largely goes to purchased energy. In the former, this is energy for heating and in the latter it is fuel for cars.

We can also see that the column indicating what is usually considered the most palpable element of the consumer society, Personal/Consumable goods, in Fig. 27.3, is small. Critics of the consumer society have continuously branded excessive personal consumption as objectionable from an environmental standpoint as well as others. Examining what some forms of this consumption actually mean from an energy perspective, they appear as hardly more than marginal. Clothing and shoes, plus certain equipment for leisure activities, combined result in a small contribution to collective energy use, around 4% of the total. Pure consumable items for

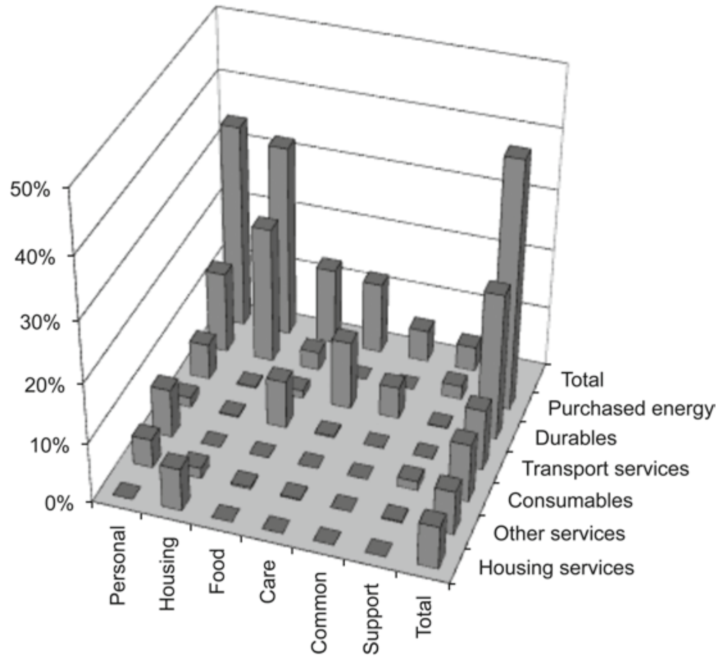

Fig. 27.3 Stockholm residents' energy use in 2000 divided into direct energy and various types of imbedded energy

personal use are even less significant in the context, amounting to about 1% of use. In all likelihood, the space used to store all the belongings is much more critical to energy use than the embodied energy in these goods. Increasing amounts of belongings create an ever-greater sense of need for larger home areas – a figure which is already large – resulting in growing energy use.

Common is a category with no city-specific properties and whose energy use must therefore be considered just as great in Stockholm as in the rest of the country. There is no reason to vary it between the different images of the future. For this reason, we do not include Common in the future discussion.

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Chapter 28
Energy Use in 2000 and 2050

This chapter consists of seven parts. The first five give a detailed description of energy use for five of the six household functions (all but Common) in 2000, followed by corresponding data for the images of the future. The sixth section goes through energy use in 2000 and 2050 for work-related travel, goods transports and use of facilities. These aspects are not visible among the six household functions, but are built into private and public consumption. Still, we have chosen to list them specifically here, because as a group they use large amounts of energy and are vital for several household functions. The last section compares energy use in 2000 with the combined energy use of the six images of the future, divided up among the five household functions that are the focus of this chapter.

To describe the drop in energy use in the six images of the future, we have selected several activities from the trends described previously and the assessments of the opportunities to reduce energy use. We quantify, motivate and summarize the energy savings in text and table format.

The changes described below are enhanced by the effectivizations we discussed in the chapter on technology. This is highly significant for energy use in all the household functions. In the Personal and Support functions, vehicle development in particular is vital. For Residence and Care in particular, more efficient heating and operation of buildings is the crucial factor for reducing energy use, while greater efficiency in production technology is key to better energy use for consumer goods in the Personal function and for all parts of the food products chain.

Many changes from the situation in 2000 have tended to move in the same direction in all six images of the future. In fact, in many cases the differences between the various future images are smaller than the difference between a given image of the future and the current status. The changes we discuss here are a combination of adjustments in individual behavior and production methods and the results of community organization.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*,
DOI 10.1007/978-94-007-0653-8_28,

28.1 Residence

28.1.1 Residence in 2000

Energy use for Residence is divided into sub-items as shown in Table 28.1.

The dominant item in the Residence category is heating, totaling 13 TWh, or more than the energy use for leisure travel. In the environmental debate, cars are usually painted as far more problematic than the home and its heating. Heating has primarily come into focus during periods of rising energy prices and then not usually as an environmental issue per se, but rather as a financial issue for households. One reason that housing and its heating have not received the attention they deserve may be that the amount of energy that goes to this purpose is less visible than that used for travel. There may possibly also be an unspoken needs hierarchy behind the lack of discussion of household energy use in public debate. Having a roof over our heads and heating are considered more basic human needs than traveling. If nothing else, travel may be seen to involve a greater amount of freedom of choice and therefore greater chances of 'overconsumption', than household heating.

Energy use for housing services consists of the energy required to operate and maintain homes. For multi-family housing, it also includes building power – the power supply to common areas such as stairwells and laundry rooms. The indirect energy use for low-rise housing is lower and is mainly linked to repairs and maintenance. Housing services also include water and sewer. When categorizing household functions, the energy use for lighting in the home falls under the "Personal" category.

28.1.2 Residence in 2050

Energy use in the home can be changed through various combinations of technological and behavioral changes. Below we summarize how energy use for Residence has decreased in the images of 2050. Changes have been made in heating, living space, more efficient maintenance, better use of excess heat and dematerialization.

All the images of the future are based on the same degree of effectivization of energy use for heating or 60%. According to the estimates in Hedberg's report this change is a result of improved heating technology and better insulation.[1]

Table 28.1 Stockholm residents energy use in the Residence category in 2000

	TWh	Share (%)
Heating	13.0	71
Multi-family housing, housing services	3.6	19
Furniture, home decorations, household appliances, etc.	1.3	7
Low-rise housing, housing services	0.5	3
Totals	18.3	100

[1]Hedberg, L. et al. Rum för framtiden (Room for the future), 2003.

Table 28.2 Changes that affect energy use in Residence in 2000–2050

	Urban Cores		Suburban Centers		Low-rise Settlements	
	Fast (%)	Slow (%)	Fast (%)	Slow (%)	Fast (%)	Slow (%)
Heating	–60	–60	–60	–60	–60	–60
Living space (m^2 per capita)	–15	–10	–10	–5	–5	0
Housing services (kWh/m^2)	–60	–60	–60	–60	–60	–60
Excess behavior (kWh/m^2)		–5		–5	–5	–5
Excess density (kWh/m^2)	–5	–5	–5	–5		
Furniture etc. (kWh/capita)	–15	–10	–10	–5	–5	0

Living spaces vary between time and space structures. People in Slow spend more time in the home than in Fast, so the demand for living space is somewhat greater in Slow images of the future than in the corresponding Fast images. For each tempo, the greatest amount of area is used in Low-rise Settlements, somewhat less in Suburban Centers and least of all in Urban Cores. This is because the price per square meter is generally higher in the more dense urban structures. Table 28.2 summarizes the change in home sizes in the various images of the future.

There are plenty of opportunities to improve energy efficiency in nearly all areas. Housing services, such as administration, repairs and maintenance of homes, are no exception. We use the same degree of effectivization, 60%, in all images. This corresponds approximately to the assumptions on the potential to cut operating power in Hedberg et al.[2]

Excess heat from homes could be used more efficiently, above all through more deliberate use of electric appliances. Since the majority of excess heat comes from human bodies and electric appliances, this item is heavily dependent on behavior. Spending more time in the home, for work and free time, means greater savings.[3] Between the different future images, Low-rise Settlements creates the greatest savings because it has a greater amount of people working from home. Next comes Suburban Centers and last Urban Cores, where the lifestyle is most outgoing. Spending more time at home generally leads to greater savings in Slow. However, the total savings from reusing excess heat is not very great. In fact, it gives no savings at all in the Urban Cores Fast and Suburban Centers Fast images. It does provide 5% savings in the other future images. Excess heat can also be used more efficiently in denser population centers, where for example excess heat from businesses can be used to heat homes in the same building.[4] Low-rise Settlements does not allow this type of energy savings. Other future images show a savings of 5%.

As indicated previously, homes will generally be somewhat smaller in the images of the future than today. This also means less consumption of furniture and therefore energy use for furniture and so on, in proportion to the reduction of the living space.

The energy use of the home in the six images of the future can be calculated by applying the changes in Table 28.2 to energy use in 2000 in Table 28.1. The result

[2] Ibid., p. 45.

[3] Ibid., p. 99.

[4] Ibid., p. 43.

Table 28.3 Change in energy use per capita for Residence in six images of the future

		Difference in percent					
		Urban Cores		Suburban Centers		Low-rise Settlements	
Residence	2000 MWh/ capita	Fast	Slow	Fast	Slow	Fast	Slow
Totals	11.1	–64	–63	–62	–61	–60	–57
Heating	7.9	–68	–68	–66	–66	–64	–62
Multi-family housing	2.2	–58	–55	–55	–53	–53	–50
Furniture, etc.	0.8	–49	–37	–46	–34	–43	–30
Low-rise housing	0.3	–58	–55	–55	–53	–53	–50

illustrates how energy use changes in each image and is summarized in Table 28.3. Energy use drops most in Urban Cores Fast, by 64%, and least in Low-rise Settlements Slow, by 57%. The most important reason for the total drop in energy use is the high efficiency of heating. The most important reason for the differences between images of the future is the different sizes of the homes.

28.2 Personal

28.2.1 Personal in 2000

Energy use (TWh) for Personal is distributed in sub-items according to Table 28.4.

The single largest share of the energy use for Personal is travel, and in particular car trips, which at 5.5 TWh represents nearly one-third of all energy use for Personal. Private air travel accounts for 3.5 TWh or nearly 20%. Broken down per capita, this is much more than air travel in the rest of the country. One-third of the energy use for "Services for leisure time" goes to municipal leisure activities, and the rest consists of smaller items such as hotel stays and body care, as well as for producing and broadcasting television programs.

'Electricity for lighting and appliances' in Table 28.4 refers to the electricity used in households, minus what is used for heating and Food (see the Food section below). What remains is the electricity used for lights and various appliances such as television sets and computers. Energy use for leisure goods is fragmented into many small items, such as flowers and gardens (14%), newspapers and magazines (13%) and body care (12%). The 'Leisure goods' item also contains energy use for such things as pet food, production of toys and various gadgets.

28.2.2 Personal in 2050

By far the heaviest part of energy use for Personal in 2000 is travel, which represented over half. In 2050 long-distance travel consumes nearly twice as much

Table 28.4 Stockholm residents' energy use, TWh, for the Personal category in 2000

	TWh	Share (%)
Travel	10.0	51
Services for leisure time etc.	2.0	10
Electricity for lighting and appliances	1.9	10
Goods for leisure time	1.8	9
Holiday cottages w. heating and power	1.3	7
Clothes and shoes	1.0	5
Restaurants, cafés	0.7	4
Alcohol and tobacco	0.4	2
Telecommunications	0.3	1
Totals	19.5	100

Table 28.5 Percent change in Stockholm residents' long leisure trips per capita in 2000–2050

	Car	Public transport	Air	Volume (pkm)
Urban Cores, Fast	30	500	–50	55
Suburban Centers, Fast	30	300	–50	29
Low-rise Settlements, Fast	30	200	–50	16
Slow vs. Fast	+10	+5	–20	+5

pkm passenger kilometer

Table 28.6 Percent change in Stockholm residents' short leisure trips per capita in 2000–2050

	Car	Public transport	Foot and bicycle	Volume (pkm)
Urban Cores, Fast	20	30	200	10
Suburban Centers, Fast	20	30	200	10
Low-rise Settlements, Fast	10	20	300	23
Slow vs. Fast	+0	+10	+10	

pkm passenger kilometer

energy as short distance travel and consists mainly of more or less equal amounts of car and air travel. Cars are the primary form of short-distance leisure travel.

Chapter 13 on travel discussed possible changes in patterns of leisure travel. The reasoning in that chapter forms the basis of the figures on short and long-distance leisure travel in the various images of the future in Tables 28.5 and 28.6.

In all the images of the future, the total travel with every means of transport other than air is greater than today, mainly due to the growing population. In addition, long car trips are increasing more than short car trips are decreasing. However, this is less important in terms of energy, because long car trips generally have more passengers per car and therefore lower energy use per passenger kilometer (pkm). See also Tables 28.7 and 28.8.

Energy use for services increase by 50% in Fast and not at all in Slow, as this category has much more opportunity than Fast to do repairs and similar activities themselves. This means that the use of services in Slow are at the same level as today.

Table 28.7 Stockholm residents' short leisure trips in 2000 and in images of the future, billions of passenger kilometer

	Car	Public transport	Foot and bicycle	Totals
2000	4.0	1.3	0.4	5.0
Urban Cores, Fast	4.1	2.3	1.9	8.4
Suburban Centers, Fast	4.1	2.3	1.9	8.4
Low-rise Settlements, Fast	4.6	2.2	2.6	9.4
Slow vs. Fast	±0%	+10%	+10%	–

Source: The data for 2000 comes from RES, the average of 1999–2001, trips on the survey day

Table 28.8 Stockholm residents' long-distance leisure trips in 2000 and in images of the future, billions of passenger kilometer

	Car	Public transport	Air	Totals
2000	5.0	1.5	5.1	11.0
Urban Cores, Fast	8.5	12.5	3.7	24.7
Suburban centers, Fast	8.5	8.4	3.7	20.5
Low-rise settlements, Fast	8.5	6.3	3.7	18.5
Slow vs. Fast	+10%	+5%	+10%	–

Source: The data for 2000 comes from RES, the average for 1999–2001. The data for air travel refers to long-distance trips. The remaining data comes from trips on the survey day

Hedberg et al. judge that operational electricity in low-rise housing could be cut from 46 to 20 kWh/m^2, and in multi-family housing from 60 to 20 kWh/m^2.[5] This is a potential of about 60%, the same potential achieved in the Fast images of the future mainly by replacing today's appliances with new ones that are several generations more energy efficient. In the Slow images the appliances are not replaced as quickly, so energy efficiency only increases by 50%. However, electricity consumption drops further because the living areas to be heated are somewhat smaller (see the section on Residence above), which above all reduces the energy use for lighting.

The volume of leisure goods, such as sporting goods and other leisure-time equipment, drops somewhat in both Fast and Slow. It goes down more in Slow, where less money goes hand in hand with fewer belongings. At the same time, production efficiency increases which means that the total energy use for manufacturing leisure goods drops more than their use.

Energy use for Clothes and Shoes will emulate the changes for leisure goods and energy use for Restaurants and Cafés is discussed in the Food section below.

The specific energy use for holiday homes drops by 40%, mainly as a result of the technological development of heating systems. The reason this category doesn't

[5] Ibid., p. 45.

quite reach the same level of reduction as Residence is that investments in holiday homes do not pay off as much because they are used less.[6] The total number of holiday homes decreases, primarily in the Fast images and the Low-rise Settlements alternative; people in Fast prefer to rent rather than buy a holiday home, which reduces the demand for them. In Low-rise Settlements, holiday homes are not as high in demand as in the other categories because more people here already have a house to take care of.

Energy use for Alcohol and Tobacco follows the economic development (plus 30% in Fast and no change in Slow), with the caveat that production of goods becomes more efficient as technology advances (30% in Slow and 40% in Fast).

All images of the future show significantly greater use of IT and communications technology than today. At the same time, technological advancement in this field has been very rapid, so the increase in energy use is limited despite a dramatic increase in volume and speed of data transfer. Energy use in Fast for telecommunications triples as compared with 2000 and doubles in Slow. The difference is due to the lower degree of consumption and lower focus on technology in Slow.

The scope of all the changes described above, apart from travel, is illustrated in Table 28.9. Changes in travel were summarized in Tables 28.5–28.8.

The change in energy use for Personal in the six images of the future as compared with 2000 is summarized in Table 28.10. The calculation includes not only the changes discussed above, but also technological changes described in Chaps. 16–19. Energy use will reduce the least in Urban Cores Fast, by 45%, and most in Low-rise Settlements Slow, by 50%. The main reason for this difference lies in how energy use for travel changes in these alternatives.

Table 28.9 Percent changes affecting energy use in Personal in 2000–2050

	Urban Cores		Suburban Centers		Low-rise Settlements	
	Fast	Slow	Fast	Slow	Fast	Slow
Services for leisure time, etc. (kWh/cap.)	50	0	50	0	50	0
Electricity for lighting and appliances	−60	−50	−60	−50	−60	−50
Goods for leisure time (volume)	−10	−20	−10	−20	−10	−20
Clothes and shoes (volume)	−10	−20	−10	−20	−10	−20
Restaurants, cafés (kWh)	−74	−73	−74	−73	−74	−73
Summer homes incl. heating and electricity (kWh/m^2)	−40	−40	−40	−40	−40	−40
Summer homes, m^2	−10	0	−10	0	−20	−15
Alcohol and tobacco (kWh)	−22	−30	−22	−30	−22	−30
Telecommunications (kWh)	200	10	200	10	200	10

[6] Ibid., p. 45.

Table 28.10 Percent change in energy use per capita for Personal in the six images of the future

		Difference					
	2000 MWh per capita	Urban Cores		Suburban Centers		Low-rise Settlements	
		Fast	Slow	Fast	Slow	Fast	Slow
Travel	6.1	–58	–58	–62	–62	–64	–64
Services for leisure time etc.	1.2	–22	–40	–22	–40	–22	–40
Electricity for lighting and appliances	1.2	–66	–55	–64	–53	–62	–50
Goods for leisure time	1.1	–46	–44	–46	–44	–46	–44
Holiday cottages w.heating and power	0.8	–46	–40	–46	–40	–52	–49
Clothes and shoes	0.6	–46	–44	–46	–44	–46	–44
Restaurants, cafés	0.4	–15	–23	–19	–27	–23	–30
Alcohol and tobacco	0.2	–22	–30	–22	–30	–22	–30
Telecommunications	0.2	200	100	200	100	200	100
Totals	11.8	–48	–49	–50	–52	–51	–53

28.3 Food

28.3.1 Food in 2000

The total amount of energy consumed so that Sweden can eat is about 40 TWh. For Stockholmers alone the figure is 7.3 TWh. Table 28.11 shows how this energy use is distributed. In our calculation, this represents 12% of the total energy used by Stockholm residents. It is clear that what we eat is significant for energy use, as well as how we cook and store food. Energy use for Restaurants and Cafés is hard to assess, because there is no data on what percentage of eating occurs there. Since eating out is often connected with entertainment as well as food, half of the energy use for this item has been assigned to the Personal household function. This means that the figure shown in Table 28.11 is just half of the energy actually used in the restaurant and café business.

Food is the only one of the six household functions that is more or less an established research area in itself. Extensive literature and calculations focus solely on energy use in the food industry. The report from the Swedish EPA, to which we referred in Chap. 12, estimates energy use for the production of food products in Sweden at 30 TWh, about 7% of the Swedish total.[7] As we also explained in Chap. 12, that calculation is not really comparable with ours. The greatest difference is that the EPA report's figures include the energy used for all production in Sweden, including production for export, but does not include energy for foreign production of food for Swedes. This means that the energy use for bread and grain

[7] Carlsson-Kanyama, A. and Engström, R., Fakta om maten och miljön (Food and the environment), 2003, p. 45.

Table 28.11 Stockholm residents' energy use for the Food category in 2000

	TWh	Share, %
Production of food products	4.4	60
Storage and preparation	1.5	20
Restaurants and cafés	0.7	10
Grocery shopping trips	0.3	5
Household equipment, consumables	0.3	5
Totals	7.3	100

Source: Input-Output analysis based on Statistics Sweden's Input-Output Tables for 2000 and unreported data from environmental accounting regarding fuel consumption, air emissions and consumption of electricity and district heating. The analysis was done at Statistics Sweden's environmental accounting department and interpreted by the authors.

products is lower in our calculation than in others, while the energy use for fruit and vegetables, which are imported to a large degree, is higher.

Statistics Sweden has further processed the databases for the sake of this book, to allow a detailed description of energy use in eating. Some of the results are presented in Table 28.12. These calculations apply to consumption in the whole of Sweden. We assume that Stockholm residents food consumption corresponds to the average and that the percentage distribution is the same as well. The total in the table, 7.7 TWh, is somewhat higher than the 7.3 TWh listed in Table 28.11. This is because the energy for electricity and for fuels is handled differently in the two calculations. However, the difference is negligible for the calculation of the distribution between different parts of the food products chain.

These analyses allow us to investigate where in the food products chain energy is used for various product groups. It is clear that there are major differences; for example, much of the energy used for bread and grain products comes from the food products industry, while meat production uses the most energy in agriculture. It is also apparent that the Housewares, etc. group differs significantly from the others, because they come from completely different industries than agricultural products. For more information, see Table 28.13.

28.3.2 Food in 2050

Energy use for Food in the six different images of the future are described below in 12 specific changes in the area. The following describes one change per paragraph and what effects it will have on energy use in the future images. The analysis is largely based on Chap. 12.

GREATER EFFICIENCY IN AGRICULTURE AND FISHING Technological advances in agriculture have the same potential as effectivization in other areas, as described at the end of Chap. 16: 30% in Slow and 40% in Fast. These advances will affect all aspects of agriculture and fishing, and therefore all items in that column in Table 28.13.

Table 28.12 Stockholm residents' energy use for the Food category in 2000, divided into the different parts of the food products chain

	Farming and fishing	Food industry	Packaging, etc	Trade	Transportation	Other	Household electricity	Totals
TWh	1.2	1.0	0.8	0.9	0.9	1.4	1.6	7.7
Share (%)	16	13	10	11	12	18	20	100

Source: Analyses of input-output-data by Statistics Sweden's environmental accounting department, with the addition of energy use from fuels and electricity and home transport of groceries (0.4 TWh). The commerce data has been corrected so that imported goods are assumed to have the same energy use as domestic goods in commerce. Household electricity is calculated as a share (22%) of the total electricity use in households, according to Statistics Sweden's data. Energy for the "Power, gas and district heating plants" industry is not included because it is primarily counted as electricity.

ENERGY-OPTIMIZED CULTIVATION Ecological cultivation has proven to have a potential to drastically cut energy use. In our images of the future there is a transition to energy-optimized organic farming that results in products with 30% lower energy use. Weed control for crops such as potatoes is partly done manually without using fossil fuels. Organic meat production reduces energy use by 40% as reasoned in Chap. 12.

EFFECTIVIZATION IN THE FOOD PRODUCTS INDUSTRY Data on effectivization in this industry are the same as those for agriculture: 30% in Slow and 40% in Fast.

MORE EFFICIENT SHOPPING FACILITIES Energy use in the food products commerce consists largely of heating in the stores and cooling in the refrigerators. In the images of the future this energy use is more than halved, mainly through technological advances (see Chap. 18) and using new methods of preservation that reduce the need for frozen goods.

MORE EFFICIENT VEHICLES Chap. 17 discussed the potential to reduce energy use in vehicles, which will benefit all elements of society. In the Food category, this leads to a two-pronged drop in energy use: goods transport gets more energy-efficient and so does consumers' shopping trips. In total, the energy use is halved, because the efficiency improvement of personal cars progresses further than in trucks.

INCREASED E-COMMERCE AND DIRECT DELIVERIES E-commerce and direct deliveries to restaurants and industrial kitchens are elements of all the images of the future, but most of all in Low-rise Settlements and Fast. In Low-rise Settlements this does not lead to any more energy savings, as compared with the other urban structures. However, a larger proportion of e-commerce also means that energy use for shopping trips does not increase, despite a generally longer distance to the grocery store. In Fast, e-commerce has gone further than in Slow. The Fast residents have less time to spend shopping and more often choose home delivery. The increase in e-commerce leads to drops in energy use for food deliveries of 30% in Slow and 50% in Fast, which corresponds to the scope described in Chap. 12.

Table 28.13 Stockholm residents' energy use for product groups in the Food category in 2000, divided into the various parts of the food products chain, MWh

	Farming and fishing	Food industry	Packaging, etc.	Trade	Trans-portation	Other	Household electricity	Totals	Share, %
Bread and grain products	80	220	130	50	60	120		640	8
Meat	260	150	80	80	70	180		810	10
Fish	140	60	40	70	30	70		380	5
Milk, cheese and eggs	230	120	130	70	80	170		780	10
Fruit	120	50	50	90	40	90		410	5
Vegetables	160	60	60	80	50	110		490	6
Beverages	60	120	80	50	60	130		490	6
Spices, sweets, oils, etc.	120	210	130	90	70	150		750	10
Housewares, etc.	10	20	100	310	40	150		820	11
Restaurants, cafés, etc.	50	30	40	20	70	100		280	4
Home transp. of groceries					370			370	5
Household el.							1,580	1,580	20
Totals	1,200	990	790	870	910	1,420	1,580	7,730	100
Share (%)	16	13	10	11	12	18	20	–	100

See Table 28.12

FEWER TRANSPORTS A greater proportion of food comes from local or regional production in all images of the future, and a major restructuring has occurred so that more food is produced closer to the consumers. The production and distribution system has been optimized according to the local production circumstances. Imports have decreased and eating habits have been adapted to the local product range and become seasonal as regards imports of fruit and vegetables. Some household needs are met by cultivation in private gardens, on balconies and rooftops. Cities collaborate with farmers in the country through training and development of suitable cultivation methods as well as new types of financial collaboration (such as Consumer supported agriculture, CSA, see Chap. 12). Economic reforms have been carried out to support these activities. In all, this leads to a reduction in energy use for food transports. A rough estimate based on the "Where the food comes from" section in Chap. 12 indicates a possible reduction in energy use for food transports by around 30%.

MORE EFFICIENT TECHNOLOGY IN HOUSEHOLDS Households use a lot of energy to store and prepare food and to wash dishes – a total of 22% of household electricity. Better technology, in particular more efficient refrigerators, reduce electricity use in all images of the future. The size of refrigerators and freezers in homes also decrease.

Technology will advance even more in Fast, and refrigerators and freezers are smaller in the images of the future where the living space shrinks the most (see the section on Residence above). The total effect of this is reductions in household electricity as shown in Table 28.14.

COOKING AND FOOD STORAGE Energy use for food storage and cooking decreases in all images of the future through reduced use of ready-made frozen meals and the cooking of larger portions each time. The total reduction is less in Fast, in which people have less time for cooking. The reductions are 25% in Slow and 20% in Fast.

LESS MEAT Consumption decreases by just over 50% while consumption of protein-rich legumes increases to meet protein needs. If the production of legumes is much more energy efficient than production of meat, the collective result is a decrease in energy use of 50%.

SEASONAL ADAPTATION Seasonal adaptation of eating habits, in particular fruit and vegetables, reduces energy used for growing them by cutting greenhouse cultivation by 20% in Fast and 30% in Slow. Other agricultural products, such as lamb and eggs, are also seasonal to some degree and have therefore been adapted to the season.

Table 28.14 Changes in household energy use for food storage, cooking and dishwashing

	Urban Cores		Suburban Centers		Low-rise Settlements	
	Fast	Slow	Fast	Slow	Fast	Slow
Dishwashing storage, cooking (%)	–60	–50	–55	–45	–50	–40

LESS WASTE Better adapting purchases and preparation of food to needs has halved the amount of food thrown away. The reduction is somewhat greater in Slow than in Fast, resulting in 10% and 5% reductions in total energy use. The calculations are summarized in Table 28.15. Energy use decreases by about 60% in the various future images, with a very significant drop in "Grocery shopping trips". This is an effect of the extensive energy efficiency improvements in cars, in combination with shorter and fewer shopping trips. In absolute figures, the reduction for 'Production of food products' is greatest. Lower energy use for meat and dairy products and the drop in meat consumption are both key factors under this point.

28.4 Support

28.4.1 Support in 2000

Energy use for Support is exclusively dedicated to travel to and from work. Travel and other energy use on the job are not the responsibility of households. This energy use is an element of the production of goods and services and is therefore distributed to this or to the household functions being served. A business trip for a person who works in the shoe industry is therefore counted as a part of the indirect energy for the "Personal" category and its "Clothes and shoes" item.

The total energy use for Support is 2.3 TWh, or 4% of Stockholm residents energy use. Sixty-five percent of energy use for commutes consists of car travel. The two other items in Table 28.16 consist mainly of public transit and road infrastructure maintenance.

Table 28.15 Percent change in energy use per capita for Food in six images of the future

	2,000 MWh per capita	Difference, %					
		Urban Cores		Suburban Centers		Low-rise Settlements	
		Fast	Slow	Fast	Slow	Fast	Slow
Production of food products	2.7	–60	–58	–60	–58	–61	–60
Storage and cooking	0.9	–65	–59	–60	–55	–56	–50
Restaurants and café	0.4	–57	–55	–57	–55	–58	–56
Grocery shopping trips	0.2	–93	–91	–91	–87	–88	–84
Household appliances, consumables	0.2	–58	–58	–58	–58	–58	–58
Totals	4.4	–62	–59	–61	–58	–61	–59

28.4.2 Support in 2050

Energy use for Support is affected by how travel changes as well as by the change in technology. Chapter 13 about Travel ended with several tables indicating the changes in travel volumes in the various images of the future. The values for commuting are repeated in Table 28.17. See Chap. 13 for the reasoning about these changes.

Combining the figures in Table 28.17 with the technological potential of various vehicles from Chap. 17 on vehicle technology gives us energy use for cars compared to the public transit item in Table 28.18. In all images of the future, the change in maintenance is proportional to the change in total travel, dropping correspondingly as the general technology effectivization potential rises to 30% in Slow and 40% in Fast.

Table 28.16 Stockholm residents' energy use per capita for the Support category in 2000

Support	TWh	Share (%)
Car, motorcycle	1.5	65
Public transit, bicycle, etc.	0.4	17
Road infrastructure maintenance	0.4	17
Totals	2.3	100

Table 28.17 Total commuting in 2000 and the changes per capita in images of the future. The percentages on the last line show the total change, not per capita

	2000, billion pkm	Urban Cores		Suburban Centers		Low-rise Settlements	
		Fast (%)	Slow (%)	Fast (%)	Fast (%)	Slow (%)	Fast (%)
Car	2.2	−75	−80	−70	−76	−55	−64
Public transit	2.0	−15	−28	−25	−36	−15	−28
Foot and bicycle	0.3	50	65	35	49	65	82
Totals	4.4	−41	−48	−44	−51	−30	−39

Sources: The data for 2000 comes from internal batches from RES and represents yearly averages for 1999–2001

[a] *pkm* passenger kilometer

Table 28.18 Stockholm residents' energy use per capita for Support in 2000 and in images of 2050

	2000 MWh per capita	Difference, %					
		Urban Cores		Suburban Centers		Low-rise Settlements	
		Fast	Slow	Fast	Slow	Fast	Slow
Car, motorcycle	0.9	−96	−97	−94	−95	−89	−91
Public transit, bicycle, etc	0.3	−58	−64	−63	−68	−58	−64
Maintenance of road infrastructure	0.2	−65	−64	−66	−66	−58	−57
Totals	1.4	−84	−64	−66	−66	−58	−57

Energy use for Support is summarized in Table 28.18. It decreases the most in Urban Cores and Suburban Centers, by some 85%, and least in Low-rise Settlements, about 80%. The drastic reductions are largely due to technological advances. As described in Chap. 17, energy use for short-distance car travel has great potential to decrease between 75% and 85%. One step in this is a transition to smaller city cars. In the images of the future, this transition is most extensive in Urban Cores, where 80% of car commutes take place in small city cars. In Low-rise Settlements the corresponding figure is 20%. In addition to technological advances, a large part of car commutes have been eliminated by the fact that commutes are shorter in these future images and in some cases also fewer due to working from home.

28.5 Care

28.5.1 Care in 2000

Energy use for Care corresponds to about one-eighth of Stockholm residents' total energy use. It is distributed into sub-items according to Table 28.19. The category consists of three big-ticket items – Education, Social welfare and Healthcare – all of which have very low levels of private consumption in Sweden. About 10% of energy use in the area can be traced to private expenses. In many cases this is the privately financed portion of public services. The state is responsible for energy use in higher education, the county council for healthcare and the municipalities produce the services and use the energy. Most of the energy goes to heating and equipment in the various healthcare, education and social welfare institutions.

The vast majority of energy use in the Care category is attributable to maintaining temperatures in buildings: schools, colleges, daycare centers, hospitals, health centers, doctors' offices, nursing homes, administrative facilities for the sector and so on. We assume that about 15% of the sector's energy use is spent on things not related to facilities (business travel, goods transports, consumables, and durables). Of the remaining 85%, we assume that two-fifths are building power and the rest is energy for temperature control, which depends on the area of the facility[8] (see Table 28.20).

Table 28.19 Stockholm residents' energy use in 2000 for the Care category

Care	TWh	Share (%)
Education and university research	2.3	34
Social welfare	2.3	35
Healthcare	2.1	32
Total	6.7	

[8] The distribution parallels the average distribution for facilities in Sweden according to Hedberg et al., p. 26.

Table 28.20 Distribution of energy use in fields of the Care category

Area of use for the energy	Share of energy use (%)
Heating	51
Operational electricity	34
Other	15

28.5.2 Care in 2050

In Fast, in which there is more money to spend, large amounts of money are spent in the Care sector, and these services also increase in Slow. As a rule, these facilities have high staff ratios and a large number of visitors. This means that the location of such facilities in the urban structure is significant to the total traffic. These facilities can contribute positively to a living urban environment if they are integrated in the inner city or suburban concentrations. Conversely, large campus areas and isolated giant hospitals risk having the opposite effect.

In Urban Cores, it is natural that large units in healthcare and university education have been placed in the new Urban Cores and areas with good connections in the inner city, or else integrated into existing facilities in future Urban Cores. Somewhat smaller units, including junior high schools, have been located close to new hubs and existing city centers.

In Suburban Centers as well, facilities for education, healthcare and social welfare are built or moved to the expanding parts of the suburban area.

In Low-rise Settlements the travel connections in low-rise housing areas have been concentrated in developments that already exist today near rail-bound public transit stations. However, some of the social services and education for lower grades are also located in the small residential centers of low-rise housing.

In general facilities are used more effectively in all images of the future. Hospital sizes, which have shrunk drastically in the past decades, have continued to do so through increased home-based care, through Internet doctors and greater incidence of self-diagnosis. This is particularly true in the Slow alternatives and to a larger degree in Low-rise Settlements than in the other urban structures. The education sector's facilities for the higher grades and universities have shrunk due to expanded distance education and Internet-based courses, as well as more efficient use of facilities.

Advanced effectivization of temperature regulation has cut the big area-dependent energy item by 60%, the same percentage that heating of housing was cut in Table 28.9.

While the number of appliances has increased, operational electricity has decreased by 60% in Fast and 50% in Slow. These are the same efficiency improvements as for operational electricity in homes, according to Table 28.2.

Other energy use in the sector drops by 60% due to a general technology-based energy efficiency improvement in producing input goods and services for the sector and through improved transportation logistics and technology, as well as a certain transition from material to immaterial flows. A drop in business travel is also significant here.

Table 28.21 summarizes the most important changes for energy use in the Care category.

In summary, energy use drops by about 60% in all images of the future, see Table 28.22. These reductions are largely the result of technological development.

28.6 Indirect Energy Use

Many factors are important to several or all six of the household functions. We list three here: Facility Use, Goods Transports and Business Travel. Each of these activities can be studied independently, but they are harder to distribute among household functions. In our calculations of energy use for household functions, all three of these activities are included as indirect energy use, either through a life-cycle analysis or an input-output-analysis.

Stockholm residents' share of the total energy use for the three activities is just over 15 TWh. This is equivalent to the energy use for Residence or Personal and these items stand for the majority of the indirect energy use in the calculation.

Table 28.21 Percent changes per capita for various items in the Care category

	Urban Cores		Suburban Centers		Low-rise Settlements	
	Fast	Slow	Fast	Fast	Slow	Fast
Facility changes in healthcare	−10	−20	−10	−20	−20	−30
Facility changes in care	0	−10	0	−10	0	−20
Facility changes in schools	−10	−20	−10	−20	−20	−30
Facility changes in higher education	−10	−20	−10	−20	−20	−30
Efficiency improvement, operational	−60	−50	−60	−50	−60	−50
Efficiency improvement, heating	−60	−60	−60	−60	−60	−60
Efficiency improvement, other	−60	−60	−60	−60	−60	−60

Table 28.22 Stockholm residents' energy use per capita in 2000 and in images of 2050 for Care

		Difference, %					
	2,000 MWh per capita	Urban Cores		Suburban Centers		Low-rise Settlements	
		Fast	Slow	Fast	Slow	Fast	Slow
Education and univ. research	1.4	−63	−64	−63	−64	−66	−67
Social welfare	1.4	−60	−60	−60	−60	−60	−64
Healthcare	1.3	−62	−64	−63	−64	−66	−67
Totals	4.1	−62	−62	−62	−62	−64	−66

Calculating energy use for these three activities is particularly difficult from the household perspective. For one thing, what is interesting is not how much Swedes make business trips/transport goods/use facilities, but only the activities that are a part of the production of goods and services for Swedes' (actually Stockholm residents') consumption. To include business trips, goods transports and facility use, we have chosen to approximate these activities as they relate to consumption among Stockholm residents by taking a proportionate amount of the national figures for travel, transportation and facility use.

28.6.1 Facilities in 2000

Energy use for facilities totals about 43 TWh, of which 25 TWh go to heating and hot water and 18 TWh to operational electricity.[9] Stockholm residents share of this is 8 TWh or almost 15% of their total energy use in 2000, if we divide the total energy use by the population.

The operational electricity in facilities varies widely depending on the type of facility, and statistics in the field are limited. The single greatest portion of operational electricity, about one-third, seems to go to lighting. Next comes refrigeration in grocery stores, 8%.[10]

It is extremely difficult to distribute the energy use in Table 28.23 among the six household functions. However, it is clear that the greatest portion of energy use goes to Care and Common. In fact, "energy use in facilities" is the largest item in both categories. We have assumed 85% in the above section, which would mean that facility use stands for 5.7 TWh in Care and 2.3 TWh in Common. Other categories also have energy use for facilities, such as Personal, where the production of goods and services requires some facility space, and Food, where commerce in particular requires facilities. In the Food section above, energy use for commerce was calculated to be 4.7 TWh nationwide, which makes about 0.8 TWh for Stockholmers. Given all this, it seems that energy use for facilities is underestimated in the study by Hedberg et al., or else it is overestimated in our calculations.

Table 28.23 Stockholm residents' energy use in 2000 for Facilities (calculated as a proportion of the national energy use for facilities), TWh

	TWh	Share (%)
Heating and hot water	4.6	42
Operational electricity	3.3	58
Totals	8.0	100

[9] Hedberg et al. 2003, p. 49.

[10] Hedberg et al. 2003, p. 30.

28.6.2 Facilities in 2050

As described in the Care section above, energy use for facilities can be reduced through a combination of technological improvements – in particular to reduce the need for heating – and reduced use of space. In all images of the future, this energy use drops by about 60%.

28.6.3 Goods Transports in 2000

Goods transports stand for about 25 TWh in Sweden,[11] which means that Stockholm residents share is just under 5 TWh. All household categories have some element of goods transports. For Food, groceries must be transported between the parts of the food products chain and input goods must be transported to production facilities. Similarly, for Personal, many goods must be transported to production facilities, and the final products must be shipped to stores.

As we are interested in the goods transports associated with Swedish consumption, the make-up of goods transports in the country is less important. Swedish goods transports include large amounts of forestry and mining products; see the previous chapter. Many of these products are also exported, so they cannot be used to illustrate goods transports for Swedish consumption.

To allow some kind of reasonability assessment of the distribution of energy for goods transports among the six household functions, we have used the total energy use for each function as a distribution factor. Table 28.24 distributes energy use for goods among the six functions, in proportion to their energy use. The difference between the energy use for goods transports in Food in Tables 28.12 and 28.24 is due to the fact that the calculations were done in completely different ways. The calculation presented in Table 28.24 is just a rough estimate.

28.6.4 Goods Transports in 2050

As stated in Chap. 17, there is a potential for improving the energy efficiency of goods transports by about 50%. In addition, it should be possible to reduce transport

Table 28.24 Energy for goods transports for Stockholmers tentatively distributed among the six household functions, TWh

	Residence	Food	Personal	Care	Common	Support	Total
Energy for goods transports	1.5	1.5	0.6	0.6	0.3	0.2	4.6

[11] The value can be calculated by combining tables 2, 3 and 5 in Åkerman, J. and Höjer, M. "How much transport can the climate stand?", 2006.

volumes, mainly by transporting things shorter distances. In our images of the future, goods transports decrease more in the Slow versions than in Fast simply because of the lower level of consumption. They also decrease somewhat more in the denser urban structures because of more efficient distribution systems.

28.6.5 Business Travel in 2000

Energy use for business travel related to consumption in Stockholm was 2.4 TWh/year in 2000, based on the total energy use for business travel for the entire country, divided by population. This is about 5% of the total energy use and is about equal to that of commuter travel. Stockholmers travel much more for work than the national average, but this does not affect the energy use for Stockholm residents' consumption, so we have only distributed the amount proportionate to the population of Stockholm. The majority of business travel is done by car, which stands for three-fifths of energy use for business travel. Most other energy use goes to air travel.

As the introduction indicates, it is difficult to distribute energy use for business travel. If a college-level researcher travels for business, it is counted under the Common function; but it is harder to see where energy use for business travel in a sector like the manufacturing industry should be placed because products from this industry can be used in all six household functions. To include business travel in our analysis of the opportunities to reduce energy use in the future, we have distributed business travel proportionately (in relation to total energy use) among all household functions except Support (see Table 28.25). Support is not included because energy use in Support mainly consists of directly purchased energy in the form of vehicle fuel and electricity. The other categories have a higher share of indirect energy in the form of input goods, such as business travel.

28.6.6 Business Travel in 2050

The chapter on travel indicated a radical drop in business travel in all images of the future. The greatest drop is air travel and travel in Slow (see Table 28.26). This is included in the 30% effectivization potential in Slow and the 40% potential in Fast, described in the Technology chapter.

Table 28.25 Energy for business travel for people in the Greater Stockholm region, distributed among five of the six household functions (except Support)

Category	Residence	Personal	Food	Care	Common	Totals
Share of energy use in Stockholm (%)	34	33	14	13	5	100
Energy for residents in greater Stockholm, TWh	0.8	0.8	0.3	0.3	0.1	2.4

28.7 Summary

In 2000, Stockholm residents' consumption of the services and goods covered by the five household functions Personal, Residence, Food, Care and Support used up 33 MWh of energy per capita. The images of the future use 13 MWh per capita, a savings of 20 MWh per capita (see Table 28.27). This is a huge reduction, achieved through a wide range of changes in the five household functions, discussed in detail in this chapter. But is it possible to pinpoint the individually most significant factors for this change? What can we say about the differences between the various household functions?

The most striking aspect is that if we look solely at what causes the changes, technology is highly significant. In all the images of the future, technological changes are behind the majority of energy savings. By technological changes we mean all changes leading to a reduction in energy use without changing the use of a given service or product; for example, more energy-efficient engines or low-energy housing.

However, the great importance of technology here does not render human actions and patterns of action unimportant. What has happened in the images of the future is that humans have used technological advances to cut their energy use rather than to boost performance and that the efficiency improvements have not led to a great increase in the activities themselves. This is a tremendous break in the trend of the twentieth century, which was to ratchet up consumption at the same rate

Table 28.26 Stockholm residents' business travel by car, air and other means of transport, and the change in this travel in Slow and Fast

Business travel	Car	Air	Other	Totals
Business travel per year 1999–2001, Greater Stockholm share, TWh	1.5	0.74	0.13	2.4
Fast, change per capita (%)	−40	−67	−40	
Slow, change per capita (%)	−50	−75	−50	
Total Fast, including pop. growth	1.3	0.35	0.11	1.8
Total Slow, including pop. growth	1.1	0.27	0.09	1.5

Sources: Travel data from RES, own batches, and energy data from Åkerman and Höjer 2006

Table 28.27 Energy use in 2000 for Stockholmers and other Swedes, distributed among five household functions

	Personal	Residence	Food	Care	Support	Totals
Total Nation minus Stockholm residents						
TWh	75	74	32	29	13	223
MWh/capita	10.4	10.3	4.4	4.0	1.7	30.9
Distribution (%)	34	33	14	13	6	
Stockholm residents						
TWh	19	18	7	7	2	54
MWh/capita	11.8	11.1	4.4	4.1	1.4	32.9
Distribution (%)	36	34	13	12	4	100

Table 28.28 Energy use in images of the future distributed among five household functions

	Personal	Residence	Food	Care	Support	Totals
Urban Cores Fast						
TWh	15	9	4	4	1	33
Distribution (%)	46	28	12	12	2	100
Change (%)	–25	–51	–45	–45	–77	–40
MWh/capita	6.2	3.8	1.7	1.6	0.2	13.5
Change per capita (%)	–48	–66	–62	–62	–84	–60
Urban Cores Slow						
TWh	14	9	4	4	0	31
Distribution (%)	44	29	13	11	2	100
Change (%)	–27	–49	–42	–46	–79	–40
MWh/capita	6.0	3.9	1.8	1.5	0.2	13.4
Change per capita (%)	–50	–65	–59	–63	–85	–60
Suburban Centers Fast						
TWh	14	9	4	4	1	32
Distribution (%)	44	30	13	11	2	100
Change (%)	–28	–48	–44	–46	–76	–40
MWh/capita	5.9	4.0	1.7	1.5	0.2	13.3
Change per capita (%)	–50	–64	–61	–62	–84	–60
Suburban Centers Slow						
TWh	14	10	4	4	0	32
Distribution (%)	43	31	14	11	2	100
Change (%)	–30	–46	–40	–46	–79	–40
MWh/capita	5.7	4.2	1.8	1.5	0.2	13.4
Change per capita (%)	–52	–63	–58	–63	–85	–60
Low-rise Settlements Fast						
TWh	14	10	4	3	1	32
Distribution (%)	43	31	13	11	2	100
Change (%)	–30	–45	–44	–49	–68	–40
MWh/capita	5.8	4.2	1.7	1.5	0.3	13.5
Change per capita (%)	–51	–62	–61	–64	–78	–60
Low-rise Settlements Slow						
TWh	13	11	4	3	1	32
Distribution (%)	41	33	13	10	2	100
Change (%)	–32	–41	–40	–52	–72	–40
MWh/capita	5.6	4.5	1.8	1.4	0.3	13.6
Change per capita (%)	–53	–59	–59	–67	–80	–60

as technology advanced. This trend has applied to such disparate concepts as travel, indoor heating, laundry and food cooling.

The single greatest factor of all those discussed in this chapter is the effectivization of home heating, which alone provides a drop of 5 MWh per capita. Using an analogous technology to reduce the heating energy for facilities adds another 2.5 MWh per capita savings. Effectivization of heating is quite simply a vital point, even when related to the total use of energy in society. Another very significant factor is the improvement of vehicle fuel efficiency. The combined savings in all transport modes simply due to technological improvements amounts to some 4.5 MWh per capita, of which cars represent about two-thirds. Of the changes that more obviously affect our everyday activities, a reduction of air travel for leisure purposes and a reduction of home sizes (particularly in Urban Cores Fast) are important, each providing a savings of nearly 1 MWh per capita.

When we compare the six images of the future, the differences in energy use are fairly small, both in total and for the five household functions. This is due to the fact that technological development is basically the same in all scenarios and technology is crucial to low energy use. The point of the different images of the future is to clearly depict a range of alternatives for achieving a certain reduction – not to create widely different images of future energy use. The energy use is to be compared with today; only content should be compared between the different images. If the level of technology described in these future images is not achievable, we will have to change our behavioral patterns more drastically in order to reach the goals set in this book.

Table 28.28 shows that the distribution of energy use changes such that Personal has a greater share, particularly in Urban Cores, where nearly half of energy use goes to Personal. Residence is the category whose share goes down most, though Support also shrinks more than the others, from four to about two percent in all images of the future.

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Part IV
Perspectives

The images of the future prepared in a backcasting study like this one is only the first stage in a longer, discursive process. Whether or not these images satisfy the requirements placed on them by the vital societal question being asked is the premise within the genre.

But do the images satisfy other demands that ought to be placed? Is it possible to live an acceptable social life within these parameters? How needs public opinion be molded in order for this to be implemented? Can they be realized with vital financial mechanisms intact? Are there internal inconsistencies in the images that will prevent them from ever being implemented? Is it even possible to convert from today's situation and current dominant development tendencies to an, at least in part, different development logic and another urban condition?

The study of the images for the future in Part IV will deal with these questions. It starts with two special studies. Chapter 29 is an ethnological investigation of the challenges that families with children, but without a car are presented with in today's city. Chapter 30 discusses the economic consistency in these images. The closing chapter (Chap. 31) discusses the three questions asked in the introduction of this work. The introduction of this last chapter can be seen as a summation of the book, followed by an analysis of the problems and possibilities inherent in the separate images, and finishing with a more general discussion about the conditions for such immense changes in the development focus this book offers.

Chapter 29
Suburban and Inner City Families with Children and No Car*

The demand for reduced energy consumption this book is based on is not compatible with increased car use in the cities. Rather all six images of the future reduce the daily, short-distance car travel per capita. This would require a clear trend break from the development in Stockholm over the latest century. On the other hand there are many people who live without a car today. This chapter is based in the thought that the experiences of these households can contribute to an understanding of how a city with less car use could function, as well as revealing those times when it is especially difficult to manage without a car.[1]

The aim of the study reported in this chapter was to investigate the possibilities for families to live without a car of their own and to discuss how this situation can be maintained over time. Many buy a car when they move, have children or when the parental leave terminates. What would make it easier to manage without a car even in such circumstances? A closely related question is what might persuade more urban residents to want to live without a car. We also wished to discover those conditions that have been important when everyday travel patterns for families without a car were established and changed, as well as the difficulties and possibilities linked to living without a car.

The chapter is based on a qualitative investigation of four households without a car. Two criteria informed the selection of these. First they all have young children. Such families are usually seen as having an especially large need for a car, since they have many errands to run and often need to take the children along. Sandqvist and Kriström write that families with children are often used in political rhetoric regarding travel. It is seen as self-evident that they need a car for daily routines, social activities etc. and would thus be hit especially hard by additional costs on car use. The authors also derive an implication suggesting that children need the family car for a normal childhood.[2]

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*Chapter written by Greger Henriksson.

[1]This chapter is heavily based on Henriksson (2008). Stockholmarnas resvanor – mellan trängselskatt och klimatdebatt (Travel habits of Stockholmers – between congestion charging and climate debate), 2008.

[2]Sandqvist, K. and Kriström, S. Getting along without a family car, 2001, p. 9.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*, DOI 10.1007/978-94-007-0653-8_29, © Springer Science+Business Media B.V. 2011

The second selection criterion was where the families lived. Two families lived in the inner city and two in a suburb (Bergshamra) on the subway line just outside Stockholm. Thus all the families live in areas where the conditions for being without a car are good. Activities, entertainment, services and more are easily available in the inner city. Bergshamra offers relative advantages for those lacking a family car. It is a small suburb with a well-concentrated service availability, exactly what characterizes the new areas in the images of the future and especially Urban Cores and Suburban Centers. Even the new areas in Metro Sprawl are oriented towards smaller central formations.

29.1 Four Families with Children

Families with small children in Bergshamra were recruited via a notice on the bulletin board of the child center. A woman called wanting to participate. She said she lived in a small, student apartment with her husband and three children. She had also talked to another family in the student area and they too were interviewed. In this way two 'student' families in Bergshamra were included. In the inner city, the author had acquaintances who fit the bill, living in the Södermalm and Vasastaden districts. All interviews were taped and transcribed. The study also included short, follow-up telephone conversations completed in June 2002.[3]

The interview material for each is presented in the same order, namely daily travel, week and annual rhythms, life and finally thoughts about personal future. This in turn creates analytical themes that will form the basis for the discussion in the latter part of the chapter.

Trips tend to fall into categories depending on frequency, which in turn is closely linked to purpose. The daily trips are dominated by work or training, while the weekly or biweekly trips are often connected with shopping. The annual trips are mostly vacation trips or trips to visit family or friends. This means that the last category holds the largest share of desired trips, while weekday and weekend travel is linked more to necessity than pleasure. Many would probably want the work site or the shopping center closer to home. While the vacation trips are seen as desired and voluntary, those touching more on service needs can be seen as compulsory.[4]

What follows below is first a presentation of the couples interviewed using the telephone interview questions from the most recent day's trips for color. The residential setting and cityscape are also described. This is eventually followed by an analysis and closing comments.

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[3] The conversations that follow were taped, but there are no careful notes. The tapes, notes and transcriptions are currently archived at the author's offices.

[4] Steen, P. et al. Färder i framtiden (Travel in the future), 1997.

29.1.1 Student Families

Bergshamra is a small suburban center. Most of the housing lies within a 500 m radius and includes food stores, care center, library and drug store, with the subway station as a life-giving artery providing access to the inner city in about 15 min. The student residential area called Kungshamra is at one end of the community and beyond it lies Ulriksdal, a large green area used for recreation. The district's other boundaries are motorways and sea coves. In places it is possible to reach the rugged shore on the other side of the motorway. Bergshamra can be described as a concentrated island in the cityscape. The actual student residential area looks like gray boxes piled up to several stories and laid out in rows.

Kalle and Anna are both 30-years old. They have lived in these apartment 4 years and have 2 sons, 1 and 3 years old. This Sunday evening Kalle had cycled over to KTH, the Royal Institute of Technology, where he is a student and printed some material from the Internet. On Monday he was free, got up at 8.30 and went down to the laundry, the first of several trips that morning. Around lunch he took his youngest on a walk through the woods. Anna, who is on parental leave, and her 3-year old took the bus 3 km away to the Mörby Center to shop. The rest of the day was spent close to home, specifically swimming and grilling together with neighbors and finally on cleaning up 'the worst of the mess' from the packing and preparation for vacation in the apartment.

Daiva is 25 and Jonas is 30-years old. Both come from Lithuania. She studies economy and is on parental leave, while he works as an engineer. They are parents to 1-year old twins and 4-year old Milda. Daiva's first trip on the interview day was to have been via bus 509 to Mörby Center, but the bus didn't arrive on schedule. She waited and waited in the hot sun while the twins squirmed in the carriage. Close to tears, Daiva finally gave up and went instead to the open daycare center. When they had fetched Milda at three o'clock, the children played a while in the park next to the center. At 5 when Jonas came home, Daiva took the bus to Solna Center to meet a friend. The only trip Jonas took during the day was the subway to Alvik to his job, changing lines at the terminal.

29.1.2 Inner City Residents

Kristina and Göran were both 39 when interviewed. They have a 6-month old daughter and live in Södermalm, 100 m from the entry to one of the central subway entrances. The Söderleden motorway (hardly perceptible) goes in a tunnel right under their condomenium apartment house built in 1990. Above ground, however, there is precious little room for cars and many streets are one-way. The old worker city district Södermalm is nowadays mainly populated by a middle class with well-paid jobs, education and cultural interests. There are alleys and paths in steep rises where postcard pictures of Stockholm open up and there is a swarming folk life on the main streets and places. Accessibility using public transport is excellent and the distance to most entertainment, service, culture and commerce is short.

Kristina is on parental leave and was contacted on a Thursday evening. During the day she had only taken one trip, a round trip to Långholmen Island. This trip called for only one vehicle with space for one passenger, namely daughter Nancy in her baby carriage, new when bought 6 months earlier. On the way out a compost pail with vegetable and fruit waste stood in the basket underneath and on the return a bag-in-box container with red wine from the state shop. The study day also included Wednesday evening when the family, with Nancy sleeping in her carriage, had walked to and from the nearby park for a theatre performance.

The same Thursday morning, Kristina's husband Göran had ridden his bike to his storage room where he has his musical instruments. He is a freelance rock musician with his own company who is hired by various bands and artists. In the afternoon he bicycled to shop food and then came home. In the evening he rode his bike to Gustav Adolfs Torg square for an outdoor concert.

Markus is 36 and Sofia 30. They live with their daughters Sara and Matilda in Vasastaden near St. Eriksplan, an area created by a city plan with broad streets where buses and cars flow freely on multilane through streets. Vasaparken and other smaller greens are square in accordance with the plan. Much as the Södermalm district, the Vasastaden district has lost its character as a worker district during the 1900s. By now similar categories from the middle class live in both. The streets are broader in Vasastaden and the area is therefore somewhat more car friendly than the central parts of Södermalm. When it comes to entertainment, shops and restaurants the districts are quite comparable.

Sofia has been on parental leave the previous year, but was working on an examination for midwife certification since June. Monday evening she walked home from the nearby City Library where she had studied all day. On Tuesday morning she put Sara and Matilda, three and one respectively, in the twin carriage and walked 200 m to the subway station. After three stops, she got off at Kristineberg and walked to Sara's daycare center. Then she returned home and left Matilda with her husband, after which she walked the kilometer to the library and studied there the rest of the day.

The travel report of Sofia's husband Markus was provided 2 days later. On Wednesday evening he was at home. He is a cultural journalist and worked on a review of a new Swedish novel. The TV was on in the background with the World Championship soccer match. On Thursday morning he and his computer took the subway to his office in the Old City where he polished the review, sending it off by noon. Then he returned home to take care of Matilda while Sofia studied. They picked up Sara who was allowed to walk from the daycare center to the subway where she lost her temper because she was not allowed to press the elevator button. So they took the elevator at their station instead of the escalator so she would have a second chance. They went to the food store to pick up onions, avocado and minced meat. The last trip of the day went back to that store, since the menu had been changed to meat sauce.

These momentary pictures are taken from a late-spring week prior to vacation schedules. It is possible to separate the different trip types that are part of the rhythms or cycles of the family existence. The answers describe things they do every day, on weekends and during vacations. Thus it is possible to talk about daily, weekly and annual rhythms.

29.2 Getting Around

29.2.1 Daily Rhythm

How do people without cars get to work or studies and how do they organize daily activities, shopping and other errands? The families interviewed live geographically and timewise in situations that serve their daily transport needs. Kalle, Anna, Daiva and Sofia study a short distance from their homes. The last three and Kristina were on parental leave at the time of the interview. All three families with young children have daycare nearby. As a culture journalist, Markus can work at home. He states that he "cannot imagine how it would be simpler with a car". However, with what can be called a normal travel need with a nine-to-five job in another suburb, Jonas' arguments against a car are mainly financial. In many ways Göran controls his existence as a musician himself, though it is possible see the advantages of his having a car as he could then move his instruments more easily to rehearsals and gigs.

The interviewees are satisfied with the choice of bike or public traffic for the daily trips. Half of them call themselves dedicated cyclists. Kristina's statement can talk for all of them: "I've bicycled to and from work year round except when there's snow or ice on the ground. Whatever the temperature, but not in all weather. It works great and it takes about as long as when I ride the bus or subway."

Those who take public transport talk about how practical it is, near to the subway as they are. Markus (inner city) says: "when we accepted the daycare place, we thought about it. That it's rather easy to take the subway there and back again." When Jonas (suburb) is asked what trips he takes during the week, he says: "I only ride to work and back," and then talks about taking the bike to the subway, changing lines at the central terminal and walking 10 min to the office. All four families live close to the subway and seem satisfied with the service. The two student families in Bergshamra have daycare round the corner.

They all have different arguments for the travel choices they have made and against a car. One example is when Markus mentions a neighbor, also with two children. He has described how he can circle for 2 h looking for a parking place on a Sunday evening. "That's probably the primary argument against," according to Markus.

Daiva and Jonas said that they "don't need to go anywhere very often" or that they "don't have that many errands to run". In other words, during the week they all seem satisfied to be without a car, even though it does not always work as it should. The bus fails to show, the subway is delayed or you cannot find a taxi when you really need one. Still, these seem to be some sort of exceptions that confirms the rule about the relatively unproblematic weekday travel.

29.2.2 Weekly Rhythm

Weekend free time activities and household tasks, excursions and major shopping are also part of the weekly rhythm. Two families mentioned that they are not much interested in weekend excursions outside the city. Social geographer Kristina Tillberg writes about the 'compensation hypothesis'. Those who live in the city travel more on weekends in order to get out of the city and in that way compensate for the lack of natural experiences, while those who live in the country are more stationary on the weekends as a type of compensation for their busy travel to the urban centers during the weeks for work, shopping and leisure.[5] Some of those interviewed point out that their friends with cars seem to have a greater need to make longer excursions on the weekends. They see their own weekend travel as rather modest.

Daiva: "All our friends have cars. [---] They make excursions every weekend, going somewhere just outside Stockholm. But we don't feel that we need excursions every day or every weekend. However, … we rented a car in the beginning of summer when my mother was here on a visit."

Going to the open-air Skansen Museum/Zoo is one weekend trip Markus and Sofia mention. It works fine with the children since they live at the start of the bus line. Otherwise the spaces for three baby carriages fill quickly in the 'Skansen rush'.

Weekend food purchases should also be included in the weekly rhythm, as other things are. None of those interviewed shop for the week at supermarkets, even if they are aware of the possible savings.

Daiva: "I'd like to have a car to do the shopping. Maybe not actually have a car, but to have access to one. But then when we bring stuff home, there isn't a lot of storage space [in the student housing]."

Anna says that the "main reason many want a car is to shop once for the whole week". But she does not enjoy it, thinking it takes time. That is why she would rather pay extra at the local store "and have more time with the children". "Everyone doesn't think buying everything at one time is essential," she says later in the interview. Personally she feels shopping is a necessary evil. Going to DIY-stores is saved until someone with a car visits, she says. Anna and Kalle have a car they can borrow, but they have only done so once. They do not have a child car seat and anyway it is a problem fastening them. However, she has gone with someone several times to such places as IKEA. The outer conditions are somewhat different for those living in the inner city, but the attitude to larger purchases is the same.

Markus: "Someone with a lot of motivation could certainly get something out of having a car by shopping at supermarkets. We just walk down to the local grocer's shop and buy what we feel like at the time. It's not really very good."

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[5] Tillberg, K. Barnfamiljers dagliga fritidsresor i bilsamhället (Daily free time travel for families with children in a car society), 2001.

Those interviewed try to defend their choices and of course there are advantages to shopping often and little at a time. This provides small, welcome breaks in the day, relaxing meetings with cashiers and neighbors.

Markus: [---] "But then I work at home. And I like to drop down to the store now and then. It fills a social need. I feel that when I've sat there with a dumb book trying to find something to say about it, it's great to go down and buy something."

Kristina says that she is "a bit jealous of people who live outside the city and go to fantastic supermarket that have everything". And so she feels that "it would have been practical to have access to a car every other week. But you don't rent a car to go shopping – it would be a bit of a bother." As to the question if they see some other solution to large-scale shopping, Göran and Kristina say they sometimes take a taxi. But not to shop for food.

Göran: "But if we buy larger things, which has happened, such as building materials or things like that, then we'll take a cab. I'm a great advocate of taxis; have always held that it is much, much more economic to ride a cab, than to own your own car. After all, we can ride many cabs without even spending as much as the gas would cost. … People think they save there … that taking a taxi to buy some boards is luxurious."

Göran and Kristina describe taking a cab with a large piece of furniture from IKEA. Other cab drivers stepped out of their car with advice [on stowing it], she remembers. One pointed and said "do it this way and you'll get it in".

29.2.3 Annual Rhythm

Vacation trips are linked to the season; visits to childhood places, to family, relations and friends are important. All those interviewed had moved to Stockholm together in the last 10 years. Two couples had roots in Skåne, one in Lithuania and one on Åland.

Daiva: "We have relatives in Lithuania. We try to go there once or twice each year. … And the family is large enough that it's simpler to have a car. That way the safety seats are already in place and everything. … And now we have three children – we haven't been back with all three yet."

Sofia: "We're practically seasonal residents in Skåne. This summer and the one when Sara was born we were there for three months. If you live that long in the country, you need a car. [---] If we had a summer house near Stockholm to get to, we might be interested in having a car there. But where we need one is Skåne and there we have a car to get around in. We visit all around there, going to see people when we are there."

Six months before the interview in the spring, Markus and Sofia bought a Volvo 244 that is parked in Skåne. The reason was to reduce the dependence on nice neighbors in the countryside who had to take them to maternity care and other health centers. But they also need to get out sometimes to give some space to Sofia's mother who lives in the other cottage on the small lot.

Other kinds of vacation trips can also create the wish to have a car. Two of the families have experienced trying trips with several changes and unwieldy baggage and child equipment that needed to be carried and placed.

Sofia: "For example, last summer we had no car. We had only one child. Then we went to Gotland Island and rented a house with Markus's brother. We travelled back and forth without a car and it was actually hell. It actually felt that people weren't meant to do that. We were to be gone two weeks, so we brought a travel crib and a car safety-seat since we were going to rent a car on the island. And then we had luggage with clothing for two weeks. We took the bus to Nynäshamn and the ferry to Visby. Over went OK. But on the way back we arrived at night and the bus to Stockholm was overloaded. We had to sit in the luggage section and it felt as if there was stuff all over our daughter. If the bus had been forced to brake, she would have been brained by luggage. It was very uncomfortable."

Markus: "It seemed like real refugee scenes. You had to fight your way onto the bus and families got separated. (Sofia laughs) Someone ran around screaming: 'I have to have my bag. I've forgotten my bag!' It really seemed as if civilization was falling apart because of poor organization. And people needed to take matters into their own hands. The real problem was handling all that baggage. Here we had two weeks of stuff, ours and the children's, to take two hundred yards from and to the ferry terminal. No simple matter that. Then it had to get to the taxi and then onto the bus."

Since it was a ferry, those with cars could drive on without having to repack. They were asked if this was a decisive moment.

Sofia: "Yes, it was. We actually said to each other that this was the last time we do it this way."

Markus and Sofia were asked how they thought it should have been handled. Markus suggested that it should be possible to check the baggage.

Sofia: "But they should have carts like they have at airports. And then more room on the bus for carriages and luggage."

Jonas and Daiva had also taken the ferry to Gotland. They had problems with other parts of the trip. Theirs was an overnight trip and their daughter was anxious onboard. When they arrived early in the morning, all the other passengers had cars, taxis or someone to meet them. But the bus that was to take Jonas, Daiva and Milda to Kneippbyn holiday village was nowhere in sight, said Jonas. Eventually it showed up. The plan for the vacation was to travel around on rented bicycles. But as it turned out there were no bike carts or child seats, as they had expected. When they came to this part of their story and were asked if it was possible to rent a bicycle with a standard child seat, they laughed and answered maybe so. But they did not know it was possible to ask for that since this was their 'first adventure vacation'.

These stories say a lot about how families with children can experience long-distance public transport. It seems as if the Gotland system needs to improve in order to meet their needs, just as most baggage handling on trains and long-distance buses need to be improved.

Next came questions about their life in general. How have they travelled previously and what experiences have they had?

29.3 The Road to the Inner City or the Suburbs

How do travel habits develop during childhood and life in general? The question is first asked in relation to Göran's life, followed by somewhat shorter descriptions of the life of the other interviewees.

If you look at Göran's life you can follow the conditions that have contributed to his lack of orientation towards having a car. He grew up in Malmö a 5-min bicycle ride to downtown. He got used to moving about independently using his bike and the public transport, though his parents always had a car.

Göran: "But that car … wasn't really necessary in a city like Malmö. Except that they used the car to get to their summer house. And Dad used it to drive to work and to the country house some fifty kilometers outside the city."

29.3.1 Always Inner City Residents

Göran continued to be a bike and bus using inner city resident when he moved out of his family home. After a few years he established himself as a musician and began slowly to develop his taxi habits. Since he has moved out he lived for 10 years in different places in central Malmö. The last 5 years of these he worked more and more in Stockholm. This meant long-distance commuting by air and a type of double living. Getting a driver's license and a car to travel between the cities was not a solution he considered. Nor was having a car in one city or the other a solution Göran thought about. It seems rather that his habits of combining several transport means were developed and reinforced during this period.

Göran has since been living on Södermalm for 10 years with his wife Kristina. He seems to have continued his habits of using bike and public transport. When these means do not suffice, Göran has developed a comprehensive taxi use. He has worked as a rock musician most of his adult life, a life that calls for rehearsals, recordings, gigs and tours. Thus his existence has been ambulant with rehearsal facilities, studios and scenes that vary week to week. "I've never really had weekdays in my life. I've toured and travelled a lot!"

The life of a musician differs from most more regular employments. For Göran this has meant an absence of fixed routines or regular patterns in time and space. Flexibility is found even in his travel habits. Each new job or gig necessitates decisions regarding combinations of travel means.

Göran states that he has never considered buying a car, even though an outsider looking at his existence would see that as a reasonable solution for the travel demands of his occupation. He has not even thought about getting a driver's license, having instead found other solutions that he is comfortable with. He says he likes to ride his bike, take taxis or use public transport and thinks that owning a car in the inner city would be more of a burden than an asset. He has consciously avoided finding himself in a life situation that could force the decision to seek a driver's license and buy a car.

Kristina's freedom from cars is different from Göran's. She grew up in villa communities full of cars with parents who drove. She rode along a lot, especially on vacations. Håkan Andréasson calls this for socialization in a car society.[6] It would have been completely natural for her to become a car user. But she too acquired different habits. During her upper secondary years she commuted by bus from her community to the nearby city. Buses were also the transport means for going into the city for fun.

Before she turned 20, Kristina took her driver's license, but never bought a car. When she moved out, she lived in Lund a few years. She studied there and the bike became the natural transport means for both financial and practical reasons. Students in university cities are seldom car users. But the time in Lund was short. She lived for a while in central Malmö, continuing to bike during the week. At 24 she became an airline hostess and lived a year in Stockholm. She would commute to Malmö by air to be with her current boyfriend. When she returned to Malmö, she continued to work as airline hostess, but with Copenhagen as base and a hovercraft as her means of reaching Kastrup. Living centrally made it easier to use public transport to her job than having a car.

When she and Göran moved to Stockholm in 1992, she continued to work at SAS, taking the airport bus or train to the job. The last 4 years she has alternated her hostess job with working in the SAS offices at Frösundavik, taking the bike to the latter as a form of exercise. For Kristina, as for her husband, their irregular, travel-heavy occupations, joined to inner city living, have been important in forming their travel habits. The most important factor behind their not having a car seems to be the continuous inner city residence.

What plans did you have when you moved to Stockholm? Was this with the inner city something self-evident?

Göran: "Yes, we wanted to live in the inner city. That was our first priority."

Markus has moved around a lot in his life. His childhood was spent in Skåne, Norrland and Östergötland, living thus in the south, the north and in between. His family drove around a lot in Sweden on the weekends and during vacations. One thing he remembers is leaving Hudiksvall in the evening and arriving in Skåne later that night or in the morning, he and his siblings having fallen asleep in the car. On the other hand he was not driven much during the week, except to away games with the soccer team. As for Kristina, the upper secondary years meant daily bus rides between the suburb and the city. When he moved out on his own, he lived in several places in Malmö. He biked and used the public transport system, never having taken a driver's license. Markus describes his life in Malmö during the latter part of the 1980s as "an awful lot of simply drifting and having no goals", but with some studies, writing and periods of doing nothing. He moved to Stockholm in 1991 and began to support himself as a freelance journalist. In the capital he has managed to live in ten different places in the southern subway suburbs, as well as in the inner city. He has mostly used the public transport system and biked now and then.

[6] Andréasson, H. Resenärer i bilsamhället (Travelers in a car society), 2000.

Sofia has always lived in the city and her childhood is very similar to Göran's when it comes to living and travelling. She grew up in Malmö and the family Renault was not used every day, but mainly on weekends to drive to the eastern part of Skåne to Österlen. As an adult she has had her own apartment in central Malmö and has mostly used her bike. She took a driver's license when she was 20 "in some diffuse sense of duty", but felt ill during longer car trips. Living in Malmö was alternated with a short sojourn in a dormitory in Lund. But she missed the sea and after three terms returned to her home city. At the same time she left a relationship and describes riding the bike form Lund as a "liberating, symbolic bicycle journey".

After that she worked as a translator and moved to Stockholm when she was 25. After a few months she bought an apartment in Vasastaden in the city's northern district. She tells us she has biked rather much in Stockholm, to the office in the Södermalm district and out to the University. She met Markus and after a while he moved in with her. When they awaited their second child they bought a larger apartment in the same area. When she did not use her bike, mostly taking the bus instead. She does not really like the subway, thinking it "somewhat scary". It was first after daycare deliveries and regular hours to keep, that she became a subway user. Today she is studying to become a midwife and suggests that her daily life is played out over a "very small area for being in Stockholm". "For the most part I move around in the neighborhood," she says and states that this is due to "a combination of circumstances and conscious decisions". She has quite purposefully sought out cafés and shops she likes in her surroundings, but it was "pure luck" that she happened to land at the Sabbatsberg Nursing School in walking distance.

29.3.2 The Academic Path to the Metropolis

Daiva grew up in Vilnius, Lithuania. The family lived in an apartment with three rooms and kitchen 15 min from city center by bus. Her mother had a university diploma in economics and worked with bookkeeping, while her father was a welder. She says they had a car, sometimes two, but she was seldom driven anywhere by her parents. Weekdays it was mostly bus trips. As there are no bicycle lanes, it is nearly impossible to ride in Vilnius. She moved to Stockholm in 1995 when she was 18-years old. She attended a restaurant school and lived in a dormitory downtown. Then she worked 6 months as a nursemaid in the Djursholm suburb before moving in with Jonas and starting a family. At this time she is on parental leave with the twins while studying economics at Stockholm University.

Jonas is born and grew up in a small village in Lithuania. His parents had diplomas from the equivalent of a technical high school and worked on a kolkhoz. He remembers that both drove tractors, but were specialized in completely different areas. His mother was the one who drove the family car since his father did not like fast vehicles. Jonas biked a lot, especially since it was 3 km to school. He attended the vehicle engineering line at the high school and worked in his brother's garage, something he thinks would be useful if they buy an older car – the new ones are too complicated for him to work on. Then he attended the University in Kaunas 200 km away majoring in mechanics and nuclear power. In 1995, not long after graduation, he was offered the chance to do research at the Royal Institute of Technology in Stockholm. He moved into a room in a dormitory on campus and soon married Daiva and moved into the student apartment. He still works with nuclear technology at a company in Alvik outside Stockholm. Today he is 29-years old. Both of them took driver's licenses when they were 18, a license that can be used for a year in Sweden. Daiva has not applied for a Swedish license. Jonas, on the other hand, moved from Lithuania a few years after Daiva and applied for a Swedish license when he sought a job.

Kalle and Anna are both 30-years old. He was born and grew up on Åland Island in the Baltic, she in a small village in northern Uppland province and spent part of her childhood on Åland. Both families had cars during their childhoods and used them frequently. Anna said it was natural for them to buy a car when they took a driver's license. In fact both had a car of their own before they were 18 and used them when they lived on Åland. Kalle moved to the Norrtälje area when he was 23 and kept his car. Anna came 2 years later, but did not bring her car. When Anna began to study at the Royal Institute of Technology and Kalle studied in Norrtälje they tried to ride together or pick each other up. In Stockholm there was a bus every 15 min and during the summer they biked a lot. A year further on they moved into the student apartment in Berghamra and for the first time in their lives they were without a car. They got married and had their first son in 1999. Today they have one more who is 1 year. Both are studying to become engineers, but Anna is on parental leave and studies at night.

Anna provides several reasons why they sold their car. The expense is one and environmental awareness another, especially for Kalle. In addition the car would only have stood parked for weeks on end and there would have been problems with inspection, burglary and the like. She also mentions the "warning example of exaggerated driving in the countryside", as one reason she got rid of the car. "On Åland, you take the car if you want to move a meter," she explains.

29.4 Plans for the Future

Daiva and Jonas seem focused on creating a life in the new country and economy has the highest priority. Put simply, they want to save money. Jonas mentions this several times. "I just think it would be a waste of money to have a car." They have really studied the costs in several consumer oriented magazines, arriving at a monthly expense of between 2,000 and 3,000 kronor to have a car. To the question of how they have arrived at that number, they have similar sources.

Daiva: "The sum can vary. But there are fixed costs, such as insurance, maintenance and lots of things. Put together, it becomes a fixed cost that can't be influenced later. [---] The Swedish Consumer Agency has calculations and …"

Jonas: "I have a reference, from the magazine Privata Affärer. [---] There is actually a table that sets values for different types of new and used cars. [---] And here there are rather succinct numbers. So if we need the car to get to large stores to buy something, it simply isn't worth it. In the future when the economy is better and Daiva begins to work, then we can buy a car. But right now I see it as a waste of money to have a car. Stockholm has rather good communications. We don't need it – it's enough with the subway, bus and commuter trains. It actually works well. Maybe even a little quicker than by car. But if we try to weigh the costs and all the worry. It's worth asking if the car is better or not? Or use the public? [---] We try to save as much as possible to avoid large loans and interest in the future. If we had a car, 3,000 would disappear each month from the top."

Their arguments about the choice to save money on today's travel for future residence seem convincing. It is their main motivation and shows that they understand their current situation as something temporary or at least a stop-over on the way.

During parental leave, one parent has no work travel. Certainly this facilitates the day's errands making a car less interesting. Choosing parents with children and no car as study object was done in order to investigate how they viewed the immediate future. Were they facing a choice? Did they think they would buy a car when both parents had a job? None of the couples interviewed excluded the possibility.

Anna says that she thinks they will buy a car. It is "practical when you have children," she says. "Sometimes you don't know when they are going to school." But she thinks it will be difficult to stay in Bergshamra since the housing is very expensive. But even if they do stay after the studies are completed, she believes they will buy a car.

Daiva and Jonas link the question of a car with plans for future residence and their desire to ensure continued financial security.

Daiva: "It's not that we don't --- want to have a car. But first we want to know what it would cost. … Since we live in a student area now, we have to remember that we will be forced to move soon. And … then it's not so easy to know where you end up."

Like the two student families, Kristina and Göran are entertaining plans for a future move. For them the outer suburbs are interesting and then it is clear that buying a car is a possibility in that scenario.

Göran: "Right before Nancy arrived [we] had a lot of discussions about having to move [in order to] get outside, to have a garden. [---] But we are very happy here."

Kristina: "And the selection is limited when you don't have a car. Then you are dependent on good communications. And we are very aware of the fact that it will be more difficult if we live outside the city … because Göran does not have a driver's license."

Kristina: "If we were to live outside the city, I think it would be necessary to have a car. In part because I work at Arlanda Airport and in part purely practical considerations. I'm not going to continue to work at the SAS offices in the future, only fly. [---] I believe you'll want to have a car if you live in a house [---] since the types of needs you have today would increase if you live in a house, I think. You have to buy things, drop-off and pick-up children, and go to your own activities. And you'll have more things to transport meaning that you would feel it more convenient to have a car."

29.4.1 Bottlenecks and Wishes

Describing a desired future life is more difficult for most people being interviewed than to talk about today's realities and having opinions about that. All the interviewees were asked about what they would wish to ease life for families with children lacking cars. Most of the answers were generally rather short and focused on details. Still, taken together the wishes provide a solution sampling.

When it comes to daily travel two of the families mentioned that travelling with baby carriages could be facilitated. For example Daiva and Jonas wanted older buses to be replaced by newer ones that are easier to use with carriages, in their case a twin one. Markus also thought that like the buses, the subway should be free for people with carriages.

Anna and Kalle talked about broader questions dealing with environment, such as forbidding mopeds due to noise and exhaust, and a car-free inner city. Compared with the other interviews, they expressed very critical views on car use and moped. Both student families wanted more rapid, more frequent cross-town links west to Solna Center and beyond.

Travel that happens on weekends and the more infrequent, irregular free time trips brought out a lot of ideas. The inner city families had fewer wishes around public transport, probably because it is simply better in the inner city. Markus and Sofia pointed to the problem families with children have with bus trips to popular places. There are only three carriage spaces on the bus. If you happen to live in mid-route, the spaces will often be filled and you cannot board. Daiva and Jonas wanted more frequent buses on the weekends. Another wish from several families was for child safety-seats in taxis.

Sofia: "I think there should be child seats in taxis. They should have one in the trunk. All taxis should be able to take out a child seat for every run. You're always worried when you're in a taxi with a small child; as when it drives over 60 mph over the Västerbro Bridge. It's very scary. And it should be possible to get a hold of a cab for emergency situations like childbirth and illness."

Shopping also brought out wishes from all four families. Now and then it is necessary to get a hold of a car for weekly food shopping or to buy furniture. So far this has been solved by borrowing a car a couple of times a year from some neighbor or visiting parents. As mentioned, Kristina and Göran have used taxi filling it to the limit with IKEA furniture and construction material. All families have thought about weekly food shopping, but feel that it is not worth having a car for just that.[7] Kalle and Anna have tried to order food for home delivery over the web, but claim that certain food chains will not deliver in the student area. Cheaper car rentals have been discussed in Bergshamra, but even there the cost is a problem in relation to the need.

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[7]This demonstrates that the existence of external shopping centers can reinforce the need for a car on a micro level. Department stores that in this way create the traffic can reasonably be said to share responsibility with the authorities that have approved the placement.

When it comes to holiday seasons, what is asked for are good systems for renting a car over the summer to acceptable prices. Kalle and Anna want it to work smoothly over the national boundaries to the Åland Islands. There is also a wish for better public transport in the old home district. Today it is slow and infrequent in comparison with Stockholm. Another important area concerns baggage solutions from door to door, such as SJ or the Gotland Ferries offering door-to-door baggage handling or a baggage cart.

"How could this baggage problem be solved?"

Markus: "In part with baggage carts on the ferries. In part with some service offer from the company whereby it would be possible to check your baggage, sending it the whole way. That would be best. I don't know if it would be possible to subcontract it to some company or to sell it as an extra service. We'd be willing to pay if it were possible to leave it all to the Swedish company. Just think if SJ had a service like that. People could come to the house in some little van and drive it to SJ Express and then send it along on the train. Drive it door-to-door, in other words."

29.5 Analysis

What habits are comprised in the daily respective the less frequent trips? What does characterize travel habits overall is that they are the means for maintaining other habits we have, such as shopping, eating, socializing and going on vacation. This does not mean, however, that the travel habit is merely a practical solution to an accessibility problem. The travel habit has its own meaning for the person. The bicycle tour or bus trip has a value in itself by providing such benefits as exercise and/or a moment's relaxation. To the extent that the travel habit is linked to feelings, preferences and values, it is also a more or less vital part of a personal style.

29.5.1 Every Day

The daily travel habits of the interviewees have developed in relation to other habits linked to such things as living, household work, childcare, employment and private economy. Together with the local transport possibilities, these habits create practical parameters that allow for daily use of bikes or public transport. It can also be said that there are circumstances that force them to be without a car, such as private finances, traffic jams and parking problems. But behind the physical and social realities stand feelings and values that control the choices they make. Those interviewed like to bicycle and get exercise. They feel that there is too much car traffic. They would rather save than waste. Having a car seems problematic and the thought causes more distaste than desire.

As we have seen, those interviewed present various patterns when it comes to choosing travel means. About half of them choose to bike first and half public transport. One of those interviewed says he often takes a cab and at least one in each family has a driver's license, meaning that they can rent a car now and then. One of the families even has a summer car in the country. Thus the travel means are mixed in specific ways to suit the personal travel patterns. In that way there are possibilities for changing the travel means as the need arises. If seen only as handling patterns it seems reasonable to expect constant adjustment when either inner motivations or outer circumstance vary. However, seen as habits, there is planning and mental energy invested in the choice of travel means and changing the habits would entail new efforts. Correspondingly, seeing new ways of traveling as consumption can be linked to a resistance to learning or re-education. We will return to the question of what is necessary for creating new travel habits. But first a short discussion of the special needs of families with children seems essential.

Set against the rhetorical background of the special transport need of families with small children, it is surprising that these same families do not experience routine trips to work, studies and childcare as a problem. However, habits are formed in relation to the life situation. When the daily time equation is seen as demanding, car habits can both be created and be reinforced. Andréasson and Waldo are among those who have demonstrated that drivers view their time schedules as that which makes the daily driving necessary.[8] But those without cars interviewed in the study have not described their daily schedules as stressed. This is obviously a life situation in itself and how one acts in relation to it.

In the households involved one of the parents (the mother) is on parental leave, while in one case the other studies and two are freelance cultural workers. Only one parent has a nine-to-five job. The on-the-spot account from early summer 2002 shows how their daily lives are organized around their temporally flexible employments and the parental leave.

The latter seems to have brought a form of slow-down or breathing pause when compared to the life prior to the birth of the children. The two inner city families arranged the day themselves – one parent took care of the child that was still at home, while the other could spend time on studies, work or something else. At the time in question there were no fixed times to meet. Kristina and Göran led a vacation-like existence, while Markus and Sofia had more to do. The parental leave and temporally flexible work seemed to have given them a lot of freedom in the choice between various transport alternatives and thus facilitated their life without a car. Are there are two types of people – those who are not in a hurry and have no fixed times to attend to and those who do? Students, freelance workers, unemployed, those on parental leave, retired persons and others could then belong to the former group.

[8] Andréasson 2000; Waldo, Å. Staden och resandet: mötet mellan planering och vardagsliv (Urban travel: a conjunction of planning and daily life), 2002.

29.5.2 Open Daily Schedule

Sociologist Åsa Waldo has written about 'bound and free time in the stress society'. She has interviewed both workers and 'non-working' persons about their travel. "The most important change in travel habits noted in the interviews with persons who suddenly had more free time due to parental leave, unemployment or retirement was that since they had no times to keep track of, public transportation was better suited. [---] At the same time the interview material contained older persons who have become more mobile after retiring and who began to use their car to a much greater extent."[9]

Waldo draws the conclusion that there are no unambiguous links on an aggregated level between how large a share of bound versus free time people have and how they travel during the week.[10] She thinks that the connection between the different types of time and the choice of travel means are clearer when you look at individual cases. This can mean that a person who always takes the car to his or her job in the bound segment, can consider using public transport or a bicycle as possible alternatives for trips of similar length in their free time.[11] The indication that people should be more inclined to using public transport or bicycles in free time than for work trips does not agree with the interpretation of the interviews in this study.[12] Among the temporally unbound parents of small children it was the shopping and vacation trips where a possible need for driving a car could be seen. How should this apparent contradiction be interpreted?

One way would be to state that it is hard to generalize about which part of life or what types of trips people feel a car would serve best. The attitude towards one's own car need probably varies along other parameters, such as where you live and if you already own a car or not. For most people, the rush hour lines in Stockholm and the expenses for and access to parking combine to make the car a less acceptable alternative for daily commuting. However, in Malmö where Waldo carried out her study, a car is still considerably faster and parking is no problem.

On a general level the studies in this chapter and Waldo's text support each other. A smaller bound and stressed time schedule makes it easier to choose public transport or a bike. This statement is most nearly to be seen as self-evident. What also normally is seen as natural, though not necessarily so, is that retired persons and students have a lot of time, while people of working age have a stressed schedule. This may be true if it is an average for larger groups that is meant. But if politicians, authorities and companies want to support non-car programs, they ought to focus in practice on all ages, since travel habits can both change and be locked in all life phases. The results suggest that there may be time for such an effect during the first

[9] Ibid., p. 158.

[10] Ibid., p. 158.

[11] Ibid., p. 159.

[12] However, Waldo takes the examples for this from those who have access to a car and these do not occur in this study.

childhood years. It is important to know who in such categories as families with children are willing to accept support and influence and not assume that all parents are in a hurry and would rather drive a car.

Even on weekends those interviewed would primarily choose what is possible without a car. However, more than for the weekdays, there is a feeling that the lack of a car is a ‘deficiency’. The families would like to be able to shop at IKEA, building supply (DIY) stores and low-price department stores. They would also like to go to other places for pleasure than those near public transportation. Such wishes are usually solved by borrowing a car from some neighbor, taking a taxi home from IKEA with the purchases or shopping a lot when parents-in-law visit. What seems to be sought is a weekend car or a once-a-month car, an example of how the desire for a car is formed at micro-level. The car is seen as a means for consuming low-price goods or excursion goals. External shopping centers are being built outside the cities at a rapid pace, leading to increased car use. Is it possible that it can be the placement of shopping centers that becomes the deciding factor in the decision by individuals to buy a car? Those interviewed seemed open to various possibilities for solving larger purchases and buying a car was only one of these. Trade, politicians and planning staffs ought to take this seriously and support developments that do not lead to an increase in car use based on structural changes in trade and buying habits.

29.5.3 Vacation

The interviewees also identify a feeling of deficiency on vacation trips, both tourist trips in Sweden and on the annual visits to their roots. All four couples moved to Stockholm together during the decade just past. Two have their roots in Skåne, one in Lithuania and one on Åland. This means that the home today and the one yesterday are linked by a corridor comprised of air, rail or water transport. During a summer vacation where one grew up there is a strong desire to visit many places and people in a short period. This has proven unsatisfactory without a car. The couples also feel that the distances to food stores, care facilities and bus stops are long. They have experienced stressful trips with several changes and ungainly baggage that included equipment for the children that all had to be carried and stowed. One example is that the first trip to Gotland Island with small children gave two of the families a feeling that “it isn’t meant to be this way”, clearly defining ideas for change, both in the ferry traffic to Gotland, but also in general train and long distance transport means.

There is also a difference between unusual and regular trips. The everyday, routine trips formed a part of everyday structure that repeated itself continuously and could therefore be evaluated and modified. It is possible to affirm that this choice was one they made, it works and therefore they could be satisfied. However, the unusual trips could not be repeated the next day and here unexpected problems could crop up. Being without a car is situationally determined, being experienced as satisfactory for a certain place and for people in a certain life situation. The exceptions are the unusual trips, times when they choose to use a car or can imagine using one the next time illustrates that the choice [of being without a car] is neither irrevocable nor unconditioned.

29.5.4 Motivations

Sandqvist and Kriström are both pedagogs who have studied youth and their families in Stockholm's inner city, both with and without a car. In the introduction [to their survey] they point out that inner city residents "represent an extreme destination" when it comes to car dependence in today's Sweden. What is meant by that is that it is easiest to manage without a car in Stockholm's inner city.[13] The conclusion from their survey of parents is that inner city residents who buy and drive a car do it simply because they like it.[14] The authors suggest that this is in agreement with the results of a study done in Lund. Even there it was decided that the group studied had good possibilities to manage without a car. Thus it was possible to explain car ownership with positive feelings for car and driving in such easily accessible areas as inner cities. This means that inner city residents who do not have a car do not necessarily dislike them, but rather hold neutral or mixed feeling about them. They simply lack a strong motivation for buying a car.

In the mid-1990s, ethnologist Wera Grahn carried out a study of families with children, but without a car in the Stockholm area. One of her selection criteria was that the families had to live outside the inner city where public transport is more spread and the distances to activities longer. Her aim was to determine who the non-drivers are, how they manage their daily lives and what relationship they have to the car society. She also studied this divergent group in order to get a picture of both them and their opposite, the car users.[15]

With these strict selection criteria, Grahn expected to find environmentally aware opponents of car use and was surprised that this was not the case. She did in fact discover discontent with the automotive dominance in society, but this was not only and not even primarily linked to environmental aspects. Nor were they active car opponents, rather pointing out the benefits of cars in certain situations.

29.5.5 The Importance of Choices

Under their current living situations those interviewed did not seem ready to change their travel habits in any radical way. But their life histories showed that they had made such changes earlier in their lives. Each time it was in connection with breaks

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[13] Sandqvist and Kriström 2001, p. 19.

[14] Ibid., p. 114.

[15] Grahn, W. Liv utan bil – en livsstilstudie av bilfria barnfamiljer (Life without cars – a lifestyle study of families with children and no car), 1995, pp. 5–7.

in everyday routines, such as when they moved, had children or changed job. One example of such a break was when they moved out of the parental home. For suburbanites who moved into the city (Markus and Kristina) the change meant that they drove less and stopped using highway bus systems, in favor of many shorter bike and local bus trips. What we are talking about is a break that includes a change in travel habits, even if that change does not seem especially big or dramatic. The same can be said about Jonas when he moved from a small village in the country to a dormitory room at Kaunas University.

Still, the others did not change their travel habits when they moved from their childhood home. Both Sofia and Göran grew up in Malmö and stayed inner city residents, travelling in about the same way as before. This is also basically true for Daiva who moved from her parental home in Vilnius to a student home in Stockholm. It was equally true for Kalle and Anna – they continued to live in the country, driving and riding in cars.

The change for Kalle and Anna began with their studies. At that point they stopped using the car during the week. In the beginning Anna took the bus from Norrtälje to the university. Kalle's studies began at about the same time as they moved into the student apartment, married and the family grew. When they moved, they sold the car and shifted entirely to bicycle and public transport. Even Jonas drove when he lived in a smaller community, but stopped when he moved in the university area. Both Daiva and Jonas seem to drive less than they did in Lithuania and Daiva does not have a Swedish driver's license. Thus the move to the student apartment was a break that changed their travel habits. In a relatively short period, both student families had changed home town, residence, occupational focus and family situation.

Changes in the lives of the inner city residents do not seem to have coincided with the point in time. They had not changed home town or type of residence when they formed a family. Nor did they change occupational focus at the same time as they moved. A possible hypothesis is that when these types of breaks coincide, the probability is higher for a change in travel habits. Together, these points in time create conditions for a situation where travel habits can change.

It seems that for the four inner city residents the continued urban residence was an important reason why they were never faced with the decision to buy a car based on daily transport needs. They had developed habits to bike and use public transport early in their lives and then maintained them. Their choice of residence and occupation have strong traits of permanence or stability. Living in the inner city is a goal, rather than a temporary solution. There have been only small changes in travel habits or the changes have happened gradually, rather reinforcing the habits than challenging them based on the experiences. Their transitions between various occupations, studies and jobs have been smooth when it comes to travel and cannot be seen as clear breaks.

It is, however, possible to describe the daily organization of the student families as provisional, a condition that began after a clear break point. Student living is a means for moving on, a provisional step towards the next change-over. In this economy is important. They are trying to save money and are making plans for their future residence. In addition, three of the families can imagine situations where they will buy a car, depending on where they are to live and work. This in turn is dependent on how they see their lives once the children are grown.

Three of the families are working on plans for a future move. The outer suburbs are interesting and the alternative of buying a car is a possibility that is included in the planning. However, Markus and Sofia seem set on staying in midcity. Sofia says that she does not think there is "any reason to have a car when you live in the middle of the city", keeping in mind the subways and buses where you can take a child carriage at no cost.

The above suggests possibilities for identifying target audiences. It is possible to analyze who might assume or maintain travel styles not dominated by cars. People pass through different physical places in their lives and both temporary and other, more permanent attitudes are formed. The interesting question to be asked is at what places and in which life phases or situations that "benign" travel habits can be created and made permanent. The need is to identify those places the function for potentially car-free people has in different life phases. The experiences and attitudes of persons living without a car can be seen as potential resources in the development of less car-dominated urban travel habits.

When it comes to future breaks and choices all four families seem to be moving towards such. Once studies and parental leaves are done with and both parents in each family begin to work, a moment of truth will arrive unasked. Time schedules with daycare drop-offs and pickups can be more difficult. There is, however, no necessity in this to buy a car, but to the extent that this change-over coincides with such other changes as moving to another type of city district, the break can impact travel habits strongly.

29.5.6 Long-term Choices

Everybody will at some point be faced with choices that include travel habits. Closest at hand is to discuss the types of choices those persons interviewed have gone through and face. Moving to another town or worksite and changes in the family membership are among the common reasons for changing travel habits.[16] Thus it would be important to create incentives and action alternatives for these situations. One important type of choice situation concerns the transition from the varied travel style of youth to the car dominated style of adult life. Research in this area has shown that the car, once one is bought, often becomes a universal vehicle. This condition is especially well-defined starting in the younger middle age and is more prominent in men than in women.

In order to make the above more concrete, it is possible to seek the incentives that inspired Kalle and Anna when they moved to Bergshamra and sold their car.

[16] Waldo 2002, pp. 185–189.

It seems that both values and outer conditions were involved. They opposed car use for environmental reasons and at the same time, it seemed that having a car in Bergshamra was more expensive and not as practical as having one in the countryside outside Norrtälje. In addition, they had moved much closer to their school and could bike or use public transport to get there much more easily than before. Thus students who have just moved in are one example of a target group. It is therefore important to note where potentially car-free families with children move, such as into student housing as in this case.

The student families know that they must move from the student housing when they complete their studies. Where will they move then? They would like to stay in Bergshamra, but the cost level would seem to make this impossible. A row house or villa in the somewhat cheaper suburbs farther out would seem the best. Let us assume that one of the families landed in a more spread-out suburb in the suburban perimeter. They would need to get to daycare, two different worksites, food stores and to make various trips to the city and local centers for other purposes. In the images for the future, the public transport and worksites are concentrated at the hubs. Getting to work once you are on the train or bus is normally not a problem. However, connections and links could be. If having your own car or even two is not a solution, is it possible that some other vehicle type is? A type of suburban vehicle could be a solution, such as a covered moped with space for two or three children and the driver. Development of such can be stimulated in various ways, perhaps through free parking at the subway, commuting train or bus.

29.6 Some Suggested Solutions

The examples below offer possible solutions that in a longer perspective should be able to reconcile the problems in living without a car. In other words, this section deals with possibilities that can be created in order for families with children to live without their own car in the future.

29.6.1 Shopping

The households interviewed expressed dissatisfaction when doing weekly food shopping and for furniture/building materials. There were problems getting to supermarkets and low-price stores, as well as getting the items home. In a long-term temporal perspective there are several possibilities. To start out with, it is important to note that today the trade is organized is mostly structured around private car use. The stores are localized on external sites providing price and advantages of scale for the department store chains. This development is also supported by city and traffic planning, as it has been promoted during the most recent decades.

The structure of trade and the localization of the stores are both historically based. Thus one possibility is a change in spatial organization by concentrating the stores in good public transport locations near to residences and worksite. Four of the six images of the future propose dense suburban centers with more residents and where the public transport between the hubs is improved. Shopping could then be concentrated to department stores in the hubs, rather than to external sites. Getting to the shopping centers would then not be a problem for non-drivers, though transporting the purchases would still be difficult. A relevant conceptual pairing concerns ones own work versus services bought. The problem with home transport can be solved if people buy that service, rather than doing it themselves. However, with a societal development that continues to emphasize doing things yourself, other solutions will have to be found.

A technical organization can be described in terms of mechanized and automated transitions between different steps of a certain process.[17] Home transport of goods is a step in the goods supply and distribution process. Using your car for home transport instead of carrying the item is naturally a form of mechanization. But the car is a universal machine, rather than one specially designed for goods transport between store and home. For just this purpose, a car has an overcapacity in terms of such factors as space and motor strength. A shopping cart or something similar would be enough if the only purpose were to avoid carrying something heavy. Mechanization in that case could mean electrically powered carts for large loads in order to make it easier to push them uphill.

Another aspect that can be placed under technical organization would be linking the infrasystem and standardization. A washing machine is connected both to the electrical network and the water/waste system. A shopping cart in a more car-free city could be linked to the public transport system. The cart could be adapted to buses or the subway. There could be a special ramp or escalator in subway stations to move the cart up and down, while the train would have special places for easily parking the cart.

Standardization is basic in modern infra and distribution systems. One example is the development of standards for important innovations in goods handling from ports and railway stations to distribution terminals in external areas. Trucks, pallets and transport packaging have developed to a standard chain. In a similar fashion it would be possible to enable the shopping cart to handle a number of plastic carriers and mini-containers with standard measurements. Packaging dimensions and handling in the stores could then be adapted to these standards. Even in the home there would be a need to be a space for this cart or its parts, perhaps in the hallway or some dedicated place in the kitchen.

29.6.2 Vacation Baggage

It is possible to use the organization concepts to categorize solution alternatives for the other packing problem mentioned in the study, that of bringing baggage on longer trips out of the city or to the summer house. The vacation baggage can be handled in the same way as the shopping carts, thus facilitating the process of getting

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[17] Henriksson G. Hållbart vardagsliv (Sustainable everyday living), 2004, pp. 64–66.

from a suburb like Berghamra to the central station. A cart can play a part here as well. Let us imagine a larger mini-container or pod, as large as the trunk of a car and with the same natural cultural identity. "I'm going to pack the car" would be replaced by "I'm going to pack the pod" for the weekend or the vacation. If transport services are made more attractive by enabling the purchase of national baggage service, like one of those interviewed suggested, the baggage might be fetched at the door in the future.

If it does not become relatively cheaper and more advantageous to buy transport services, new co-operative systems could be used. Perhaps people can own things like cars together. It will then be possible to use a carpool vehicle for the vacation trip. You can also use rented cars. The interviews also showed that trains are preferable to long car trips with children. The alternative of renting a car for the remaining trip and/or for the entire vacation stay might be interesting. A solution might be to develop national or even international carpools. As some people would want to drive the carpool vehicle the whole way, it could mean that several such vehicles could end up on popular vacation sites in high season. These can then be used there by other pool members. The baggage travels along with the majority who do not drive the whole way on the train, airplane or boat trip. At transitions, the baggage would be delivered by a combination of a rented or pooled car. Such solutions could also exist in the interface between public and private, official and private, as well as bought or do-it-yourself services. The bulky vacation gear could naturally also be made available in shared forms.

These bulky items can also be rented at different places. There are functioning systems already for renting such things as skis. It should be possible to rent or use equipment for children such as safety seats, bicycle seats, helmets, cribs or high chairs in the same way. It is already possible to reserve beds and chairs for children in various cabin villages and similar facilities. In the service, do-it-for-me society, such services are highly conceivable. In a do-it-yourself scenario some form of co-operative arrangement for shared use is possible. Such co-operation need not be local, but also have a network form, especially then for distribution nodes.

Below is a summary of solutions that would stimulate freedom from cars, especially among families with children who do not own a car.

1. Taking home purchased goods would be simplified if the rules were changed and the responsibility for doing this was transferred to the seller.
2. Simple technical standards should be introduced by the merchants in order to facilitate transport of goods by foot and in public transport, such as a cart with mini-containers and adapted package sizes.
3. The baggage service on long-distance public transports should be improved. Door-to-door delivery of baggage, universal carts, mini-containers (pods) sized to car trunks, adaptations of trains, buses, ferries and their terminals to serve families (with children) with a lot of baggage – there should be carts or conveyor belts, and it should be easy to walk/ride with said cart and carriage between entities like terminals, stops, railway cars, compartments and levels on ferries.

4. Improved availability of child equipment for rent at vacation sites, including carriages, safety seats, bicycle seats, helmets, cribs and changing tables. Or national/international co-operative networks for joint use of these with proper local distribution centers.
5. 'Subsidized' rental cars for vacationers without cars.
6. National car pools that simplify car availability at reasonable cost where the vacation trips connect, both at the start and the end of the trip.

In order to stimulate an increase in the share of people without cars, the study suggests that the community should try to strengthen those incentives that act in choice situations. One step here would be that people who move into an area with good conditions for not having a car be informed and in other ways influenced to sell their car. Such a strategy is based in those residential areas with the greatest potential for housing people who do not own a car. Another strategy could focus on demographic target audiences. Earlier research has shown that it is in the 25–40-year span that transition to car use tends to become permanent.[18] This is probably connected with demands from both family and work. This study has shown examples of factors that act in consort with steps to help people in this age category manage without a car. The type of work is important, as is parental leave for a time.

It is reasonable for municipal policies to stimulate residents to avoid having cars. Potential car-free groups can be found based on the age criteria, specifically then students, persons on parental leave and those in occupations where site and time dependence is relatively low. It is especially important to take steps to encourage and facilitate other means of transportation than cars in the transitions from student, parental leave and an independent occupational choice. Such steps should seek to ensure that the balance between the expenses and complications of owning a car and the comfort and attractiveness of not owning one tips towards the latter. However, for the habitual car user a break point is probably needed. It can be a clearly defined situation in connection with a larger change in daily living, something that truly provides a reason for considering and questioning the car habit.

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Chapter 30
Images of the Future from a National Economic Perspective*

This chapter focuses on some macro-economic aspects of the images for the future. Long-term scenarios of economic development are frequently done using economic models. We intend to compare our future scenarios to economic scenarios that normally serve as a basis for various investigations and policy proposals.[1]

We will compare the assumptions made in the different images of the future and discuss their impact on growth and other economic factors. One question posed is if the various assumptions in the images of the future hold water from an economic perspective. Another question is what happens in the economy if energy efficiency and energy prices change significantly. If the technological developments make energy cheaper, resources for increased consumption are created, which in turn may increase the environmental load. Given this, can lower energy prices, which may be a result of technology change in the images of the future, be compatible with sustainable development? On the other hand, if the environmentally adapted technology is expensive, causing the relative price on energy to rise steeply, is this only an inflationary effect in the economic perspective or does it constitute real economic growth?

The mental model used here is the general equilibrium structure described by national economic theory and that serves as the foundation for all general equilibrium models. The point of departure for this future study is radically different from how economic scenarios are usually structured, since they most often reflect a probable development. Our images, on the other hand, are designed to sketch a possible development that departs from business as usual. Nor are our images quantitative, which is the norm for model simulations. Thus both the purpose and design differ, though an overall comparison is still possible.

We will begin by studying two different energy price developments and analyze them from a macro-economic perspective. This will be followed by a discussion of

[*] Chapter written by Sofia Ahlroth.

[1] See also Ahlroth, S. and Höjer, M., Sustainable energy prices, 2007.

M. Höjer et al., *Images of the Future City: Time and Space For Sustainable Development*, DOI 10.1007/978-94-007-0653-8_30,

how our scenarios compare to those done for the Swedish Long-term Survey (LU) and the Resource Efficiency Study (REU).[2]

As a point of departure we assume that the global energy use is on a sustainable level, in accord with our presentation in Chap. 3. The theoretical reasoning that follows presupposes as well that the shift to a sustainable energy use happens on a global level; in other words, it is not a national Swedish policy that has forced the change. For Sweden this shift means that the energy use diminishes radically. All discussion in this section focuses exclusively on Swedish energy use and is based on the following conditions:

1. energy use in Sweden is drastically reduced,
2. the actual energy used provides as much benefit as the amount of energy used today, and
3. the world around us follows the same use pattern, thus avoiding any drastic effects on export trade.

30.1 Are Higher Energy Prices Necessary for a Sustainable Society?

Our images of the future extend from today, to around 2050, a period of about 40 years. Two extreme cases are possible for the energy price development in 2050 stated in real terms:

1. The energy price increases to such an extent that the part of income used for energy use is markedly greater than today, in spite of reduced use.
2. The energy price does not increase, making the part of income used for energy less than today's and in inverse proportion to the efficiency rise in energy use. This means that there are economic resources available for other uses.

In both cases to be discussed the expenses tied to the effectivization measures were included in the price. Thus the price level being discussed is the consumption price where both investment and operational expenses are added to provide cost cover for the companies. The second case assumes a greater technological leap, either enabling a shift to sustainable energy sources without a price rise or a greater effectivization in energy utilization.

The two extreme cases set up two widely different situations, both with large macro-economic changes as compared with today. We will discuss the macro-economic effects of these two cases, as well as the alternative where the price rises due to higher taxes. In order to focus the discussion, we intend to look at a closed economy without exports. This has only small effect in this context as the development is assumed to be the same in the rest of the world.

[2]Swedish Government Official Reports, Effektiv användning av naturresurser (Effective use of natural resources), 2001, and Swedish Government Official Reports, Långtidsutredningen 1999/2000, 2000, Appendix 1.

30.1.1 Case 1: The Relative Energy Price Rises

In case 1 a larger part of the income is used for energy than today, raising the question of whether this is only a price rise and thus inflationary, or if it means that energy effectivization causes increased growth. We propose that the price rise is due to a quality increase, since the environmental impact of the energy extraction and use are both less than before. The general welfare is greater as the energy supply no longer impairs the environment. But from the point of view of economic accounts the energy price increase is merely an inflationary effect. This is due to the fact that since environmental quality is not a defined commodity, production has not increased, nor has the real gross national product (GNP).[3]

However, some part of the development may be seen as growth also in economic accounts. One example is that since a car with a catalytic converter is defined as having higher quality than one without, it is not considered an inflationary effect that the Swedish car park is more expensive due to the catalytic converters.[4]

However, there is a difference if it is a consumption commodity or an input commodity that increases in price. Energy is an input commodity and its price affects the price level for the whole economy. As long as the price increases per energy unit in proportion to the effectivization of the energy use, the economy will not be affected in real terms; but if the price rises further, it will mean that a larger part of the economic resources will be used without increasing production. The cost increase is treated in different ways in the national accounts, depending on if it is an investment or an input commodity that has caused the expense. Investments are part of real GNP. If an input commodity such as fuel would become more expensive

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[3]Actually in this context the interesting measurements are either the net national product (NNP) or if future environmental and welfare effects are desired, the environmentally adjusted net national product (ENP). The NNP corresponds to the GNP less capital wear, meaning the real income left after the resources utilized to restore the capital written off during the year has been deducted. Still, the distinction lacks significance in the discussion above. In the ENP adjustment has already been made for the wear on the natural capital.

(See Ahlroth, S., Green accounts for sulphur and nitrogen deposition in Sweden. Department of Forest Economics, Umeå, Swedish University of Agricultural Sciences, 2000, and Skånberg, K. Constructing a partially environmentally adjusted net national product for Sweden 1993 and 1997. Stockholm, National Institute of Economic Research, 2001). These measurements would even show the welfare changes provided by a sustainable development.

[4]This can be compared to the handling of environmental costs in the environmentally adjusted national accounts. How increased expenses for environmental protection should be booked is discussed in the new handbook for environmental accounts (Integrated environmental and economic accounting UN, 2003) where instead of counting environmental protection expenses as increased production costs, the possibility of counting the costs for those measures necessary to achieve a more effective energy extraction and use in commercial life as a part of building the gross capital formation. This would mean that it would be counted as a quality increase, not a cost rise, and consequently not produce an inflationary price (UN 2003). However, such a calculation would not affect the standard NNP measure, only the ENP. For a detailed presentation of the bookkeeping of environmental protection costs, see Steurer, A., et al. Environmental protection expenditure and its representation in national accounts, 1998.

without a concomitant increase in the production of goods and services, the effect would be merely inflationary. If the improved environment would be represented as an economic commodity or service, such as if the emissions had a price in the form of certificates, then there would be an output and thus not only the nominal NNP would increase, but real GNP as well.

In other words, an increase in the energy price (fuel and the like) would in normal cases only be seen as inflation, while the companies investments in new energy technology would be counted as an increase in GNP. New technology in consumption goods (cars, heating systems for private homes, energy efficient household devices and the like) ought to be booked as quality improvements (such as catalytic converters) and thus also increase the GNP. How all this is actually done in the national accounts is a practical question.

What we have discussed so far are the direct effects of a strong energy effectivization and strongly increased energy prices. What then are the dynamic or indirect effects and will they differ?

Suppose that energy supply decreases, as we have postulated in our scenarios, but that the energy use efficiency in both consumption and production increases correspondingly, meaning that a smaller amount of energy suffices for the same production and consumption as earlier. Still, since the energy prices have increased, the consumption patterns are affected, something that in turn affects the production structure.

Now, if the consumers can easily switch among various goods and services, they will primarily choose less energy intensive goods. Then demand for energy decreases, while it increases for other commodities. However, many of the high-energy goods and services have a low price elasticity, in that they are essential or at least in high demand, implying that consumption does not shrink a lot in spite of the increased price. The actual income goes down as a result of this, leaving less money for buying other goods. Thus what the dynamic or indirect effects are depends on the price elasticity. If the consumers easily move to goods with lower energy content, sectors with low energy intensity will grow. How this affects the GNP depends on the productivity in these sectors. Productivity has historically been lower in low-energy sectors like service, as they are usually labor intensive. If high-energy goods and services cannot be replaced by other ones, then the high-energy prices will shrink the consumption space and we get a lower growth rate due to failing demand. Without changes in preferences and new production forms that create new types of growth sectors, the high-energy prices will initiate a lower growth pace.

The consumers will also be affected by another cost increase. To enable the large energy effectivization, an initial investment in new technology will be necessary. Consequently some of the consumption space will be used for this, meaning that the households will need to cut down further on their consumption of other goods, in addition to the cuts caused by higher energy prices. This does not mean that the economy shrinks, but only that there is some reallocation of final demand.

30.1.2 Case 2: Unchanged Relative Energy Price

In case 2, the situation differs significantly from today's. The relative price on energy is similar, but it takes less energy to produce the same amount of goods and services. It follows then that the society has extra resources. In our images of the future the amount of sustainable energy is limited and thus the remaining consumption space cannot be used to buy more energy. Thus, if a new balance is to be established, the demand for energy must be satisfied. How then will the low energy price be maintained? If energy becomes much cheaper, demand ought to increase. Conversely, if availability were limited, as it is in a future sustainable Stockholm, the price would rise. There are three possibilities for holding the price at a low level.

1. *Preferences change radically*, steering demand away from energy-demanding consumption. One reason could be a perceived threat that the accessible oil is petering out and that there is therefore a need for replacement. Another could be a radically increased environmental awareness.
2. *Price controls*, raising the question of how the insufficient energy availability should be distributed. Some type of planned economy might be necessary, including nationalization of the energy companies. Thus energy use would need to be regulated centrally, which is rigid and hard to administer. A black market in fuels or high-energy goods could easily appear. Such a situation is socially and economically unsustainable since it would lead to financial inefficiencies and societal tensions. Thus the price control alternative is uninteresting for our purposes.
3. *Extreme technological development* is the third possibility. If energy technology develops to a point where the energy needs can be satisfied with renewable energy at a low price, then we can have high growth and high-energy demand without therefore pressing energy prices upwards. However, the conditions we have in our images of the future are different and thus in this case this alternative is uninteresting as well for our purposes.

In order for our hypothetical situation to arise where there is equilibrium on the energy market at a low price level, it is therefore necessary for the preferences to change. How then would a sustainable consumption mix look? Does it take more explicitly environmentally-based preference changes than those we have drawn up in Slow and Fast?

We assume that the energy efficiency has increased to such an extent that the earlier consumption level can be maintained. But since energy is cheaper in our hypothetical situation, there is room for more consumption. The extra income must be spent without an increased energy use. Alfredsson[5] studies the effects of a

[5] Alfredsson, E., Green consumption, energy use and carbon dioxide emissions, 2002.

change to a 'greener' consumption pattern. Through the changed consumption pattern, the households will have money left they can spend on other consumption. This is found to neutralize much of the energy profits gained by the green consumption pattern. Even with only a moderate income growth of one percent annually, the energy savings would be erased by the energy used for increased consumption.

The changes assumed in Alfredsson's study are mostly behavioral ones, such as shifting to energy efficient foodstuffs (high nutritional value and energy content per unit used in production), but also technological changes, such as lower fuel consumption for cars and lower energy use for heating residences. The chosen changes are rather comprehensive and involve the food, transport and residence product groups or all of 90% of the household energy use. In the study, no general energy effectivization in production is assumed, implying that the greater part of the energy use in the economy will not be changed. Nor will the energy production itself be changed. The conclusion is that changes in both consumption and production sectors are necessary. Still, the basic question remains. Given that growth continues and our resources increase, can energy use be kept low without high-energy prices?

One possibility is that when choosing between consumption goods and recreation, the choice would fall on the latter as in the Slow scenarios. This implies that you buy fewer goods and services in the market place. Claims can be made that more recreation calls for greater consumption since many recreational activities demand large amounts of component goods in the form of equipment, services from the tourist industry and lots of transportation. In that way recreation becomes synonymous with increased material and energy use. However, if you choose to reduce your income to increase your free time, then the consumption of marketed goods cannot increase. Rather we will turn to other types of occupations that do not call for as large a monetary input, such as a lower consumption of both energy or other goods. With less working time, more goods and services can be produced by the household by doing the cooking instead of buying ready or semi-ready products or doing repairs and maintenance on home and appliances. This causes a reduction of productivity, which contributes to a leveling of the growth curve.

In the Fast scenarios, on the other hand, people will choose to work a lot and thus maintain a high consumption level. It is harder to see how the energy demand can be maintained at a low level here, as opposed to in Slow. A high living standard at a high tempo often means greater mobility and more time-saving solutions, such as more transports and more devices of various types. As we see our images of the future this can also mean that many services are consumed. People have smaller residences and spend more time outside the home eating at restaurants and going to theatres, shows and the like. Services like cleaning, maintenance of the car, boat and home and also caretaking of the older and younger generations are bought on the service market. While this kind of work is low-energy, the production level is also low and the possibilities for increasing productivity are limited, especially in the care segments where a high personnel to client ratio is considered a quality criterion.

Another possibility for maintaining a low energy demand is to create a quality increase that brings a dematerialization – the goods and services in demand are more expensive, but offer a higher quality, thus reducing the resource utilization since fewer units sell for the same amount of money. Such a preference for durable, more expensive goods is supposed to have developed in the scenarios for a sustainable Stockholm, especially in Pulse.

Naturally it is possible that the demand for energy actually cannot be kept at a sustainable level and that the government therefore raises the relevant excise taxes. This would create a more beneficial economic situation than if the actual costs for supplying energy increased. The state receives increased tax income that can be used to satisfy the growing demands for care, schooling and similar services that are forecast for the next 50 years due to the demographic development (see discussion below) or to subsidizing private services.

Increased taxes do not affect the GNP level as such. It simply means that the economic resources are redistributed. Possible effects on the GNP are through structural transformation, such as that the public sector grows more than it otherwise would have and in turn reduces the average productivity in the economy since the resources are transmitted from a high to a low productive sector. Should the taxation be distorting by affecting a behavior that is not intended to be affected, it can cause unwanted production and consumption reductions (such as labor taxes, which have negative influence on employment). However, an energy tax is not distorting, but should rather be seen as a price on otherwise unpriced commodities, such as environment and human health.[6] If it affects consumption and production, it simply demonstrates that they are not worth what they cost to produce.

The income generated from the energy tax can also be used to lower other taxes. A reduction of the income tax would facilitate a structural transformation towards an increased consumption of services since their price would sink. This would in turn possibly increase the number of job opportunities and thus increase economic growth.[7] The increased consumption could also stimulate the economy, especially if demand increases on sectors with high productivity. Additional positive growth effects can appear as the number of distorting taxes will be reduced, since the intent is to reduce the distorting income tax and increase the non-distorting energy tax. However, now we are back where we started: we have increased resources that force the energy price upwards via increased demand. It is very difficult to imagine a society with low energy use lacking in any factor that forces the energy demand down, such as high prices. If a system of emission allowances is introduced instead of a tax, the prices will not rise as much, as it is not the quantity, but only the distribution that this price mechanism regulates. The limited access will still cause the prices to rise.

[6]Bohm, P., Samhällsekonomisk effektivitet (National economy efficiency), Chap. 2.1, 1996.

[7]Swedish Government Official Reports, Skatter, löner och sysselsättning (Taxes, salaries and employment), 1996.

30.2 Welfare Effects

The effects discussed in the previous section are those that would be visible in the conventional national accounts system. But we also gain positive environmental effects. The fact that the energy prices rise due to more expensive, more environmentally adapted technology can be interpreted as having included the external effects in the price. The environmental effects may be of different types. While there are no immediate environmental effects from a reduction in greenhouse gas emissions, a number of future negative consequences can be counted. A reduction in energy use and a transition to renewable energy types will, however, reduce other emissions than just greenhouse gases. There are two aspects to the welfare increase caused by the environmental gains.

The first are the efficiency gains in the economy brought about by a better environment. This can be seen implicitly in the national accounts down the road, provided that the calculation methods are sufficiently sophisticated. People are healthier, feel better and thus produce better. The real capital is not used up as rapidly. Fewer resources will be needed for such areas as cleaning polluted ground, sewage treatment equipment, official control devices and hospital care. Productivity in forestry and agriculture would increase due to reduced effect from pollution.

In addition to the purely economic gains, the overall welfare will increase. These unpriced welfare effects are not visible in the national accounts, something that is possible to change in environmentally adjusted accounts systems.[8] These welfare gains can include increased quality on recreation in various natural settings, such as ocean, archipelago, lakes, forest and countryside. An improved environment in the city core increases wellbeing during both work and free time. In addition to the purely economic benefit of a healthier population, the improved health brings great welfare gains, as well as a better life quality.

30.3 What Economic Development Is Caused by the Images for the Future?

In this section we intend to compare the images of the future with some economic scenarios. For example, the scenarios prepared in the Long-Term Survey (LU) aims at describing the most probable development, provided that no drastic or unforeseen changes occur. Our images for the future, on the other hand, take quite the opposite track by presupposing a rather drastic change when it comes to energy supply. What we want to do here is to compare the various scenarios so as to discuss how our images stand in relation to the usual economic scenarios and to speculate a bit about what growth rate can be possible in the Fast and Slow images of the future.

[8]Ahlroth 2000 and Skånberg 2001.

Table 30.1 Development 1960–1998 as a percent, plus scenarios for 1998–2015

Period	GNP	Productivity	Real hour-wage	Average working hours
1960–1975	4.0	4.3	4.5	−1.2
1975–1997	1.5	1.4	0.3	0.1
1998–2015 BASE	1.9	1.8	2.2	−0.2
1998–2015 LOW	1.3	2.0	2.4	−1.2

Source: Långtidsutredningen (The Swedish Long-term Survey) 1999/2000, 2000, Appendix 1.

First let us look at the economic development over the four last decades of the 1900s. Table 30.1 shows the development for the GNP, productivity and average working hours both historically (1960–1997) and in the LU scenarios from 1998 on.

Between 1960 and 1975 the GNP increased on an average of 4.0% annually while the average working hours shrank by 1.2% The explanation is that productivity per hour worked increased. The reduction in working hours was partly compensated for by increased employment, meaning that the number of hours worked in the economy shrank only insignificantly. The real hourly wage increased by 4.5% thanks to the productivity increase. Even after more than one fourth of the hourly wage increase had been taken out in reduced working hours, the real annual salary still increased by just over 3.0%. The period between 1975 and 1998 deviates rather much from the earlier period. The LU 1999/2000 presents a number of scenarios for the period 1998–2015 and one extension to 2030.[9] An extension of the basic scenario in LU has also been done for the Resource Efficiency Study (REU).[10] The LU has not created any scenarios for the economic development as far into the future as 2050. Here, we will call these scenarios LU 2015, LU 2030 and REU.

In the base scenario in LU 2015, the National Institute of Economic Research (KI) assumes an average annual production growth of 1.8% (see Table 30.1). Most of this is used for increasing real annual salaries and only a small amount for reducing working hours. This assumption points to an average GNP growth of 1.9%. There is also a low growth scenario landing on an average growth pace of 1.3%, based on the desire of the salaried employees to take out a larger part of the growth in increased free time than in the base scenario.

In LU 2030 the share of older persons increases and there are fewer persons working in actual numbers starting in the mid-2010s. Beyond the LU scenario time boundary of 2015, the support load on workers increases as elder and health care commands increasing shares of all costs. Developments on the labor market and the economic growth are indicated as crucial for maintaining care levels. The annual GNP growth is expected to be relatively low, stopping at 1.2%. Taken together with a low growth in tax income and zero growth in the public sector, this means that

[9]Swedish Government Official Reports 2000.

[10]Swedish Government Official Reports 2001.

the space for public consumption diminishes. At the same it is expected that demographics will fuel a strong increase in demand for publically produced services. Thus the forecast is more negative than for the period prior to 2015.

The Resource Efficiency Study (REU) also commissioned a 2030 scenario, which turned out to be more optimistic than LU 2030. The most important growth limiter was determined to be population growth. On the other hand, productivity is assumed to rise faster than average during the last 20 years, in part due to increased investment in education and competence development. Part of this will be used to shorten working hours. It is thought that the public sector will grow relatively slowly, but as in the LU scenarios, its share of the GNP will increase. Based on these conditions, it is estimated that the GNP will reach an average growth rate of 2.0%, or as high as during the period up to 2015.

In the following sections we will compare the assumptions made in these studies with our scenarios when it comes to technological development, service consumption and working hours development.

30.4 Technological Development and Energy Use

The LU scenarios are based on the assumption that technology development and consequently productivity development follow a certain trend, but that the material use per unit produced is constant. In the REU scenario an assumption has also been made about resource efficiency, based on an analysis of development between 1957 and 1996.[11]

The high material productivity over the four last decades of the 1900s is mainly the result of structural changes, moving from heavy use of raw materials in production to equally heavy use of labor and knowledge to produce goods and services.[12] The REU scenario assumes that this development will continue. Our scenarios would mean a further dematerialization. Material productivity has historically been consumed by an increased production.[13] Since labor has been the most expensive production factor, business effectivization has mainly focused on increasing production per employee. In our images of the future we assume that a trend shift will occur in that technology development focuses not only on labor productivity, but also on material productivity.

Both LU and REU use the consumption patterns that dominated in 1993. The structural transformation predicted in their scenarios depends entirely on changed relative prices (except for the reduced working hours). While in our images of the future we assume that the preferences will have change in some ways. In both Slow and Fast demand increases for high quality durable goods,

[11] Ibid., p. 130.

[12] Ibid., p. 133.

[13] Ibid., p. 133.

thus reducing the amount of goods and contributing to a dematerialization. Another trend is towards a greater demand for services, as opposed to goods. This contributes to a change in the consumption ratios for production material and energy.

REU assumes that, given that energy prices do not soar unexpectedly, the total energy use will rise by 18% between 2015 and 2030 unless some type of political measure is introduced to limit energy use. However, an active environmental policy can reduce energy use. In order to meet the Kyoto Protocol requirement to stabilize CO_2 emissions at 4% over the 1990 level, model simulation by LU showed that the CO_2 tax would need to be almost three times as large. The REU study assumes that the CO_2 tax will grow at the same pace until 2030, meaning it will be nearly nine times the 1998 level.[14] This would result in a reduction of the carbon dioxide emissions by 10% between 1998 and 2030, instead of an increase by 45%. It does not involve any technology advance beyond the one already described. An introduction of alternate energy sources would improve both the economic and the environmental situation. REU studied the Factor 4 concept regarding use of natural resources in relation to production and concluded that it is completely realistic in a 30–50 year period when it comes to the release of carbon dioxide and nitrogen oxides.[15] The tax increase is expected to cause the GNP to be 1.0% lower in 2030 than it would otherwise be. This corresponds to a reduction in the annual growth rate by one third per mille. Though many would see this tax increase as rather draconic, it does have a rather moderate effect on the economy in the long term. In our scenarios the postulated technology development means that any increases in the CO_2 tax and other fee instruments will be phased out following an initial investment phase.

The relatively low general technology development assumed in LU and REU differs strongly from the advances our images of the future presuppose. Both those studies reduce investments somewhat towards both 2015 and 2030. The considerably larger change that our study postulates calls for a high investment pace, at least during the first part of the 40-year period. This will also interfere with the consumption space and will make it even more difficult to satisfy the demands on public service at the same time. In the long run, however, it will contribute to a strong increase in productivity leading to solid economic growth.

30.5 Consumption of Services

Our scenarios also include a shift from goods to services. The LU and REU scenarios suggest that the service sector is one of the three to increase most strongly. In Fast, welfare is to a great extent created through a significant consumption of

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[14] Ibid., p. 208.

[15] Ibid., p. 210.

services. This ought to call for a larger increase in the service sector than what has been assumed in LU and REU. As the service sector traditionally holds a lower productivity development than the rest of the commercial sector, the productivity development in the other sectors must be considerably larger to compensate. In order to maintain public consumption in the face of the demographic development and simultaneously provide possibilities to have a large private service sector, the initial productivity increase must be rather strong. The service consumption will increase in Slow as well, though here the residents will also use the increased free time to do much of the needed work themselves, instead of buying services.

So far the relative prices for services have kept the private demand at a low level, partly due to the relatively low income distribution in Swedish society. In societies with larger income distribution, service occupations are often in the low-income range making it possible for more households to consume private services. It is difficult to create a society where many people can afford to buy services since low prices on services are double-edged in that cheaper services result in lower salaries in the service sector. In such a situation, those who work in the service sector would not be able to utilize private services themselves to the same extent as those who work in other sectors. One alternative is for the government to provide subsidies in the same way as it does for care services and schools, something that would necessitate finding more resources for the public sector. However, increasing taxes and the public consumption for these service types is hardly a feasible alternative, since it would be difficult for the current service level to hold pace with today's demographic development. If Sweden is not a sustainability oasis in an otherwise high-consuming world, which is not what our images of the future are about, we will not be able to increase our exports to any radical degree. Thus the share of services in the economy must increase in relation to the share of goods. Or it may be possible for future high quality services to be produced in some manner we cannot conceive of today, one that does not demand as much working hours.

30.6 Change in Working Hours

The number of hours worked in the economy is an important factor for the economic development. In our images of the future, the demographic development is expected to follow the forecasts of Sweden Statistics and we assume the same employment development as in LU. Beyond this, the number of hours worked can be affected by the average working hours.

During the 1900s the Swedish households have achieved standard improvements through a mix of consumption of goods and reduced working hours.[16] In Fast the preferences tend more to consumption of goods and services than to free time, preferring to retain the working hours at the 1998 level in order to increase consumption,

[16] Swedish Government Official Reports 2000, Appendix 1, Chap. 2.

especially of private services. In order for Fast to be feasible, the goods producing sectors must have a strong productivity increase and the profits from these sectors must benefit large parts of the society. This is a classic dilemma, namely to share the cake in a way that creates welfare for the entire community at the same time as the motivation for innovation remains strong.

In Slow preferences will move in the opposite direction – in order to attain a slower life tempo, working hours are reduced by 25% , a level that is rather close to the low growth scenario in LU 2015. In that study, the assumption is that the average working hours will shrink at the same rate as in the 1960–1975 period, as shown in Table 29.1. This would make the working hours around 20% shorter than today, as early as 2015. LU is also counting on a small work distribution effect, where the reduced working hours result in more jobs. The shorter working hours cause GNP to be 10% lower in 2015 than it otherwise would have been.[17] Since the economy is facing a downturn after 2015, it can be assumed that the decrease would be even larger up to 2030. On the other hand, since much of the working hours reduction we are expecting is already completed in the LU scenario, the change is already mostly complete when the downturn comes. Thus the postulated working hours reduction would be consistent with an economic growth of around 1.0%.

During the 1960s and 1970s many of the services carried out by households moved out into the marketplace.[18] This meant that they moved from the informal economy to the formal and were thus accounted for in the GNP, increasing the strong economic development during this period. In Slow, some of these services return to the informal economy, specifically those people feel provide higher welfare if produced in the home. This means that some production is once again removed from the GNP. This is a one-time effect that does not affect the productivity development in the economy though it does reduce the GNP level for the period the working hours shortening occurs. Production shrinks, as does the tax base. Some of the services previously provided by the public sector are now done at home, thus reducing the pressure somewhat on the public sector. In Fast however, the care services for children and the elderly increase in both the public and private sectors.

The demographic development mentioned above becomes stronger between 2030 and 2050. The Statistice Sweden's forecast suggests that the population growth will become negative after 2030, while the share of elderly increases and the share of people of working age shrinks.[19] The population growth has proven to be closely correlated with the economic development, meaning that growth will be dampened in the future for that reason alone.[20] Thus the upside-down population pyramid contributes in two ways to making it hard to maintain care services in the future.

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[17] Ibid., Appendix 1.

[18] Jonung, C., Kvinnorna i svensk ekonomi (Women in the Swedish economy, 1982, p. 299.

[19] Swedish Government Official Reports 2000, Appendix 9, p. 4.

[20] Malmberg, B., Age structure effects on economic growth – Swedish evidence, 1994 and Lindh, T. and Malmberg, B., Age structure effects and growth in the OECD 1950–1990, 1999.

30.7 Conclusions

It is hard to imagine a society with an ecologic and socially sustainable energy use without downward pressure on demand via high-energy prices. This is especially true in a society like Fast where the average working hours and consumption level continues at a high level. It is difficult to see how low energy prices could be maintained while ensuring that energy consumption remains within a sustainable level.

What then is a reasonable growth in relation to the images of the future we have compared the various scenarios with? The REU scenario is closest to those we have described in this study. Ours stretch over the period 2000–2050, or 20 years longer than the REU. We postulate a greater growth-promoting technology development and thus a higher investment pace than in REU, while our assumption of a larger increase in the service sector would tend to lower the economic growth. Other variations include the fact that the service sectors increase more in our future images and that the working hour reduction is different. REU supposes a moderate working hour reduction of 6.0%, while both of our images have either none or a rather strong reduction of 25%. The larger reduction reduces growth, while the lower increases it. The consumption pattern have changed in part due to a change in time use and an increased consumption of services, while both LU and REU suggest unchanged consumption preferences.

In the REU scenario GNP growth is assumed at 2.0%. The high average working hours in Fast should bring a higher growth than in the REU scenario, though it is largely countermanded by the fact that a large share of the increased consumption would come in the service sector. As that sector has low productivity development, this would mean that growth would still not be very high. There is also a question mark as to how equality and thus the social sustainability would function in such a society.

The energy price development is an important factor that separates our images from the REU scenarios. Even if the energy prices do not increase as rapidly in Slow as in Fast, the price development could in both cases be assumed to be greater than in REU. The latter scenarios assume neither special restrictions on energy supply nor higher demand for sustainable energy types. Keeping in mind the probable weak population growth seen after 2030, the growth rate in both Fast and Slow is lower than the REU growth of 2.0%.

Our speculations lead us to draw the conclusion that the growth decreasing factors such as high service share and environmental adaptation are stronger than those that motivate growth such as technology development. Fast will probably end up at a decidedly lower level than in the REU scenario, showing 1.0% annually or a 60% growth for the first half of the twenty-first century. In Slow the entire productivity increase is consumed by the reduction in working hours and a greater share of services.

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Chapter 31
The Sustainable City: Necessary System Shifts and Their Conditions*

This chapter, which is divided into three sections, will initially offer responses to the three introductory questions.

The *first* is how a city and urban life might appear should the requirements of a sustainable development in fact be fulfilled. This is the subject of the first section titled *The City in the Images of the Future.* As much of the book deals with this theme, this section will to a great extent serve as a summary of earlier chapters.

The *second* question concerned feasibility. Can the city and urban life be altered so as to satisfy the demands of sustainable development? Certain characteristics of the images create problems that make them hard to implement. Such features of these images are discussed in the three sections of the second part. One discusses the strains between the various components in the images, strains that can lead the images to collapse due to internal conflicts. The second part discusses financial and technological conditions for the suggested forms of urban life in the images. The last part of this section covers the attractiveness of the images offered. This discussion revolves around whether the images can be expected to appeal to urban residents and contain ingredients that enable them to serve as unifying visions for important groups of urban residents and decision makers. All three parts focus on the problems that are specific to the different urban images.

The *third* question concerns the barriers to a sustainable development of the type sketched in the images of the future, what the necessary conditions for overcoming these are and which possibilities exist in both the short and the long term for supporting such development tendencies. The last section of the chapter deals with these questions, handling problems that are common to all six images, problems that are to a much smaller degree connected to specific characteristics in each image of the future, than to the drastic change of energy consumption levels that all six share. As has been said earlier there are bigger differences between the current situation and the extrapolation of today's energy trends on the one hand and the six images on the other, than there are between the six images. This is why we have chosen to discuss transition problems on a general basis. The first part of this last

*This chapter is written by the main authors. Sofia Ahlroth has been a co-author to the section titled *Inner strains.*

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section takes up various instances of inertia in communal and urban life, inertia that can present strong barriers for a transition to an urban community that is adapted to a significantly lower energy use than today's. This is then followed by a discussion of strategies for implementation intended to promote transition to a sustainable city and a sustainable urban life.

31.1 The City in the Images of the Future

In order to establish how the sustainable city might operate, images of the future have been developed. In the previous chapters the city was studied from the many perspectives summarized in the images. In this section we turn back to see what the result was arrived at in the chosen projections. Were there any new insights? What do the images of the future show? Did they take us to new understandings? What to the images actually illustrate?

This book owns several characteristics. The primary one is the consistent focus on the household perspective, the clarification of the time-space perspective and the linking of structural, behavioral and technological changes. Add to this a concentration on an objective that is simple to understand, but hard to attain – a dramatic reduction in energy use. Yet another characteristic is the fact that the images are founded in one specific place, namely Stockholm in Sweden, and in a defined, though distant future.

The household perspective means that questions tied to goods and service production perforce move somewhat into the background. Rather the environmental effect of production is handled indirectly by being counted as part of the goods and services purchased by the households. By isolating the household perspective in this way activities that actually result in high-energy use are revealed and logically make it possible to extend the discussion to see what can be done to change these activities. It has also been possible to focus the discussions on how people's lives can be shaped in different contexts and thus provide a contribution to the question of which of the various development foci are possible.

The time/space perspectives presented in Chap. 4 permeate this book in that the images of the future are carved from them. The question of how combinations of these should be structured occurs in all future studies that hold more than just an image. It is not probable that any one of the images presented in this study will be implemented in full. But it might be possible for traces of several of the urban structures to exist in one and the same city. It might also be possible to have several temporal structures in the same city. Indeed, that is how all cities appear today. There are elements of all images of the future in nearly all cities. It is also probable that cities with greater similarity to one special image of the future will also have the problems and possibilities linked to it to a greater extent than the other images. And there is probably a greater potential to create energy efficient solutions in cities that consciously develop a certain urban structure, since such cities are easier to link to an efficient infrastructure. With Fast and Slow, however, the situation is different, though political action that promotes one above the other is possible. But at the same time it is very difficult to receive support for political action that opposes a tempo development most of the residents strive to achieve. The temporal welfare discussed in Chap. 10 will hardly be realized without a temporal policy and in order even to be a possible political question, there has to be an awareness of temporal welfare. This type of awareness, however, seem not really to have a place in today's debate and stressed-out everyday life, but does have a potential for development from those life situations many urban residents experience. In any case, every city contains both Fast and Slow, and there will be elements of both even in the cities of the future. It is important to observe which tempo city planning is following, since they place different demands. Different cities will be better or worse adapted for the two temporal regimes.

The images of the future in this book are designed with Stockholm as base. In spite of that, there is not much that is Stockholm specific. In the arguments we make for urban structures, the household activity patterns and the possibilities of technology there really is not even much that is specific to large urban areas. While it is true that the maps and details in the images are Stockholm specific. Still, many of them are even applicable in sparsely populated areas. Even so, the Stockholm view has been productive since by using a metropolitan area as an example it has been possible to refine the meaning and consequences of the urban structures.

In order to illustrate a city where the residents do not generate higher resource utilization than what the earth can tolerate in the long run, images of the future are based on structural, behavioral and technological changes. These images are also thought to serve as illustrations for how energy use can be reduced through changes in several segments simultaneously. More detail on the effect of these changes can be seen in the image quantification. This is based on a calculation of household energy use in the calendar year 2000 and has been done specifically for this book. It is in itself an important source for analyses of what is energy demanding and has revealed that two-thirds of today's energy use is for Residence and Personal (see Chaps. 2 and 27 for definitions). In the images of the future this percentage is about the same, but Residence shrinks considerably more than Personal. It is also possible to see that heating hot water and indoor air, as well as travel are all energy demanding. Large changes will be required to reduce the energy use to the levels called for in the images of the future. Even if it appears to be hard to reach that lower level, the proposed reductions in energy use must be seen only as a beginning.

Technology development is very important for all images of the future. It is responsible for as much as two-thirds of the total energy reduction, especially through large technical advances in the heating and transport sectors. It will be difficult to accomplish so large a technological effectivization. However, thinking about more energy efficient technology should not be controversial since the technical developments in the last 100 years has in much been characterized by ensuring that energy could be used more efficiently. Still, these effectivization wins have not always been used to reduce total energy use. For example, the last 25 years the effectivization of automobile engines has been applied more to improved performance than to reduce fuel consumption.

When it comes to behavior things are different. Since the beginning of industrialism, the technological developments have advanced thanks to the continuous reduction in energy costs in relation to labor costs. This relatively cheap energy has made it possible for products to be more energy-intensive than what they otherwise should have been, thus enabling the development of energy-intensive behavior. It is possible therefore to assert that technological development and behavioral change are pulling in different direction when it comes to energy-intensity. The behavioral changes called for in the images of the future are rather large in certain areas as compared with today. In spite of this they do not result in any really large reductions in energy use and the technological development dominates when it comes to creating these. This so, it will become increasingly difficult to accomplish energy effectivization via technology as that development continues. In the choice between technical improvements and behavioral change, it might seem simplest today to choose the former. But the images of the future can probably only be realized in a society with a widely spread awareness of the energy used by various activities. In such a society it is hard to believe that only technology should advance. It is more reasonable to see technological development and behavioral change work in parallel. At this point it might be useful to remember the condition for the images of the future, namely reduced energy use by 60% up to 2050 (see Chap. 3). After that point in time, the reduction needs to continue. In such as situation it will be extremely important that even behavior changes to favor low energy use.

31.2 Feasibility

31.2.1 Inner Strains

In the images of the future we have described how urban life has been adapted to a postulated future energy use. The images do not offer any proposals for how life ought to pass, rather presenting descriptions of how a city with low energy use could look. The question is if these images are realistic in the sense that they are internally consistent or if there are problematical strains between their various components. One type of internal strain focuses on the possibility that the pressure for increased energy use grows so great that the postulated reduction cannot be realized. Another arises if the images of the future are based on ideas that are in direct conflict with what most people want or that the images risk leading to exploitation of certain groups. While such images may be possible, they carry with them a development that contradicts generally accepted assumptions about equality and fairness. Thus it is important to examine the extent to which there are risks that such inconsistencies are built into the images and to make them a part of the discussion of the sustainable city of the future.

The danger of strong pressure for increased energy use can reasonably be discussed based on the arguments presented in Chap. 30 concerning how a large alteration in energy supply might affect the economy. In that chapter two imaginable energy price scenarios were indicated, one where the technological development led to sustainable energy alternatives that also were inexpensive and another with strongly raised prices.

In the first case the postulated low energy price frees up consumption space. This means that the demand for energy, either indirectly or directly, ought to increase and push the energy prices upwards. Thus the question arises whether a sustainably low level on energy use and a parallel low energy price can hold in the long run. As was described in Chap. 30, it is difficult to see regulation or rationing as long-term solutions. What is needed is that preferences change in such a way as to use less energy.

This can be accomplished by taking out the increased productivity in increased leisure time instead of increased consumption, or in other words reducing work time. Reduced energy intensity in those goods and services that are consumed will lead in the same direction. This can be done through a stronger preference for high quality, more expensive goods. Another tack is to make production techniques and product development more energy efficient, aiming towards a less energy intensive use of goods and services. Yet another alternative is that the government steps in with raised energy taxes. The subsequent effect on growth and welfare will depend on how the government uses its income increase.

It might be possible to combine low energy prices with low energy use in the Slow alternative, since the average work time is expected to shrink by 25%. In Fast, however, the same effect would only be possible via an exceptional development of the technology for energy effectivization, something that is difficult to visualize when the energy prices are low.

In the second alternative, the one with strongly growing energy prices, production would need to be redirected towards strongly reduced energy intensity. The conclusion in Chap. 30 was that the final effect depends on consumer preferences. Should the consumers move easily to other goods and services than those that are energy intensive, the non-intensive segments will expand. If, however, the energy intensive goods and services cannot be replaced by others, the high energy prices will cause the consumer space to shrink and the result will be a strongly reduced growth rate due to lower demand. In both cases the required investments in energy technology will be large. Thus initially the consumption possibilities will shrink. However, this will not bring a reduction in the GNP, only that production will turn to other goods. The link between the fickleness of preferences and the speed of the growth rate could be interpreted to mean that sluggish preferences are consistent with Slow, while growth in Fast can be accomplished if the consumers are prepared to move to less energy intensive goods.

Beyond these macro-economical inconsistencies, there is an apparent, basic inner tension in the images of the future that can be described thusly: "Why should people be satisfied a so energy sparse consumption as then stipulated in the images of the future?" The four areas where problems of this ilk could be heaviest are air travel, short-distance car travel, reduced heated space and service consumption.

In the Fast images Stockholm residents would fly half as much as in 2000. It would be even less in the Slow images. This change would be a trend reversal from the strong increase in flying over the most recent 20 years. How dramatic a decrease it ought to be can be discussed. After 9/11 air travel shrank immediately and drastically around the world. While air travel did return to previous levels after a few years, it does demonstrate that air travel reduction is possible. Another perspective on reduced air travel is remember the fact that the level proposed in the images correspond to those recorded in the early 1990s. Thus it is not too difficult to imagine a Stockholm whose residents fly only half as much. One force that would be able to keep air travel down is fear. In an unsafe world it is possible that many will think twice before flying. It is possible that many would look at other travel means and/or other travel goals as better alternatives to reduce vulnerability and perhaps the uneasiness of flying. Price is naturally another way to reduce air travel. Today's low air prices would disappear if carbon dioxide taxes were applied, perhaps in the form of landing fees, quickly affecting the choice of travel means and frequency. Business travel could be reduced by substituting greater use of telecommunication. This would save both time and money for the companies. However, it is difficult to see how telecommunication could replace air travel for private purposes to any greater extent.

All of the images of the future include dramatic reductions in commuting. In Low-rise Settlements the means is a large share of distance work done at home, while the condition that brings the reductions in Urban Cores and Suburban Centers is that there are more people living in the vicinity of the hubs. The number of commuting trips does not shrink, only the distance travelled. There is probably need for some sort of incentive to accomplish such a change, such as replacing today's tax deductions for long-distance car commutering with some form of stimulation for work at or near the home.

The problem with short-distance car travel is greatest in the Low-rise Settlement image where the available public travel means cannot match those in the other two images. The physical accessibility worsens in Low-rise without a car. This need not be a great disadvantage if, for example, the residents feel that the significant places still are within reach. Today there are already many who choose to live outside the inner city, in spite of the reduced accessibility. Even so, a structure like Low-rise Settlements entices a greater car ownership and use. It is easy and cheap to park the car and it can be the fastest way of getting from one place to another. Were the cost to own and drive a car high, car travel would shrink; a similar effect could be seen if time were not experienced as being in short supply. Compared with today, it can be easier to manage without a car in the Low-rise alternative, since the pure external establishments are not part of this image of the future. Trade focusing solely on car owner is unusual. Taken as a whole, it must said that the Low-rise/Fast alternative appears very problematic. People have more money than today and fewer live in good public transport locations than in the other images. Still it is postulated that car use will shrink drastically. It is probably only through the use of very strict control means or very high energy prices that the low energy use could be maintained in this image. Under those conditions it is possible that the other images of the future would be more attractive.

This internal strain that arises because the households have more money and thus a greater capacity to travel via car is a part of the other images of the future as well. But in these, the alternatives to car use are good enough that the strains will not necessarily be as large. It is essential in all six alternatives to facilitate car-free living. The car-free families with children in Chap. 29 present a number of situations that would be especially hard to handle without a car. It was also emphasized that travel is matter of habit and that measures to facilitate car-free living ought to be introduced in situations when people are already changing habits, such as when they move or have children.

The per capita residential surfaces shrink in all images of the future, except in Low-rise/Slow. There use of premises use also shrinks for offices, as well as for social/medical care and schools. In Urban Cores and to some extent even in Suburban Centers there is also a reduction in space use, mainly because so much of construction is placed in the different central locations. In spite of this it is thought that there is a certain pressure for increased residential areas, mainly in Fast where the economy can allow it more easily. In Low-rise it is more difficult with limited surfaces, since the new construction is on less attractive land. On the other hand, more residents work at home in Low-rise and thus have need of somewhat larger residencies. It is not simple to find motivations to promote such a change, as long as we do not assume that costs will rise significantly. For such a development to be accepted, there will probably be need for new institutional arrangements that support an effectivization of and economizing with space, as well as collective use of it.

The demand for goods and services, and therefore for energy, tends to increase indirect relationship to increased financial resources. The effects of increased energy and material productivity has historically been balanced by production increase. A strong and environmentally adapted technology development is necessary in order for this trend to change. It is not enough only to switch to a 'greener' consumption.[1] There are also signs that the tendency today is sooner that increased incomes primarily lead to resource intensive consumption of leisure trips. The general answer to how growth, as in Fast, should be possible to be combined with sustainable energy use is that consumption must be focused more on services. In the study *Bilen, Biffen, Bostaden* (Car, Steak, Residence) this is seen as one of three main tracks on the way towards a sustainable consumption.[2] Many would rather invest a bit more in care of themselves. And with more money in the wallet many more could see themselves using more money on food by a more careful choice of raw materials and buying environmentally labeled food to a greater extent.[3]

Fast is the temporal regime where financial welfare is highest. In the Fast images free time has changed so that consumption of goods is less important and the service segment of free time more important. Thus the energy use for goods has been reduced by 10% and that for services increased by 50%. Those services that have increased are mainly new, knowledge intensive services in the form of expert help to make better decisions in a number of different questions that may relate to free time and residence. The immense knowledge content of the new services contributes to the productivity increase and makes jobs attractive. The service increase is not in any way as defined in Slow regimes. Here the goods energy use decreases by 20% without any increase in services. The development in Slow has moved to more free time and less financial growth. Thus there is no space for service development primarily aimed at the household market.

It is mainly in the Fast images that the relationship between buyer and seller of low qualification services could develop into a strong source of tension. In order for

[1] Alfredsson, E. Green consumption, energy use and carbon dioxide emission, 2002.

[2] Swedish Government Official Reports, Bilen, biffen, bostaden, 2005. The other two tracks that are mentioned are greener consumption and less consumption/more free time.

[3] Mårtensson, M. Lundell E. Tid, pengar stad (Time, money city), 2007.

the households to afford to buy services, they must be relatively cheap. This in turn means that either salaries or taxes must be lower than for other jobs. If salaries are low, the risk is great that the financial differences between the households will be rather large. This could possibly be counteracted by a type of generational work, where low age rather than low class position would characterize the service sector. However, it is hard to see how this could solve the problem. A seemingly more flexible strategy could be to lower the taxes on services. In that way the governmental incomes shrink and even if the income loss could in part be compensated by raised energy taxes, there is a danger that publically financed services would be depleted and increased class differences created.

Another much debated problem with an expanding service sector is the risk that it becomes a low-status female sector. As is shown in the time use studies reported in Chap. 15 and Appendix B, it is women who do most of the household work today. Following today's pattern it would also primarily be women or perhaps immigrants who would take the low paying jobs on offer. That could contribute to confirming and reinforcing the income differences that exist today. On the other hand, it would seem that the Slow society would contain the more classic female trap, though it is not the image of the future per se that creates this risk, but the gender differences that exist today. In Slow the average work day is shorter, while more time is spent on care, residence and food. Obviously then there is more time invested in services that women are primarily responsible for today. There are also signs that men would prefer to avoid such services. One example of this is that more than half of the fathers to children born 1999 have taken less than 1 month parental leave by the time the child is 4 years old. Half of these fathers took no parental leave at all.[4] This is so in spite of the fact that the so-called 'daddy-month' cannot be transferred to the mother, i.e. the opportunity to take 1 month off work with 80% salary, is not taken. Consequently the gender aspects of the temporal part of the images of the future are rather different, though there are pitfalls in both cases. Countermanding the different variants of female traps is a large challenge in all the images.

The inner strains identified and discussed here exist primarily in the Fast alternatives. The only exception is the traditional female trap that could easily occur in Slow with the shorter work day, supposing of course that today's gender arrangement stands fast. What creates strains in the Fast images is the continued income growth for the households and for this a broad arsenal of measures will probably be needed to keep the strains in workable limits.

31.2.2 Financial and Technological Conditions

Large investments are required in order to implement each of the images of the future. The most obvious is in Urban Cores where the construction is in large, coherent housing clusters, perhaps in the form of what architects call mega-structures.

[4] Swedish National Social Insurance Board, Statistikinformation, 2004.

These are then linked by newly laid, trackbound transport systems. What we are talking about is building new, highly concentrated, relatively large cities around the Stockholm inner city and interlinking them with a new traffic infrastructure.

The investments needed for Suburban Centers are of a different character. What are called for in this scenario are expansions of a large number of existing centers and stations. None of these will need immense financial investments, but the negotiations can be difficult in the planning stages since we are talking about exploitation in places where there already exist many activities.

The third urban structure, namely Low-rise Settlements, comprises the construction of several hundred large low-rise areas. Compared with Suburban Centers, there ought to be much fewer conflicts around the land use. However, looking at the whole this structure would mean that something that today is strongly connected with what is known as Greater Stockholm would be heavily compromised, namely the green areas near the inner city strongly defended by many.

The size of the investment would logically be largest in Urban Cores, even though the new construction is smallest in that structure measured in square meters. However, it will be more expensive to build the rather technically advanced urban cores with their internal, local transport systems and the connecting regional line. It is not certain that building the urban cores will require more energy than the other urban structures since we are talking about less land surface and housing space. Nor will the energy use for laying out the new transport lines be that large since rather small parts will go in tunnels.

The transformation of the urban structure is rather large in all three scenarios, but keeping in mind that the population is almost 50% larger than today makes the investments in a 50-year perspective rather reasonable. It might, however, be difficult to gather the necessary capital for other reasons than the total amount. This is clearest for the Urban Cores alternative. The strong ties between housing and traffic investments can make more difficult for the Urban Cores to develop gradually. What is needed to draw investors is making decisions that are credible in the long term. Neither Low-rise nor Suburban Centers are as dependent on this as they can more easily manage a gradual growth. On the other hand this means that these two can more easily collapse as programs. They can begin as an idea and then develop into something else. There will be a lot of attractive land that 'ought' not be built up according to these images of the future.

One condition for low energy use in the images is a rapid, comprehensive technological development, and that this development is accepted by both companies and households. Here the conditions differ between Slow and Fast. In the former there is a danger that the technological growth gets caught in a negative spiral due to the slower consumption pace. There is a risk that old technologies stays on to block new, more environmentally adapted technology. If the demand for new technology shrinks and thrift leads to a price sensitivity, the risk is that the producers react by refining existing old technology and shelve inventions. In that way there will be segue from product innovations to process innovations as described in Chap. 14. It is also possible that the thinner wallet in Slow teaches the households to think about their economy in a longer term. In that case it might prove profitable to invest well in energy efficient technology and that a sharper eye is kept on product cost during the entire use phase. A high energy price would then motivate many to buy energy efficient goods.

When discussing the economic conditions for the images of the future, the problems are linked to the different urban structures and relate to the shifting character and scope of the necessary investments. In that way Urban Cores is seen as the most demanding alternative. Problems linked to the conditions for technological development are primarily linked to the temporal regimes, principally with Slow due to the fact that its technical renewal will probably be slower.

31.2.3 The Images' Attractiveness and Brilliance

The conditions for realizing the images is affected by the extent to which they are seen as generally congenial, meaning attractive and capable of being communicated as something worth striving for, a savior in need or something exciting to dream about and be involved in. Another way of putting it would be to speak of the brilliance of the images. All of the images of the future, the three urban structures and the two temporal regimes have parts that appeal to significant groups of big city residents. There is support for all alternatives in the choices that actually have been made and continue to be made, as well as in the preferences indicated in our questionnaires. The evaluation of an eventual brilliance is harder to carry out, but something can be said about the most prominent characteristics and their ability to mobilize the general public and various decision makers to support of the images.

Suburban Centers

In an interview study, most of the interviewees preferred Suburban Centers, the urban structure that most nearly builds on and reinforces the existing structure of suburban housing and infrastructure. Many link this alternative to a type of suburbs that already exist, rather the relatively sparsely built-up areas from the time before heavy exploitation. These are suburbs with reasonable density, relatively strong stability, understandability and informal social controls. However, it is possible to question suitability of this impression, keeping in mind the rather heavy concentration of both work sites and housing necessary for Suburban Centers to function as planned. With 130 hubs where this image proposes to place most of the new residents and work sites, this structure will not be dominated by small scale and low houses.[5]

Still, the proposed geographic joint localization of service, housing, schools and work sites do create conditions for development of a lively, varied and not too stressed urban life. So even if all the interview persons understood the image fully, the authors still feel that Suburban Centers is the urban structure that probably will win the favor of many current and future Stockholm residents. But it is also a fact that those dense hubs do not meet with purchase or settlement opposition, rather being popular objects on the Stockholm housing market. Neither voting with words or with feet speaks against this urban structure. Instead the greatest problem seems to be those residents who already live in each suburb. New exploitations in or next to already built and occupied housing regularly meet with strong feelings in opposition, feelings that only seem to provide expression to the negative results of the proposed intrusion. Other values that might outweigh the lost space and disruptions during the construction phase are given little space, such values as a livelier, more differentiated social environment, a greater shopping audience for local stores with potential for the center in question to live on, as well as new, proximate services.

The Suburban Centers image of the future presupposes that both the housing space and the surface available at the work sites shrinks by between 5% and 15%, and that the commuting is more or less halved counted in passenger kilometers per capita. Earlier we have averred that a combination of stick and carrot will be needed to accomplish such paradigm shifts. One area that is difficult to deal with is air travel, seen to increase strongly. It is hard to visualize that the image with a reduction in flying by 50–60% per capita can be realized without restrictions or taxation. That the long-distance car and train travel, as well as the short-distance public transport and bicycle use can increase strongly is probably not enough of a carrot to keep vacation flights within the necessary limits.

A partly different question is if Suburban Centers can be presented in such a way as to draw enthusiasm and find a broad acceptance. Does the image own any possibilities for developing a brilliance or any hope of functioning as a guiding star in the urban political discussion? Naturally there is something deeply appealing in the concept of using and adding to those investments and city patterns that already have been established. Existing housing is tied together through new cross-town trackbound connections and the wide, but rather unexploited suburban landscape would be at points made more dense without taking especially large segments of the safeguarded green wedges into use. The proposal could be described as a distinct, but well-balanced inner regional expansion. The region is enlarged through the addition of interesting activities and goals, while being concentrated in those places that already boast high accessibility and which will be provided with the extended public transport means. Such a program ought to capture a certain degree of urban con-

[5] Mårtensson, M. and Lundell, E. Tid, Pengar och Stad (Time, money and city). In Gullberg, A. et al. Bilder av framtidsstaden, 2007.

struction hegemony in the Stockholm area. Surely it appeals as a well-balanced ‘just right’ ideology – sensible and without a lot of fuss – at the same time as the inner city enthusiasts and villa people could continue to fulfill their dreams.

Urban Cores

Contrary to the interest in Suburban Centers, a thorough investment in new *Urban Cores* in the suburban area that would, through its density and the number of goods and services made available, stand pat against the traditional inner city and its shops, met with a very limited enthusiasm among the Stockholm residents who participated in the interview study.[6] Clearly there is little faith in being able to accomplish housing and environment in the same class as the inner city. Rather there seems to be a sharp, negative picture of the huge areas developed in the postwar period and the image has been coupled to that, a challenge the Urban Cores image of the future must meet. If it is not possible to build a city in the new urban cores, the vision will soon die. However, the assumption must be that it is within the bounds of possibility to create new, dense and interesting settings with good urban qualities in the new urban cores and their satellites. The fact that the city construction during the 1900s failed in this ought not to lead to a dismissal of the stated challenge. There are a number of traits in the image that opens up possibilities for building new urban cores, namely the large flow of travelers with good opportunities for innovative terminal solutions, the new, automatic monorails that circle continuously in the cores making all their parts easy to reach, as well as the large availability of services, specialized goods and all kinds of entertainments. Add to this the broad base of many thousand workers and residents within bicycle reach, with many times that number a bit farther away. Still, the opposition to Urban Cores can probably only be countermanded on a broad front by the power of example – by building successful, attractive areas.

The areas that today stand closest in similarity to the new urban cores, if in smaller versions, display a somewhat varied pattern when it comes to reputation and attractiveness. Quite naturally these own far from the qualities that can be

[6]Ibid.

expected in the new cores. In spite of this, these suburban centers with their neighboring housing areas are not generally in poor repute, rather drawing large numbers of residents, customers and other visitors.

One stumbling-block for the Urban Cores concept is the noticeable reduction in surface per capita. However, there is a larger number of places to visit in the immediate area around the home than in Suburban Centers. Still, simply tempting people with attractive settings is probably not enough in this case to achieve restraint in surface space. It will therefore be necessary to concoct a mix of stick and carrot even for this image in order to turn the routine growth of temperature regulated surfaces to its opposite. A carrot in this case might be the very comprehensive increase in long-distance train travel – vacation trips used to compensate for a relatively cramped residence. But restrictions in the continued expansion of air travel are needed in this image as well. A reduction is quite necessary, as it is for the shorter commuting and service trips. Cutting back on car ownership could contribute to this development by putting a higher price tag and lowering accessibility for the shorter, more environmentally damaging and more easily replaced car trips. This while the long-distance, less environmentally damaging and less frequent car trips could be handled relatively simply through car pools and rental firms.

Urban Cores has the potential to develop a brilliant, attractive vision. Given the apparent technological and urban utopia references, the possibilities for sketching a picture that fires the imagination are great. But for this to happen at all, it is necessary to win over the general public. Still, it is difficult to get free of the fiascos experienced as a result of the city building optimism no further away than the 1960s. Even so, time passes and with it a softening of the fixation with earlier failures that will open the scene for new utopias to project far beyond the massive shadows of past dystopias. For those whose preferences lie with the old villa suburb or the tradition-filled urbanity of the inner city, there are possibilities to experience these inclinations in the most spectacular of the images of the future presented in this book.

Low-rise Settlements

A possibly surprising result from the interview study mentioned above, was that the villa suburb, here called *Low-rise Settlements*, lacked a significant following among the interviewees.[7] There seems no end to the flight to new-built collections of villas, more well-established gardens, and summer cottages transformed into permanent residences. The fact that this image calls for a rather extensive expropriation of the area's green wedges is a clear drawback, but similar objections concerning the whole or the public interest do not always prevent the realization of individual wishes. It is possible to prove the attractiveness of this image through other studies and in the registered price picture, at least when it comes to the residential model. The continue growth of the single family house in the suburban landscape is also a current trend in both Sweden and internationally. Thus this exploitation model will probably not meet any comprehensive opposition provided that the conflict with the local green interests can be solved.

It is more likely harder for the households to accept that their activities will by and large be carried out at home as this image presupposes. Such work has greater proportions in this image than in the other two urban structures and even though the space standard is as high as today's, the short-distance free-time travel is more limited. A decentralized urban structure makes the car a more purposeful, attractive travel means, even during weekdays. However, such behavior does not fit within the strict limitations postulated for all the images of the future and that most clearly apply in the Low-rise alternative. Without significant restrictions, high fees, a new mindset or all these in combination it is hard to visualize how this image can be attained, in spite of investments on well expanded bus systems to both the new and the older residential areas.

The greater possibilities for improving one's own house, to carry out hobbies in the residence or on the lot and the opportunities for working in the garden can all be circumstances that can make it easier to accept that semester travel will grow little and air travel will shrink a lot.

Launching Low-rise Settlements as the garden city of the twenty-first century could provide this construction program with an identity that implies a considerable brilliance. The desire for living close to the land, preferably in one's own house, has long been a clear trend in Swedish urban living and the possibilities to build on this trend in the future seem to be good. This alternative can combine differing demands, such as for security, social mixing and stability, as well as local identity. It also offers space for personal cultivation, thus satisfying a growing interest for gardening. Being part of a larger urban context makes it possible to present it as an alternative that links local identity with the large, global contexts.[8]

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[7] Ibid.

[8] See Rådberg, J. Drömmen om atlantångaren (The dream of an Atlantic steamer), 1997, p. 158–166, regarding the brilliance in such an alternative.

Fast

In an interview study, some of the respondents found it difficult to choose between money and time, which in this context means between *Fast* and *Slow*.[9] The choices offered were seen as two rather equal means for reaching a result for ones own life situation. However, most of the respondents had no difficulty choosing between them. With today's dominant consumption dynamics that makes a gradually increasing consumption level the normal situation for the great majority of households, Fast can continue on already established dynamics. That the majority says they are satisfied with their material situation and would rather accept a reduced work day than more money does not seem to affect what they do. The bar for what is normal consumption seems always and rather unnoticeably to end up on higher levels.[10] The major stumbling-block in Fast is thus not to persuade urban residents to continue living a rather time-stressed live in exchange for constantly rising incomes. The difficulty rather lies in steering consumption towards services and products that do not generate as large an energy consumption per monetary unit as today. If you look at end services or the benefit the consumer has from his/her choices, it is not a given that the energy intensive alternatives offer a greater result. The problem seems not only to be simply being in a rut and limited choices, but also what the consumers have learned to appreciate and display for others.

If the alternative can truly be brought to life, Fast has a great potential for gathering significant groups of urban residents who long for a varied, exciting life, one with decidedly greater possibilities for developing a more sophisticated and differentiated lifestyle supported by expensive personnel intensive consumption. With the affluence that will become available in the continued financial growth stipulated in this temporal alternative, it is not unthinkable that these new possibilities will compensate quite well for the loss of the most energy wasting pleasures and habits that must be discarded if the future sustainability image is to succeed.

[9] Mårtensson and Lundell 2007.

[10] Shove, E. Comfort, cleanliness and convenience, 2003.

Fast owns a significant potential that can be presented very persuasively as a hip, urbane alternative and thus recruit large numbers of converts.

Slow

Slow, on the other hand, offers reduced work hours in combination with unchanged consumption possibilities in a development that both departs from and in some ways continues current trends. Reduced work hours is long-lasting trend that has been slowed and, since the early 1990s, changed appearance. Once mainly a phenomenon with wide distribution in the population, reduced work hours has been concentrated to persons who actually do not work at all due to studies, unemployment, illness, early retirement or an opaque mix of all these. It is hardly likely that this development could continue long, in part due to the large social tensions such a distribution of work would bring with it both in the financial transfer systems and through the conflicts between the social groupings that exist within the regular economy and those who choose or are forced to live outside it. The element of Slow that departs more definitively from the current development is the freezing of the consumption level required. It is only during shorter crisis conditions that the average material living standard has remained static during the last century or so. In order to determine if the satisfaction with the material level achieved mirrored in several of our interviews has the possibility of being transformed into stable action patterns in the future, it is necessary to try to understand why this has not happened earlier since similar answers have been given in previous interviews. It seems that the consumption logic that has dominated for a very long time consistently contributes to raising what is considered a normal, lowest acceptable standard.[11]

The possibilities are good for a significant recruitment to the vision of shorter normal work hours with a more even distribution of work between able-bodied persons, even if this future is combined with a zero consumption growth. This is especially true if a certain level of security can be included in the image; if, at least in part, striving after increased income can be linked to worry for future crises and support problems. However, an even stronger assist for this image of the future is the vision

[11] Ibid.

of a social life with more time for family, friends and social intercourse, as well as for one's own interests and for a certain element of self-support. Such a vision owns the potential for attractive large groups of urban residents who either feel pressed for time or would like to be able to spend the larger part of their lives on activities of their own choosing. Thus even this alternative can be expected to mobilize a large following.

There has been no intention of ranking the images of the future in this run-through of their attractiveness or outward brilliance. Rather an attempt has been made to discover if there are sufficient amounts of both these characteristics to implement them. The arguments suggest that Urban Cores would require a lot of work to balance the distrust that alternative seems to meet. The possibilities seem excellent for the other alternatives, both with the general public and decision makers. However, the Slow alternatives will probably require more mobilization than the Fast since they represent a clearer break from current trends.

31.3 Barriers

31.3.1 Bonds to the Old

An ecologically sustainable city or urban life cannot be planned or ordered into existence. Those element of social or socio-technical innovations required calls for processes that are so profound and complicated, disparate and still integrated that no single authority or actor can control or steer the transformation. Not even a strong coalition of persons in power can manage such an operation. More or less general stumbling-blocks are easy to find. Bonds to the old or that barriers to the implementation of more comprehensive changes towards a sustainable urban development are linked to the complex weave of dependencies between a long list of elements in the current social and socio-technical systems. On the one hand stand regulatory complexes, institutions, develop practices, user habits and social views, expertise know-how and a broad construct of activities by interested parties, while on the other there is a physical, permanent infrastructure. One way to describe this is to say that a path dependency develops in all these systems, one that becomes established and thus hard to change.[12] In an urban situation this means that in normal conditions the many, mutually dependent processes create a sluggishness and resistance to changes. However, when the constellation of various circumstances is just right, this mass of linked processes can make the changes even more sweeping.[13]

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[12] See e.g. Jonsson, D. et al. Infrastrukturens dynamik, 2000; Kaijser, A. I fädrens spår (In the steps of our fathers), 1994; Shove 2003.

[13] In principle there are two ways in which a system can be changed. It is either done through substitution, that is a new element replaces an old one without there being any noticeable change at the start. But if, in addition to fitting into its predecessor's function, this element displays radically different characteristics, its successive distribution in the system can have revolutionary results.

The other way and the more radical manner that a system can be changed is if the ruling system is destabilized by external or internal threats or strains. This happens when, for a while, an unstable situation arises where different, alternate systems compete and where, as a rule, one of these wins the day and gains the opportunity to become established.

In spite of the fact that the city houses a large number of lifestyles and cultural expressions, there are certain systems within it that have a very large impact and that standardizes large segments of urban life. Part of what follows is a discussion of some of the conserving characteristics or inertia in the systems. Some of them own a general impact, while others are more directly linked to the city and to household functions. We see consumerism as a system with general impact. It is constructed of individual motivations, as well as institutional arrangements in the form of product development, marketing, sales organizations and venues where consumption can be displayed or the chosen lifestyle communicated.

One of the most important elements in the history of the twentieth century is the growth and progress of a consumption society. Consumer goods enabled residents to be quit of the traditional, generally safe but also limited social contexts and express their own individuality in a dynamic mass community. Individuals could create new, personal identities without having to break from their families, friends and a shared culture. The consumer goods were used to define, redefine and facilitate relationships between friends, family members and strangers. Consumerism could also frequently satisfy social needs with less conflicts than other, more substantial forms of social belonging, thus mitigating conflicts between generations, genders and classes in a relatively harmless manner.[14]

Consumerism has contributed strongly to making the satisfaction of needs so materialistic and energy-intensive. In spite of the fact that an element of immaterial needs and desires increases as living standards improve, consumerism also satisfies this kind of need through an increased material consumption, such as larger and faster cars with fewer passengers. Even the expanding use of services contains extremely large elements of energy use, such as more frequent flying with shorter time spent at each destination. The increasing material welfare and high taxation of the production factor labor leads to a gradual adaptation to and a normalization of higher, more energy-intensive consumption levels. The constant identity formation work uses a large amount of material and energy-intensive attributes as means.

The general comfort revolution, where all chores are to be handled without physical effort and as little social friction as possible, is one vital ingredient of consumerism.[15] While the fundamental features of this development seem completely natural and worthy of support, if carried to extremes it leads to a number of social and health related problems. When all muscle work is replaced by machines the population tends to suffer of a number so-called welfare illnesses. Another expression of the comfort revolution and the conflict reduction mentioned above is when a multiplication of devices and space becomes the solution for controversies. With one TV per family member each one can see what they will. The same is true of cars – with one per license holder there are no conflicts as to who should use the family car. Beyond a general increase in consumption, this type

[14] See Cross, G. An all-consuming century, 2000, on this theme, especially pp. 2–3; and Strasser, P. "Making consumption conspicuous", 1992.

[15] See Shove 2003 and Pettersson, R. Bekvämlighetesrevolutionen (The comfort revolution), 2008.

of comfort leads to greater distance between people and the ability to show consideration and handle conflicts when resources are in short supply shrinks.

In spite of a radical reduction in work hours in both paid and unpaid work, it seems that the dominant time use regime leads to a compensatory increase in material and energy-intensive consumption rather than an increased temporal welfare. There exists as well a powerful standardization system for time use and scheduling work and everyday chores, one that increases the feeling of rush and temporal distress. The time press can be overwhelming for certain population groups, especially for single parents, but also for families with two working parents and small children. This is particularly true if these family situations are combined with strong career ambitions and resource heavy consumption ideals. Such time pressure also affects women with two jobs, frequently also with responsibility for children and their own elderly parents with care needs.

Consumerism and its various faces have strong, individual drives. It thrives on a competition between individuals where a larger, more remarkable and 'correct' consumption becomes an important element in seeking for identity, social belonging and meaning. It also presupposes strong institutional arrangements. It is even possible to claim that the structure and content of the city have a decisive import for which expressions consumerism as a whole takes among its residents. It concerns how factors such as the availability and localization of goods and services; the plan, capacity and operational set-up of the transport systems; and the selective adaptation of the residences, work sites and public settings in a physical and social sense all combine into varied forms and display of consumption.

The comfort expansion in housing use calls for an increase in the temperature regulated surfaces in the permanent residence, a greater incidence of double and triple housing, and a gradual addition of energy-intensive facilities such as floor heating and air conditioning.[16] Here cheap, easily distributed energy plays a central role.

For a long time now, the food system and fare choices require a high energy use in the production phase and to a growing extent is based on energy-intensive, fully or semi-manufactured products. This includes a growing consumption of meat and a calorie intake that for many consumers exceeds necessity resulting in an unhealthy increase in body mass. The ability of preparing a simple, nutritional and environmentally correct meal is in retreat, in spite of the great interest in cooking.

The focus on consumerism described here would not have been possible if the energy system had not in much promoted capacity expansion, rather than energy effectivization and householding. The abundant, cheap energy has been a necessary condition for the enormous economic growth, increased living standards and consumption expansion that the western world has enjoyed during the 1900s. Among other factors, it has been an essential element in the comprehensive urbanization and suburbanization, the drastically increased food production and the heavy growth in travel, as well as the expansion of heated surfaces and other housing comforts. The development of the energy system has often been an overlooked

[16]For a discussion of the problems inherent in this development, see Chappells, H. and Shove, E. "Debating the future of comfort", 2005.

necessity for many of the household behavior changes during the last century. One important trend shift in the function of the energy systems did not occur until the 1970s. At that point a long-term trend was cast off where the energy used on a national level had kept step with the growth in the GNP. The rapid adaptation that followed the rising energy prices, especially in the industrial sector, led to a remarkably rapid effectivization of energy use.[17]

With car use and air flight as cornerstones, the dominating and expansive transport system depends heavily on the energy system and its low prices. This system creates its own demand by supporting a continuous suburbanization and thinning out of the inner city. It has not, at least not in the cities, adjusted to its external costs.[18] The widely expanding use of cars had its Swedish break-through periods in the 1920s and the 2 decades between 1950 and 1970. Its growth laid the basis for new systems for commerce, distribution and localization of activities. Together this led to a structure with much longer distances between residences on the one hand and stores and service points on the other. This contributed to a further suburbanization and regional growth. Car use is also one dominating component in the system for commuting to work that also leads to a growing geographic separation between home and work. Commuting trips over increasingly long distances between these two places also contributes to the ongoing regional expansion and the thinning of the inner city.

Other important elements of consumerism are the dominating free time and recreational systems that are wholly dependent on the transport system and thus promote an increasingly comprehensive free time travel. The ownership of a second and a third resident farther and farther away and an increased travel to more distant, temporary travel goals both lead to a growing free time travel with steeply rising market shares for air travel. The wish, but also the need to visit and maintain various properties also tends to increase time pressure and reduce independence.

At an urban area level there is a dominant lack of co-ordination of the various traffic types with each other, as well as in land use and localization development. This has led to a situation where a number of individual choices among households, companies and organization are made based on what gives the best result for each, a situation that on the whole means that everyone suffers from poorer transport and localization solutions. Because of this lack of co-ordination, energy and land use are unnecessarily large and even growing. It is true that authorities and research organizations inventory and map the interests linked to various territorial and sector related decision venues, but this very seldom leads to the realization of any energy optimal suggestions. Ideally a strong urban building regime and an informal power structure where leading private and public interests collaborate long-term about the basic urban building principles should be able fix this situation. However, a strong urban building regime is no guarantee that a sustainable development is promoted. After WW2 and up to around 1970 a very powerful regime with comprehensive, municipally led suburban construction at

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[17] Schipper, L. and Johnsson, F. Energianvändningen i Sverige (Energy use in Sweden), 1994, pp. 87–103.

[18] Jansson, J. O. Transportekonomi och livsmiljö (Transport economy and living environment), 1996.

greater and greater distances from the core was created in Stockholm and many other Swedish cities.[19] The cityscape was transformed to benefit car use and a continuing decentralization trend was fixed in place, gaining a dominant position in urban development. However, from a sustainability point of view the investment in concentrated multi-family housing that was carried out in the Stockholm suburbs was a positive step. Both the land use and the residential space were less in these housing stocks than in detached villas and row houses thus, due to the higher density, making these areas easier to supply with public transport means such as subways and busses.

The dominant urban building regime can be seen as a parallel to how the households solve their conflicts. Both fall within the principles enabled by the comfort revolution. By continuously increasing the resources taken into use rather than looking for smart, resource saving and solutions that promote co-ordination, conflict solutions are achieved in the short term while the future conflicts over how scarce resources should be used to create sustainable solutions are aggravated.

Those institutions and socio-technological systems that must undergo innovative changes in order to develop a sustainable urban life are not only found at an urban level. They include general, national, urban specific and purely local systems. Often they are interwoven and mutually dependent, frequently seemingly immovable or in any case exceedingly stable and hard to affect. The interplay between power alliances, strong organizational and technological structures, and a deep integration within the daily routines of the households all too often would seem not to leave any openings for change. But there is still an idea development and trial activities in many fields with potential for creating substitutes or full system embryos capable of change. Large, seemingly deeply rooted systems always have some Achilles' heel, and can under pressure of outer or inner strains be weakened so that new constellations can find space, expand and either replace or marginalize old structures. Examples of such include heating systems with one heating source per room, the responsibility of each property owner for the street in front of their property and, in some places, the inner city electrical trolley.

To a large extent sustainable urbanism is a question of adjusting the urban structure so as to utilize the potential inherent in an urban situation optimally in order to increase the possibilities for a sustainable lifestyle. Urban singularity defined in the concentration in space of humans, values and social processes, prepares the way for energy efficient solutions intended to satisfy human needs.

31.3.2 Systemic Shifts and How They Can Be Understood

The images of the future call for changes in energy use that are so large in relation to current levels or to an extrapolation of today's trends that they cannot be

[19]For more information on this see Gullberg, A. City. Drömmen om ett nytt hjärta (City. The dream of a new heart), 2001 and Gullberg, A. and Kaijser, A. "City-building regimes in post-war Stockholm", 2004.

implemented simply through renewal within the framework of today's systems. Rather this must be done in new ways that shape systematic shifts if household needs and wishes are to be met. It is not only purely material parts of the needs satisfaction that are involved, but also a number of non-material aspects of the wish complex. Symbols for belonging and distance creation are involved, ones that are very important in shaping the identity and social base of each individual. The changes in the way household needs are satisfied include a combination of technological change, infrastructure changes, alterations in household action patterns, societal cultural values and the current political landscape. Thus it is characteristic of the sequence that many elements must be changed in parallel, namely production and distribution, but also consumption and lifestyle.

The postulated changes are profound in that they affect several levels of communal life. Yet they are also broad. Since energy is a universal input factor, all parts of the households' activities will be involved. Thus changes will stretch over all household functions, that is over all those activities that the households combine in order to create a final welfare. Of course this does not mean that the changes need not be as large in all functions or to have the same depth. However, the proposed changes are of such scale that they can most nearly be characterized as system shifts.

There have been very few systematic analyses of this type of change. There are, however, some attempts in literature about socio-technological system shifts that are worth looking at.[20] The aim here is not in any way to carry out a complete analysis of all the problems linked to the path to the various images of the future. Rather we want to discuss some ideas about how certain conditions can be created for the transitions to the images and how barriers against them can be removed or reduced. Thus in what follows it is the character of the changes or transitions that will be discussed, as well as those characteristics that describes the type of sequence in question and possible patterns for these sequences. This will be followed by a discussion of the possibilities for controlling this process type.

The system shifts are multi-dimensional as they are not caused by any one single factor, but are the result of the interplay between many who affect each other mutually. Changes in technology, legislation, community life and the action patterns of households and individuals are all combined in such shifts. Logically then they play out on several levels. On the micro level they appear as new phenomena or practices that do not fit into the established systems. On a middle level the configuring rule system changes and on the macro level there are traits and trends that affect the entire society and culture. There are also a multitude of participants in the change processes, including companies, households, consumers, voluntary organizations, research institutions and political bodies. Multi-dimensional changes that play out on several levels and involve many actors are not quick, but have effect only in the long term of decades. This linking of levels that characterizes the shifts are often not the result of conscious action by strategic actors, but an unintended result of their actions.

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[20] See Elzen, B. Geels, F. W. and Green, K. (ed.) System innovation and the transition to sustainability, 2004a and Weingaertner, C. Analysing synergies between urbanization and sustainable development, 2005.

For this reason, the process lacks an overarching rationality controlling a transition. The actors look for ways forward, seeking measures and learning as the change progresses. They find their way by looking for solutions and acting provisionally.[21]

Obviously it is impossible to reduce large scale changes that embrace several societal sectors and involve several levels of community life to one or another overarching pattern. There are too many possible patterns. In order to illustrate a pattern and provide ideas for the continued discussions let us relate an empiric case that concerns one of the household functions. What is involved is maintaining the households with food or connections with the food chain as the Swiss society transitioned to a more ecologically focused production between 1970 and 2000.[22]

As in all other European countries in the post-war period, Swiss agriculture was run on industrialized forms with large inputs of artificial fertilizers, chemical biocides and high mechanization. During the 1970s and 1980s this system began to have problems with overproduction and negative environmental effects. These were duly noticed and criticized. The pressure on the established system created opening for the growth of several forms of ecologic agriculture, one less radical and the other more far-reaching. At the start there were few ecologically focused producers, but their number grew during the 1980s and became organized. Early on collaboration between farmers, agronomists and politicians created a research institute for the more far-reaching alternative. An official marking of ecological foods was set up in the early 1980s. As late as 1990 the farmer who applied the more radical alternative still formed no more than 1% of the total. They were pioneers and enthusiasts, seen as rather odd individuals. This applied as well to their customers. A co-operative chain of food stores initiated the less radical form of alternative agricultures in the early 1970s. Thus the alternative production developed on two paths, in part from the bottom up as a social movement and in part from the top down as a result of major company's initiative.

The surrounding society had gone through several significant changes that created new possibilities for the alternative agriculture. Two ecological catastrophes had led to a strongly increased environmental awareness, thus putting strong pressure on the completely dominant, industrialized agriculture. Slowly, but surely the proponents of the established system began to change their view of reality, their preferences and strategies. These macro changes caused changes in consumer preferences, something that had an effect on the strategies of large distributors and retailers. Ecological foods began to find their way into the well-known stores. On top of this several events took place on the international scene that created additional pressure on the established regime in the form of demands for reduced agricultural subsidies and a gradual deregulation of farming and of the food markets. New agricultural policies were formulated that aimed at reducing income subsidies

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[21] This discussion is based on Geels, F. W., Elzen, B. and Green, K. "General introduction: System innovation and transitions to sustainability", 2004, as well as Elzen, B., Geels, F. W. and Green, K. "Conclusion. Transition to sustainability", 2004b.

[22] The case is described in Belz, F.-M. "A transition towards sustainability in the Swiss agri-food chain", 2004.

for the farmers and provide financial support to different types of ecologic production. The collapse of the old system helped both forms of alternative production to expand strongly during the 1990s, especially then the less radical form. But even the radical alternative expanded, not least when the country's next largest food chain invested in its products. By around 2000 the industrialized agricultural production had nearly disappeared. Most farms operate in accord with the less radical variant while the far-reaching ecological system stood for a significant part of the food production.

This description demonstrates that niche development can play an important role in system shifts. The rapid change in Swiss agriculture during the 1990s would not have been possible had not openings for alternative production developed in the preceding period. The large changes did not suddenly pop up like mushrooms, but grew in ground developed by accumulated experiences from an earlier period, experiences that stretch all the way back to the early 1900s when the first types of alternative farming appeared. Such a niche period was essential in order for rules and networks to develop and be established. A research institute was founded, shared principles, guidelines and rules for ecologic production written, the farmers formed an organization and a marking system was created. Still, as long as the established system remained stable, the alternative forms of agriculture were unable to break through, remaining at the niche level as late as 1990.[23] The case also shows that the pressure the established system was exposed to via events and processes at a macro level played a vital role in the breakthrough of the alternative systems. These events and processes altered consumer preferences and the strategies of retail trade. Lastly, the case illustrates how the transition or system shift was accomplished through interplay and alliances between several actors, namely retail trade, consumers and the government.

Radical renewal begins in niches so that the new directions can be protected from normal competitive pressure. Such protection in one or another form is essential since the innovations usually seems more or less crazy to most, though there are great expectations in the minds of the pioneers. One example is that the Swiss ecological foods were much more expensive than those offered by the conventional system. The renewal inherent in new directions is often not apparent at the start and the pioneering activities frequently are all over the place. One general characteristic of the niche phase is that there is much experimentation and testing of many solutions. The niche activities will only stabilize after a while, leading to the growth of a dominating form of the alternative direction. The process is distinguished by learning and the formation of relationships between actors. When a production operation is renewed, such relationships can be between like-minded actors or between suppliers and buyers.[24]

Experiments and niches can play an important role as hotbeds for radical alternatives, but by themselves they are not sufficient to cause a system shift. There is nothing inevitable in the process that causes small-scale, local experiments to grow

[23] This pattern is hardly unique, but seems to have occurred several times before in the history of European agriculture, starting in the Middle Ages. See Thirsk, J. Alternative agriculture, 1997.

[24] Geels, F. W., "Understanding system innovations: a critical literature review and a conceptual analysis", 2004.

into stable, increasingly large-scale changes. In most cases the renewal stays local as experiments never attain a breakthrough and do not spread widely.[25] To transcend this it is necessary that opening appear in higher system levels. Such openings occur as a result of strains in the established supply systems for satisfying a household function. These can be of varying types and span ranges from the truly large contexts, such as climate changes that put pressure on energy and transport sectors, to competition strategies between companies or changed customer preferences.

These niche operations can gain a breakthrough when they are linked to parts of the established system where strains have occurred. The key to success lie in how well the new alternative succeeds in solving bottlenecks or other strains in the established system. According to this pattern, the radical renewal will appear through collaboration between the growth of new niche solutions on the one hand, as well as processes and events in established systems and their context on the other. The renewal will happen when widely different processes are linked. In this context the existing systems constitute not only barriers, but also possibilities for the new to lift out of the niche existence.[26]

The thought that there exists or appears openings in established systems means that in certain situations there may exist a spectrum of possibilities, though this does not in itself suggest which possibilities will be implemented nor when this might happen. The opening occurs when social processes with varied temporal paces meet up. This means then that the point in time that a change occurs can have a greater import than how comprehensive it is. In addition, openings or open spaces are characterized by unpredictability. Entirely unexpected results can result from small initial efforts and even seemingly hopeless projects can succeed and gain rapid distribution. What makes it possible to take advantage of these openings is a combination of skill and will among the actors and the sluggishness that characterizes the material life. Indeed, the inertia in established systems and organizations are a condition for the existence of openings. The systems and organizations are tied to certain operational forms and resources and thereby limited in their handling possibilities.[27]

The very fact that openings are characterized by unpredictability and that the distribution of alternatives are a result of process links means that the strategies chosen by the actors are of great importance to the transition. How all the problems are handled, which visions inform their actions and how these visions are adapted over time all become important factors for explaining the transition sequence.

Transitions of the type being discussed are what have been called complex changes above, ones that comprise high uncertainty and involve a variety of actors.

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[25] Berkhout, F., Smith, A. and Stirling, A,. "Socio-technological regimes and transition contexts", 2004, p. 53.

[26] Ibid., pp. 55–56; Elzen, Geels, and Green, 2004, pp. 291–292. The latter emphasizes the importance of having actors who believe in the possibilities inherent in the alternatives and are prepared to work against all odds. Networks need to be built between different kinds of actors with this focus, such as entrepreneurs, users, risk capital and politician/administrators willing to support the alternative.

[27] See Ahrne, G. and Papakostas, A. Organisation, samhälle och globalisering (Organization, community and globalization), 2002, pp. 107–111.

Thus it becomes a question if and how politicians and other decision makers can identify possible, fruitful transition paths to new systems and thereby influences system renewal. Politicians and public authorities are only one type of actor among many and own limited power, limited cognitive capacity and limited resources for influencing system dynamics. Since system innovation cannot be planned ahead of time in a rational way, rather growing as the actors work their way through a variety of uncertainties, the government cannot control the transitions as a central actor by setting up specific objectives and then implementing them using appropriate instruments in the correct circumstances. Such a handlings pattern will not function since the transitions are the result of unpredictable interactions between different interested parties, and by power games and development processes that cannot be foreseen, as well as unexpected catastrophes or new action possibilities.[28]

In such a context, the strategy must rather be to try to find ways to adapt the ongoing dynamics so that it swings in the desired direction. The thought behind this is that a small initial deviation can lead to a drastically different result in the long run. Thus the transition policies gain an exploratory character and are focused on stimulating growth and long-term development of more basic solutions to today's problems. What is at work here is not a traditional, direct and interactive process control, in the sense that it grows in the interaction between actors with different interests and wishes. The political activity must combine interactive instruments and traditional methods for controlling action from above. The strategy must be to take initial steps based on limited knowledge and limited understanding, all followed by evaluation. This is adapted when the need arises and the whole takes the form of a cyclical process with measures, evaluation of these and new measures or put simply: learning by doing.[29]

It is clear that the transition process contains strong tensions between actors with widely different wishes and between strategies with varied character, not least between flat and hierarchical controls. In this context the construction of visions can play an important role. Such a process is an attempt to identify far-reaching, if vague goals and then to try to draw out pathways to implement them. Visions are a sort of partial agreement between different actors, something that is essential in identifying the next process step. The support and expectation needed in order to create protected niches can be constructed around a vision. Experiments in niches with new alternatives contribute to testing the sustainability of the vision and indicates pathways for implementing it. The experiences gained from these experiments will in turn provide bases for revising the controlling vision. The co-ordination of competing perspectives involved in this process is not easy to accomplish. The risk is naturally large that competing interests continue to push their own visions and that the basic conceptual differences on the best way towards a sustainable society remain and perhaps even are strengthened. Still, the concept of guiding principles is still valuable as it indicates clearly that this is a deliberative process

[28] Elzen et al. 2004, pp. 287–288.

[29] Ibid., pp. 288–291.

where the interested parties are prepared to consider their positions in the light of argument and evidence.[30]

It is difficult to indicate what political action aimed at stimulating system shifts might contain. The lack of empirical documentation is clear; though it is possible suggest what some of the measures could be by studying the phases in a transition discussed earlier. One part of a political action in favor of a system shift could be how new elements that could lead to a transition are handled. Such innovations pass through two phases, both of which can be facilitated by suitable measures. The one is the niche phase where the emphasis is on testing the terrain and learning about it, and the other is the breakthrough phase where the emphasis is on distribution and financial aspects.

Experiments and niches play an important role during system shifts in serving as hotbeds for radical alternatives. Usually innovations need to pass through a very long niche phase before they can be linked to existing systems and enable a breakthrough. However, the actual breakthrough does not depend only on the existence of niches, but as much on ongoing processes in larger contexts. In order for innovations with transformation potential to be linked to an existing system and in time change it, actors who are convinced of their potential are necessary, ones that are willing to work though the odds are long. Those odds can be improved by building networks that include different types of actors, such as ones that handle development of new technology, users willing to buck existing trends and investors willing to take enormous risks. In addition politicians and administrators who dare to write rules that benefit the innovations must be found. Research efforts can deepen understanding of which the possible alternatives are and how they can be developed further. Since transitions are characterized by learning as you go, financial support is needed for experiments, establishing networks between actors, developing visions and other measures. In the next phase, that of the distribution of the alternatives that have developed during the niche phase, a long list of instruments are appropriate, including subsidies and taxes, emission standards and direct regulation.

It has already been stated that due to their complex character, transitions cannot be controlled from above by previously determined goals, though it is possible to stimulate change in a more sustainable direction over long time spans. This calls for a vision detailing what this direction ought to be, meaning which combinations of technologies and their social context can contribute to a sustainable system. Under such conditions, political control or political interventions not only need to focus on economic conditions (taxes and regulation), but must also study beliefs, expectations and institutional factors. The strategy ought to be to modulate ongoing dynamics rather than plan and control. Such an effort comprises formulation of future visions and setting up experiments that test the visions, followed by evaluating and adapting the visions. What we are talking about is a goal oriented incrementalism that embraces several cycles of adaptation and learning.

[30] See Berkhout et al. 2004, p. 56–59, concerning the importance of guiding visions.

31.3.3 Possibilities for Change and the Vitality in the New

In accord with the argument presented in the previous section, that which is possible and is available in an effort to benefit development towards a basic ecologic urbanism is the possibility for reinforcing and in a suitable way modulate an ongoing societal process and to keep a large number of alternative technologies, organizational forms, visions and mental approaches alive in social greenhouses and glades or in protected niches. When the possibilities for a system change present themselves, the access to living visions and a host of alternative institutional, technological and socio-technical arrangements with potential to promote a sustainable development can be a deciding factor for if a new desirable system can be defined and eventually be established. Quite simply there needs to be a selection of alternatives to choose from when the possibilities for a system change open up. Most of the alternatives that have been tested and kept alive will never be developed to full scale, but without them the possibilities for system shift with the desired characteristics are reduced.

A great variety of life styles, cultural expressions and future dreams are clear urban characteristics making the city a perfect place to play host to a great number of alternatives. Yet another hallmark is that collective solutions have an immense potential for success in cities as a result of the strong mutual, though often impersonal dependencies that exists between people. The type of collective solutions that are most likely to be central elements in the sustainable city and provide greater benefit to practically all urban residents are ones that already are well tested for creating new possibilities and for economizing with resources in this type of societal formation. Good examples include water, sewage and public transport systems.

Even if a system change to a sustainable city and supportable urban life cannot be planned into existence, there are general strategies for how functioning efforts to promote such a development ought to be structured. It is important to support such societal change tendencies as are favorable for a sustainable development, as well as to promote, encourage and inform about social and technical experiments that in suitable circumstances could gain footholds. On a fundamental level the degree of freedom increases as the choices made by the households deal less and less with simply keeping alive in a physiological sense and more on identity work in the sense of relating to various life roles, fulfilling oneself and manifesting ones own self image in various ways. In reality, however, considerable difficulties in attempting to change these patterns in any large scale are created by the well worn demand spirals that mark consumerism. There is, on the other hand, considerable space in a type of social glades that make it possible to develop living patterns with clear sustainable profiles both individually and sub-culturally. Enthusiasts, eccentrics and other more or less odd characters have always developed living situations in ways that the majority usually considered bizarre. But once the greater community's perspectives and problems shift, these life experiments can come to be reassessed. One relatively spread out life pattern is one whose converts develop modest consumption habit and prefer to take care of left over materials, as well as maintaining and repairing their property.[31]

The crucial question and one that also affects several household functions and how the desires and needs in these can be satisfied, is if consumerism can be turned into more sustainable paths. Consumerism would seem to be so deeply entrenched in the way western society functions, a habit with a several centuries long tradition that it does not seem realistic to believe that it would collapse. In addition it has gained a rapid distribution over practically the whole globe. But is it essential that it should be more energy and resource intensive goods and services that feed the demand spirals that are consumerisms hallmark? When, as in the West, the material superabundance has gained such enormous proportions, it is not unlikely that immaterial values might come to the fore among the richest, most style conscious and dominating classes in societies, followed by the usual descent through the social hierarchies. The immense efficiency increase that has enabled consumption to expand and work time to be shortened during the 1900s suggest the possibility of such a shift even though consumerism has made new lifestyles and consumption habits possible while bringing to the fore a number of existential problems. Thus it ought to be possible to count a greater importance for the spread of knowledge and spiritual satisfaction than earlier. Many of today's problems do not point to lacks in the material consumption, but to large difference in the possibilities for spiritual stimulation and social fellowship.[32]

Thus there do exist spontaneous forces that can possibly operate towards a modified consumerism. These can be supported using measures that slow down the tendency towards an exaggerated consumption, steps that should primarily deal with demonstrative consumption defined as cases where the gratification from the consumption expenses depends on how much the individuals' spends in relation to other expenses. A progressive tax on total individual expenses for the year, defined as income less savings, would slow the tendency towards a horse race in the consumption area. Thus the tax would reduce the inclination to offer a great deal of time on earning money to buy material utilities and little time in the company of family and friends. However, since a consumption tax of this kind would not affect the composition of consumption, it must be supplemented with some form of tax on energy use.[33]

In the effort to curb consumerism it is important that the urban area can offer everyday routines and techniques, ideals and life values that satisfy the demands for a sustainable life and can serve as example and inspiration for others. These practices can demonstrate that a sustainable life is possible and that it can have many attractive elements. Thus it will be possible to dispute the widespread conception that such a life must be dull, ugly and full of restrictions and privations. By

[31] Etzioni, A. "Voluntary simplicity", 1998; Durning, A. T. How much is enough?, 1992, pp. 136–150.

[32] Fogel, R. T. The fourth great awakening and the future of egalitarianism, 2000.

[33] Frank, R. H. Luxury fever, 1999, pp. 207–226; Ehrlich, P. and Ehrlich, A. One with Nineveh, 2004, pp. 206–236.

focusing on private services and a development of individual talents, rather than energy intensive devices, vehicles and services, it will be possible to pursue a quite acceptably sophisticated and differentiated identity creating effort. Finding and developing new social contexts, new bragging venues where this type of conspicuous consumption and know-how can be displayed and be appreciated would certainly be a step in the right direction.

If we keep in mind that time scarcity plays an important role in motivating an intensified goods consumption, then the municipal time policies aimed at promoting temporal welfare is yet another way to modify consumerism. The time offices introduced by Italian and German cities and discussed in Chap. 10 ought to be tried in other countries as well. The content of such policies can include removing temporal restrictions that make it hard make everyday schedules work. They could include such elements as shop and government hours, as well as the public transport schedules. Time offices could also procure services that facilitate co-ordination of everyday needs, such as babysitters, running errands and doing household chores.

Clearly there are several structures that act restrictively on the possibility of developing sustainable lifestyles. Tax laws and the construction of the social insurance systems that work against an expansive, differentiated sector with personal services and an in places impaired public transport sector that frustrates an energy efficient local travel market are but two of a number of possible examples. Reforming these systems so they promote sustainable behavior patterns and rein in energy intensive alternatives is not in itself a universal solution, but would without a doubt provide impetus for several societal processes to move in a sustainable direction.

Other elements in the efforts to promote sustainable urbanism include those aimed directly towards energy use. An increased awareness, greater knowledge, and improved, detailed energy information aimed at the households would form a dynamic factor with potential for greatly influencing the overall energy system. But it is possible to imagine that certain households, companies, co-operatives and other amalgamations might serve as pioneers. With support from authorities and large suppliers, the development of such operations would be facilitated. The information provided could include household energy use for each function and device. Supported by a new energy regime, leading companies could be motivated to develop renewable energy at the same time as they gain incentives for promoting an energy effectivization of their customers instead of expanding capacity. Local interest could be raised by encouraging local actors, households, companies, associations and co-operatives to produce their own energy through wind, sun and water systems as a supplement to network distribution and including the possibility of delivering any surplus energy to the network.

Yet another possibly positive factor would be intensified municipal energy planning with clear goals for reduced energy use in both the long and short terms. Such efforts should be linked to a local and regional plan for traffic and land use. It is also worth supporting the mobility offices that several municipalities have set up. The purpose for these is to provide advice in travel and transport questions, to display various available environmentally adapted alternatives and to promote these. This could also include an effort to co-ordinate the various traffic systems and promote an environmentally adapted function for them. This context should also include the link between localization and land use on the one hand and the transport questions on the other. One idea worth trying is to assign a cost on the traffic caused by certain localizations and debit those choosing that localization – the more traffic, the greater the cost.

In societies where the material resources including energy must be handled with greater care so as to ensure that the output to the residents can remain constant or grow in spite of a reduction in material input, a partially new, but on the whole reinforced institutional middle level play an important role. An essential condition for this arrangement to work is that they are locally rooted. A middle level can serve as a procuring link between households and small businesses on the one hand and public administrations and larger companies in the system world on the other. While such a middle level will express themselves differently in the different images of the future, they all aim at creating stronger links locally, using and developing local resources and thus strengthen, enrich and concentrate local communities. One imaginable form is a club where like-minded individuals and households join ranks to share resources, perhaps to operate some premises and make local office space available to rent. Another possible form is to develop such local efforts on a commercial basis, combining a property service, guard functions and errand central. Various types of association solutions are also possible.

A municipal energy plan and the new ‘middle level’ would be able to get involved in efforts to reduce commuting to working with the local property owners to make both temporary and permanent work sites available, as well as jobs linked to the space. This is in accord with the facility management concept. Such activities would be perfect for public authorities by supporting companies and/or workers who choose shorter commutes as opposed to today’s travel deductions for long-distance commuters.

An urban attempt to attain a better balance between various travel means could result in large effects on energy use. An important step is taken by transforming the family car from serving as a universal mobility tool to serving primarily for longer vacation trips and some of the heavier moving tasks of the household. If access to cars available for temporary rentals and car pools increased dramatically, the possibilities of living in urban areas without owning a car would increase and demand for such a service grow. If in addition demand increased for home delivery systems, a public transport with a standard height was introduced and greatly improved possibilities for travelling on foot and with bicycles were created and included active guidance, the conditions would exist for increasing car use where it is most energy efficient. If in addition alternatives were arranged, routine car travel could be reduced.

Car rental firms and car pool organizations could also handle a greater repertoire of rental and co-owned items, including such things as tools, extra living space, work sites and leisure houses. In this context and when the discussion concerns several images of the future, we are talking about a certain alterations in the perspective on ownership. It is probable that the difference between disposing over a utility and owning it outright will probably change and the willingness to let others use it increase, with or without payment. Basically we are talking about an increased faith in other people, something that probably could be reinforced thanks to the effect that a new or reformed middle level with local roots could develop.

Extensive changes would be desirable within the construction and property sectors, as well as in our habit for using buildings. Increased influence for users of housing and premises would also be welcome, especially when it comes to applying innovative processes. Introducing a variable tax on a number of energy intensive services would have the potential of restraining an environmentally damaging expansion. Supply of heating, cooling and hot water are examples of such services. The possibilities for renting premises and housing supplements for shorter or longer periods could possibly reduce the large stock of heated surfaces that stands ready for use during any peak loads. Setting up climate zones in buildings so that objects being stored can be placed in areas with greater temperature variations is also a possible change. Interest in working environment and health could possibly lead lowering indoor temperatures a few degrees. At best the ongoing miniaturization process could lead to a reduction in residential space. Devices such as TVs and computers are increasingly using less space, as does digitally stored media.[34]

The possibilities for letting all or parts of premises and housing for longer or shorter periods of low or partial use could be supported via tax rules and regulations. Procurement could be handled either by the new middle level or other local interested parties. New regulations for taking in roomers ought to be developed. Stimulating letting parts of detached, private housing is especially important as in just that stock there are large segments of redundant space. Not only should the tax rules be adjusted, but those who build new residences should also be encouraged to use flexible designs facilitating two-family housing. It would also be possible to offer incentives aimed at accomplishing this.

There does exist an organized leasing operation dealing with summer houses that are not used by their owners for the moment. This could be expanded with organizational and tax rule support. It is possible that a broad offering in nearby areas could dampen more long-distance travel, at the same time as existing leisure housing would be used more efficiently. Even leisure house pools can be a possible alternative. It is possible that the new middle level could administer such operations in suitable locations.

Though a sustainable urban life in no way needs to be synonymous with dressing in sackcloth, it cannot be denied that several of the changes that appear to be essential can in a shorter perspective have effects that can seem negative and even unbearable. This is why it is necessary to find ways to link such changes with support for the positive alternatives that are intended to take the place of the reduced phenomena. Such combinations in specific areas can be called starter packs aimed a lowering the threshold that must be passed to get a transformation on track. In this it is especially important not only to consider the functional sides of an operation,

[34]Concerning the possibilities for limiting energy use in housing, see Hedberg, L. et al. Rum för framtiden (Space for the future), 2003.

but also to take into consideration the identity formation import and include it in any starter pack.

The starter pack should include both creating alternatives and moderating measures. A proposal for such a packet has been developed for personal travel.[35] Metropolitan areas offer great potentials primarily for public traffic, but also for biking and walking. The relatively long, time-wasting commuting trips in these regions also suggest that distance work at home or from a local office hotel within biking or walking distance could present attractive alternatives. It is possible to discern three such moderating measures that are not mutually exclusive. The first concerns parking policies (cost and access), the second physically reduced accessibility by car (low speed zones, speed bumps, pedestrian streets, reserved driving lanes, bicycle paths, signal priorities for busses, measures that simultaneously benefit, walking, cycling and public traffic) and the third that calls for special fees for driving cars.[36]

Examples of possible moderating measures include:

– a conservative policy on increasing road capacity;
– so-called traffic calming;
– low-speed zones in densely built areas;
– fewer parking spaces;
– higher, market adapted parking fees;
– restricting policy towards establishing external shopping malls;
– overhaul of rules for company cars, parking benefits and travel deductions;
– company car pools at companies with reduced need for individual company cars; and
– differentiated environmental and congestion fees.

Starter packs are used make it easier both to accept and live with these restrictions by combining them with increased compensatory measures in other areas.

Examples of measures creating possible alternatives include:

– planning and developing decentralized access to local food store;
– day care centers and schools;
– concentrating housing using parking lots, old industrial land and already exploited land;
– prioritizing bicycle and footpaths, as well as public transport in all traffic planning;
– improving the possibilities for tele-work, tele-services and tele-shopping;

[35]The example can be seen in Åkerman, J. et al. Destination framtiden (Destination future), 2000.

[36]Munich offers an example that combines strategies one and two. With a restrictive parking policy with high fees for the inner city and slow-speed zones on 80% of the street network the share of car travel is low in spite of a very high car ownership share (600 cars/1000 residents). Singapore and London present successful examples of fee systems for moving vehicles.

- stimulating car access without car ownership using leasing, rentals and carpools;
- stimulating cycling through interconnected cycling paths, monitored bicycle parking lots, and enabling bicycles to be brought on both short and long-distance public transport;
- extending the trolley network and design the city with radial lines and cross town connections;
- increasing the average speed of city buses using clever ticket systems, optimized distance between stops, priority at crossroads and reserved lanes;
- improving real time information systems for public traffic travelers;
- providing information on public transport and bicycle paths to newcomers;
- setting up city gate parking at the more peripheral trolley stations with priority for small, eco-cars;

Starter packs can also be developed for other areas, such as sustainable food supply and fare or energy efficient use of the collected housing stock.

It is almost impossible to influence the attitudes of large groups to so high a degree that the attained behavior changes have structural effects. This is why so many who are interested in implementing sustainability search frantically after solutions that do not call for such changes. Still, the results of these attempts do not in any way weaken the impression that the likelihood of certain changes in population attitudes must come if a sustainable development is to be realized. The necessary fundamental change will certainly be facilitated by a certain shift towards greater consideration of and interest in current and future generations. Such a shift is in keeping with an important result of research into what creates happiness, namely that it isn't money or income that makes people happy, but a kinship with family and friends. The quality of human relationships mean far more for an individual's experience of happiness than do income and work. One reason why a raise does not increase the personal sense of well-being as much as is expected is that it is the change in income rather than the income itself that affects happiness. In this income differs from friendship and other personal relationships. Increases in these have a lasting effect on happiness. People accommodate themselves more quickly to things that can be bought, than things that cannot be had for money – more quickly to goods than to relationships.[37]

An alliance with social overtones could be effective, as with the health and feel-good trends. Thus even institutions in the preventive care and rehabilitation areas can have a supportive role in working with environmentally positive changes such as an environmentally adapted food supply with more vegetables, meat from free range animals and improved cooking skills, as well as institutional kitchens and restaurants that promote health and environmental adaptation. Increased daily exercise in the form of muscle powered transports to work, shopping and service could also be supported by these trends and organized interest. Seen as a whole, the health interest

[37] Lane, R. The loss of happiness in market democracies, 2000, pp. 77–98 and Layard, R. Happiness, 2005, pp. 62–75.

could contribute to counteract the growing comfort fervor that not only undermines health, but also creates a constantly increasing resource and energy use.

There exist great possibilities in taking action in support of a development towards a sustainable city and a sustainable urban life, both by finding ways to support tendencies that on a general level challenge the systems that block the path to a desirable development and by defining urban specific systems. However, the problem with all these efforts is that they can never guarantee a successful development, however comprehensive and well thought out they are. It is only if and when propitious openings for a sustainable development occur that all efforts can result in a transition to new, sustainable patterns for life in the city.

Finally, we would like to highlight two important issues that get new meaning in light of the images of the future we have presented here. The first is the need for major investment in, for example, buildings, road and rail infrastructure, as well as airport capacity. As has been shown by the images of the future, the low-energy society differs rather radically from the forecasts that today's planning is based upon. As the lifetime of roads and buildings is typically expected to be 50–100 years, this could be a reasonable time frame for assessing such an investment's profitability. However, within that time frame, society may well have been forced to rather drastic transformations that can affect the need for transport infrastructure and building use. This calls for completely new decision support tools for long-term investments. A continued use of forecasts based on historic trends risks lock development on a path leading towards an energy intensive society. Moreover, the effect can be a massive destruction of capital when forthcoming climate change implies that buildings and transport infrastructure cannot be used as the calculations presupposed.

The second question regards how economic models such as the Stern report ought to be looked upon in relation to the images of the future. The models in the Stern-report seem to indicate that the costs for climate adaptation will be high, but manageable, provided certain measures are taken at once. This seems to be in contrast to the trend breaks included in this book's images of the future. There may be several reasons for this contrast. One could be that the Stern-review underestimates the transformation costs; that the economic structure of the models in the Stern-review is impossible due to too high costs on the path towards that structure. Another possible explanation can be that the Stern review is in fact not contradicting the images of the future. Instead, the differences in social structures and in the composition of the economy may be much bigger than the differences in production volume. This would explain the relatively limited effect on GDP in the Stern-review.

It is our hope that this book will stimulate a discussion on what a sustainable city and a sustainable city life could look like and how it could be achieved. It is particularly in areas that face major challenges. This applies to the general consumption trend that needs to be channeled to a radically different energy mix. This means among other things that trends in air travel, car commuting, housing size and eating habits needs to change, and that the technical development must be much more dedicated to energy reduction rather than just focusing on efficient energy use. Another topic of the future regards how to achieve temporal welfare in the city. The aim of a sustainable city must be kept alive, re-evaluated and renewed in images of the future, which in turn can form the basis for a continuous questioning and recognition of structures that can prevent or delay a sustainable development. There is neither reason nor room to believe in spontaneous processes of healing when it comes to global environmental issues.

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Part V
Appendixes

Appendix A
Energy Use by Stockholm Residents Distributed Over Consumption Posts According to COICOP[1] and Over Household Functions

[1]Classification of individual consumption according to purpose (COICOP – UN).

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Private consumption	2000	Share (per mille)	Personal (%)	Food (%)	Residence (%)	Care (%)	Common (%)	Support (%)	Reference notes
01 Foodstuffs and non-alcoholic drinks	15,334	76		100					
02 Alcoholic beverages and tobacco									
0211 Spirits	174	1	100						
0212 Wine	393	2	100						
02131 High-alcoholic beer	369	2	100						
02132 Low alcoholic beer	611	3		100					
022 Tobacco	416	2	100						
03 Clothing and footwear	3,556	18	100						
04 Housing, water, electricity, gas and other fuels									
0411 Actual rentals paid by tenants, excluding heating	9,012	45			100				
0412 Rentals actually paid for secondary residences and tenant-owners	3,825	19			100				Rents exclusive of heating and hot water
0421 Imputed rentals of owner-occupiers, exclusive of heating	1,732	9			100				
0422 Imputed rentals for secondary residences, exclusive of heating	261	1	100						
0431 Goods for residential maintenance	272	1			100				
0432 Services for residential maintenance	2	0			100				
0451 Electricity	20,742	102	33	21	46				See Chap. 25
0452 Gas	88	0		50	50				Distr.[a]
0453 Liquid fuels, domestic heating and lighting oils	14,050	69	1		99				See Chap. 25
0454 Solid fuels: wood, coal, pellets, chips	913	5	6		94				See Chap. 25
0455 District heating	24,414	121			100				

05 Furnishings, household equipment and routine household maintenance								
0511 Furniture and furnishings	2,176	11			100			
0512 Carpets and other floor coverings	291	1			100			
0513 Furniture repairs	15	0			100			
052 Household textiles	632	3			100			
0531 Major household appliances whether electric or not	213	1	15	85				See Chap. 25
0532 Small electric household appliances	48	0		50	50			Distr.[a]
0533 Repair of household appliances	12	0	15	85				See Chap. 25
054 Glassware, tableware and household utensils	415	2		100				
0551 Larger motorized apparatus	100	0	50		50			Distr.[a]
0552 Smaller tools, garden equipment, accessories, batteries and lamps	290	1	50		50			Distr.[a]
0561 Consumables and cleaning items	831	4		50	50			Distr.[a]
0562 Domestic services and household services	73	0	33	33	33			Distr.[a]
06 Health	1,494	7				100		
07 Transports and vehicles								
0711 Cars, new	1,092	5	71	5		2	22	RES[b]
0711 Cars, used	772	4	71	5		2	22	RES[b]
0712 Motorcycles, scooters, mopeds and motocross	60	0	71	5		2	22	RES[b]
0713 Bicycles	116	1	71	5		2	22	RES[b]
0721 Spare parts and accessories	244	1	71	5		2	22	RES[b]
07221 Gasoline, diesel	22,568	111	71	5		2	22	RES[b]
07222 Oil, glycol and carburetor spirit	149	1	71	5		2	22	RES[b]

(continued)

(continued)

Private consumption	2000	Share (per mille)	Personal (%)	Food (%)	Residence (%)	Care (%)	Common (%)	Support (%)	Reference notes
0723 Maintenance and repairs	780	4	71	5		2		22	RES[b]
07241 License, training, driving test, plus necessary fees thereto	79	0	71	5		2		22	RES[b]
07242 Roadworthiness tests	39	0	71	5		2		22	RES[b]
07243 Bridge tolls	115	1	71	5		2		22	RES[b]
07244 Parking	76	0	71	5		2		22	RES[b]
07245 Car benefit and rental	701	3	71	5		2		22	RES[b]
0731 Railway transports	388	2	100						
07321 Road transports; taxi	371	2	100						
07322 Road transports; long-distance bus transports	0	0	100						
0733 Air transports	12,270	61	100						
0734 Sea transports	753	4	100						
0735 Combined passenger transport	2,703	13	50					50	Distr.[a]
0736 Other transports services; moving	74	0	50					50	Distr.[a]
08 Communication	1,167	6	100						
09 Recreation and culture	7,318	36	100						
10 Education, recreation center fees	129	1				100			
11 Restaurants, cafés, hotels and other overnight services						100			
111 Restaurants, cafés, other eateries, kiosks and vending machines	5,284	26	50	50					Distr.[a]
112 Hotels and other overnight services	738	4	100						
12 Other goods and services									
1211 Hair and beauty care	497	2	100						

1213 Other items for body and beauty care	802	4	100						
12311 Jewelery, watches	609	3	100						
12311 Jewelery, watch repairs	28	0	100						
1232 Individual items: bags, baby carriages, highchairs and various accessories	201	1	100						
12401 Childcare	81	0				100			
12402 Elder care	56	0				100			
12403 Personal assistant	200	1				100			
12404 Individual care	10	0				100			
1251 Life insurance	334	2				100			
1252 Home insurance	72	0			100				
1253 Medical insurance	93	0				100			
1254 Car insurance	137	1	71	5		2		22	RES[b]
1255 Other insurances	63	0	100						
1262 Financial services	586	3	100						
12701 Funeral services	133	1				100			
12702 Fees: passport, hunting, senior enforcement officers, etc.	0	0	100						
12702 consultant fees, tax declaration assistance, etc.	94	0	100						
	164,752								
Governmental consumption expenses 1999 (current prices)									
General public expenses	4,778	24					100		
Defense	3,647	18					100		
Security and justice administrations	1,276	6					100		

(continued)

(continued)

Private consumption	2000	Share (per mille)	Personal (%)	Food (%)	Residence (%)	Care (%)	Common (%)	Support (%)	Reference notes
Education and university research	7,921	39				100			
Health and medical care	6,160	30				100			
Social security	7,535	37				100			
Residence supply and community development	426	2			100				
Recreational activities, culture, religion	2,492	12	100						
Agriculture, forestry, hunting, fishing	98	0					100		
Energy, mining, manufacturing, construction	43	0					100		
Communications	2,746	14	50					50	Distr.[a]
Other business purposes	570	3					100		
Undistributed public expenses	39	0					100		
	37,731								
	202,483								

[a]Distr. is used to indicate that the energy used is distributed equally over the relevant household functions
[b]Swedish National Travel Survey (RES)

Appendix B
Household Functions and Time Use 1991 and 2001

Personal

The Personal category covers the time spent on activities that embrace basic human physical needs, such as sleep and personal hygiene. In the time use studies carried out by Statistics Sweden (SCB) the category includes personal care after night sleep, afternoon nap, bed ridden due to illness, personal hygiene, dressing and undressing, sauna, solarium and other personal care. In addition, the category includes trips connected with personal needs and in connection with meals.

When it comes to recreation both sports and open-air activities are included, comprising the following activities: walks and hikes in the countryside, other walks, hunting, fishing, indoor and outdoor sports and exercise, car excursions and other sports or open-air activities. Other activities mentioned are association activities, entertainment and culture including the following: spectator at sports events, going to the movies, theater and concerts, visiting exhibitions, going to the library and other entertainment. Also included are trips in connection with free time.

Social intercourse includes parties, get-togethers, visiting family and friends and visits from them, telephone conversations, visits to restaurants, cafes and bars, dancing, discotheque, party games and other social events. There is even information about time spent watching TV, listening to radio and reading.

The hobbies category includes knitting, other handicrafts, computer time, technical hobbies, meeting, games, playing alone, listening, playing records, recording, playing instruments or singing and other hobbies.

There is even a category often called other free time, including resting, meditating, and doing nothing, as well as other and unspecified free time.

Residence

This category includes those activities that to a varied extent relate to the household's facilities, such as household chores, maintenance work, other work at home and trips in connection therewith, even for care and purchasing.

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Food

We have collected those activities that relate to the household's fare in this category, including cooking, baking and in-house production of food, meals and buying goods and services.[1] The category also includes purchasing other non-durables than foodstuff, as well as durable goods, since it is impossible to separate these activities. Trips in connection with buying non-durable and durable goods in connection to work in the home are also included here.

Care

This category includes time for care of one's own children and other's. It also includes time spent for certain types of studies and trips in connection therewith. The SCB study includes only focused studies under this heading, meaning studies expected to lead to some type of diploma or occupation. Such studies have as their main purpose to increase competence in a certain area and are often a full-time activity, though it can also be part-time. Study circles are not included in this category, being rather defined as personal, as they are often tied to a hobby or other free time interest.

Support

This category includes the time used to earn a living. All time spent on some form of paid work is therefore placed in here. In addition to the salaried work time, this category includes time seen as related to the paid job in some way, such as trips to and from work, lunches and any needed clothes changing before and after work. It makes no difference if the work is a regular job, overtime work, secondary job or moonlighting.

[1]Since we lack exact information regarding the time spent on cooking in our material for Greater Stockholm, we use the national averages for 2000/2001 See Tid för vardagsliv (Time for everyday living), 2003, p. 136.

Table B.1 Average time for activities by gender, hours and minutes per day during weekdays and weekends. Stockholm. 1990/1991

	Women		Men	
	Weekdays	Weekend	Weekdays	Weekend
Personal				
Personal care	08:39	09:46	08:14	09:47
Trips relating to personal needs, incl. meals	00:01	00:03	00:01	00:02
Sports, outdoor activities	00:14	00:31	00:21	00:45
Association activities, et al.	00:03	00:05	00:07	00:19
Entertainment, culture	00:05	00:08	00:05	00:08
Social intercourse	00:56	01:42	00:42	01:38
TV and radio	01:17	01:52	01:32	02:32
Reading	00:31	00:47	00:33	00:43
Hobbies	00:11	00:16	00:10	00:18
Other free time	00:13	00:19	00:07	00:11
Trips relating to free time	00:17	00:42	00:19	00:56
Total personal	**12:27**	**16:11**	**12:11**	**17:19**
Residence				
Household work	00:59	01:38	00:18	00:43
Maintenance work	00:12	00:20	00:16	01:00
Other work in the home	00:06	00:05	00:05	00:06
Trips relating to work in the home, incl. trips relating to care and purchasing	00:27	00:27	00:22	00:33
Total residence	**01:44**	**02:30**	**01:01**	**02:22**
Food				
Cooking	00:53	01:08	00:21	00:32
Meals	01:07	01:36	00:56	01:34
Purchasing goods and services, incl. durables	00:33	00:28	00:18	00:27
Total food	**02:33**	**03:12**	**01:35**	**02:33**
Care				
Care of one's own children	00:49	00:43	00:16	00:25
Care of other persons	00:05	00:10	00:04	00:14
Studies	00:24	00:09	00:12	00:09
Trips relating to studies	00:04	00:00	00:01	00:00
Total care	**01:22**	**01:02**	**00:33**	**00:48**
Support				
Earning a living	05:14	00:43	07:39	00:51
Business trips	00:36	00:05	00:54	00:05
Total support	**05:50**	**00:48**	**08:33**	**00:56**

Source: *Tidsanvändningsstudy* (Time use study) 1990/91, SCB, 1992

Table B.2 Average time for activities by gender, hours and minutes per day during weekdays and weekends. Stockholm. Population 20–64, corresponding to study period in 2000/2001

	Women		Men	
	Weekdays	Weekend	Weekdays	Weekend
Personal				
Personal care	08:25	09:47	08:31	09:37
Trips relating to personal needs, incl. meals	00:01	00:02	00:03	00:02
Sports, outdoor activities	00:20	00:43	00:23	00:35
Association activities, et al.	00:05	00:05	00:04	00:10
Entertainment, culture	00:03	00:06	00:04	00:13
Social intercourse	00:52	01:34	00:35	01:37
TV and radio	01:28	01:41	01:40	02:27
Reading	00:28	00:39	00:24	00:34
Hobbies	00:18	00:18	00:20	00:36
Other free time	00:17	00:23	00:18	00:29
Trips relating to free time	00:22	00:43	00:13	00:48
Total personal	**12:39**	**16:01**	**12:35**	**17:08**
Residence				
Household work	00:53	01:26	00:22	00:44
Maintenance work	00:08	00:14	00:10	00:36
Other work in the home	00:11	00:13	00:10	00:08
Trips relating to work in the home, incl. trips relating to care and purchasing	00:33	00:30	00:18	00:34
Total residence	**01:45**	**02:23**	**01:00**	**02:02**
Food				
Cooking	00:39	00:52	00:21	00:30
Meals	01:11	01:57	01:01	01:44
Purchasing goods and services, incl. durables	00:34	00:39	00:16	00:26
Total food	**02:24**	**03:28**	**01:38**	**02:40**
Care				
Care of one's own children	00:44	00:36	00:16	00:15
Care of other persons	00:05	00:09	00:04	00:10
Studies	00:34	00:23	00:26	00:11
Trips relating to studies	00:07	00:01	00:04	00:02
Total care	**01:30**	**01:09**	**00:50**	**00:38**
Support				
Earning a living	04:51	00:48	06:52	01:16
Business trips	00:40	00:07	00:55	00:07
Total support	**05:31**	**00:55**	**07:47**	**01:23**

Source: *Tidsanvändningsstudy* (Time use study) 2000/2001, SCB, unpublished results

Appendix C
Stockholm County Population (1997) According to Distance to the Nearest Track-Bound Public Transport and Car/Public Transport Travel Time Relations

Table C.1 Distance to nearest track-bound public transportation as a percent of total population stated as distance classes

	Distance classes, meters from section				
Section	–300	300–600	600–1,200	1,200–	# residents
Subway					
Hässelby strand–Alvik	15	33	18	34	101,255
Kristineberg–Skanstull	37	47	15	0	122,177
Gullmarsplan	45	31	23	0	2,382
Globen–Hagsätra	22	40	24	15	63,549
Skärmarbrink	48	49	3	0	4,141
Blåsut–Farsta strand	29	45	15	11	46,859
Hammarbyhöjden–Skarpnäck	26	39	10	26	46,070
Mörby C–Bergshamra	15	39	23	23	15,911
Universitetet–Stadion	30	48	21	0	23,445
Ropsten–Karlaplan	41	43	15	0	28,447
Östermalmstorg–Hornstull	52	42	6	0	47,809
Liljeholmen	3	30	46	21	8,794
Aspudden–Norsborg	26	43	17	14	110,918
Mids.kransen–Fruängen	25	35	21	19	40,573
Hjulsta–Huvudsta	40	47	10	3	75,114
Akalla–Solna C	24	57	19	0	41,273
Västra skogen	34	49	16	1	5,726
Stadshagen–Kungsträdg	45	54	1	0	27,690
Commuting trains					
Bro–Sundbyberg	8	15	29	48	97,817
Märsta–Solna	8	14	23	55	161,115
Karlberg–Stockholm S	51	43	3	2	25,138
Älvsjö	7	8	51	34	15,843
Stuvsta–Södertälje Port	6	14	38	42	98,196
Södertälje C	2	6	20	73	49,904
Södertälje syd	0	1	20	79	2,996
Nykvarn	3	17	30	50	8,763
Järna–Gnesta	7	21	25	47	11,471
Farsta strand–Västerhaninge	5	16	25	54	102,101

(continued)

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Table C.1 (continued)

Section	Distance classes, meters from section –300	300–600	600–1,200	1,200–	# residents
Krigslida–Nynäshamn	10	21	32	37	29,954
Local trains					
Kårsta–Tibble	4	10	20	66	102,553
Österskär–Täby C	9	17	23	51	59,637
Rosl Näsby–Bråvallavägen	11	25	19	45	14,792
Näsbypark–Vendevägen	17	32	35	16	14,890
Djursh Ösby–Stockholm Ö	18	49	19	13	10,014
Gåshaga–Ropsten	17	23	12	47	49,586
Saltsjöbaden–Neglinge	4	5	2	90	31,905
Solsidan–Tippen	4	9	4	84	20,247
Igelboda–Slussen	17	22	25	35	52,153
Nockeby–Alvik	31	37	29	3	26,404
All track-bound traffic	**19**	**28**	**20**	**33**	**1,797,612**

Table C.2 Travel time relation between public transport and car travel between the inner city and within certain districts

From	To inner city	Within each municipality or district
Western suburbs (Västerort)	1.27	1.98
Southern suburbs (Söderort)	1.06	1.92
Solna	1.27	1.67
Sundbyberg	1.16	1.42
Järfälla	1.27	2.37
Upplands-Bro	1.64	3.11
Sollentuna	1.37	2.46
Upplands Väsby	1.40	2.51
Sigtuna	1.38	2.20
Danderyd	1.21	2.13
Täby	1.17	2.29
Vallentuna	1.19	2.75
Vaxholm	1.14	2.23
Österåker	1.24	2.91
Norrtälje	1.32	2.70
Lidingö	1.45	2.26
Ekerö	1.25	2.75
Nacka	1.01	2.29
Värmdö	1.11	2.96
Tyresö	1.05	2.28
Haninge	1.09	2.20
Nynäshamn	1.20	2.75
Huddinge	1.14	2.24
Botkyrka	1.12	2.19
Salem	1.25	2.69
Södertälje	1.34	2.73
Within the inner city	**1.05**	–
Entire county	**1.18**	**–**

Appendix D
Specification of Images of the Future

This appendix contains the precise information that forms the basis for the three urban structures described in Chaps. 4 and 22–25, as well as the relatively schematic suppositions that form their foundations. The first table shows the changes in the number of residents and work sites stipulated for each of the six future images. These are then broken down for each new construction type, again for all future images excepting only the two Low-rise Settlements alternatives. These are not discussed, as the suppositions made do not lead to any differentiated results between the temporal structures Fast and Slow (Tables D.1–D.5).

This is then followed by an attempt at geographic specification of the three urban structures as they were shown on Figs. 22.1, 23.1 and 24.1.

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Table D.1 Geographic specifications: general breakdown

	Residential				Work sites				
	2000	2050	Concentr.	Supplement	2000	2050	Concentr.	Supplement	Change
Urban cores fast									
Expanded inner city	291	395	51	53	274	254	30	−50	−20
Outer urban cores, 6	51	301	9	241	41	211	5	165	170
New hubs, 22	79	195	14	102	42	172	5	125	130
Older hub-like centers, 12	110	150	19	21	47	67	5	15	20
Other areas	1,075	1,265	190	0	338	338	38	−38	0
Totals	1,606	2,306	283	417	742	1,042	82	218	300
Urban cores slow									
Expanded inner city	291	392	32	69	274	254	48	−68	−20
Outer urban cores, 6	51	282	6	225	41	211	7	163	170
New hubs, 22	79	286	9	198	42	172	7	123	130
Older hub-like centers, 12	110	152	12	30	47	67	8	12	20
Other areas	1,075	1,194	119	0	338	338	60	−60	0
Totals	1,606	2,306	178	522	742	1,042	131	169	300
Suburban centers fast									
Expanded inner city	291	366	32	43	274	264	30	−40	−10
Regional centers, 18	151	211	17	43	76	125	8	41	49
Development areas, 117	535	1,100	59	506	153	414	17	244	261
Other areas	629	629	70	−70	239	239	27	−27	0
Totals	1,606	2,306	178	522	742	1,042	82	218	300
Suburban centers slow									
Expanded inner city	291	366	15	60	274	264	48	−58	−10
Regional centers, 18	151	201	8	42	76	121	13	32	45
Development areas, 117	535	1,110	28	547	153	418	27	238	265
Other areas	629	629	33	−33	239	239	42	−42	0
Totals	1,606	2,306	85	615	742	1,042	131	169	300

Low-rise settlements fast									
Expanded inner city	291	366	15	60	274	244	48	−78	−30
Centers at rail traffic, etc. – 125	635	635	33	−33	229	404	40	135	175
New and expanded edge communities, 400	40	665	2	623	10	165	2	153	155
Other areas	640	640	34	−34	229	229	40	−40	0
Totals	1,606	2,306	85	615	742	1,042	131	169	300
Low-rise settlements slow									
Expanded inner city	291	366	0	75	274	244	69	−99	−30
Centers at rail traffic, etc. – 125	635	635	0	0	229	404	57	118	175
New and expanded edge communities, 400	40	665	0	625	10	165	3	153	155
Other areas	640	640	0	0	229	229	57	−57	0
Totals	1,606	2,306	0	700	742	1,042	186	115	300

Table D.2 Geographic specifications: urban cores fast 2050

New urban units	Residential	Work sites	Total unit area in 1,000 m^2	Land area in hectares
Urban core				
In existing	10,000	7,670		150
In supplement	44,000	30,000	3,000	150
Totals	54,000	37,670		300
Hubs				
In existing	4,230	2,140		
In supplement	4,600	5,680	415	196
Totals	8,830	7,820		
Older regional centers				
In existing	10,750	4,330		
In supplement	1,750	1,250		
Totals	12,500	5,580		

Table D.3 Geographic specifications: urban cores slow 2050

New urban units	Residential	Work sites	Total unit area in 1,000 m^2	Land area in hectares
Urban core				
In existing	9,670	8,000		150
In supplement	51,520	29,830	3,300	150
Totals	61,190	37,830		300
Hubs				
In existing	4,000	2,230		
In supplement	5,820	5,600	459	196
Totals	9,820	7,830		
Older regional centers				
In existing	10,200	2,500		
In supplement	3,670	1,000		
Totals	13,870	3,500		

Table D.4 Geographic specifications: suburban centers fast 2050

Centers and areas with rail access	Residential	Work sites
Regional centers		
In existing	9,330	4,660
In supplement	2,400	1,800
Totals	11,730	6,460
Large area		
In existing	5,580	1,550
In supplement	5,560	2,680
Totals	11,140	4,230
Small area		
In existing	4,080	1,250
In supplement	1,850	890
Totals	5,930	2,140

Table D.5 Geographic specifications: suburban centers slow 2050

Centers and areas with rail access	Residential	Work sites
Regional centers		
In existing	8,830	4,940
In supplement	2,380	1,780
Totals	11,210	6,720
Large area		
In existing	5,300	1,550
In supplement	6,010	2,620
Totals	11,310	4,170
Small area		
In existing	3,870	1,250
In supplement	2,000	870
Totals	5,870	2,120

Geographic specification of the three urban structures in Chaps. 22–24

In presenting the three alternative future urban images we have used Stockholm as an experimental field. The geographic draft sketched below is a first, extremely schematic scrutiny of how these alternatives could appear when it comes to housing localization and the expansion of the transport systems. They are a text representation of the maps shown in Chaps. 22–24 and should not be seen as concrete proposals, but as provisional illustrations. The centers and hubs are not named, as there is no expectation that non-Swedish readers will recognize the names listed and whether they are new or old on the ground. However, their indicated spread along the various trackbound commuter lines in the Greater Stockholm region will provide an indication of the amount of work necessary for the implementation of these concepts.

The great number of economic, legal, technical and opinion conditions that must be tested in connection with any concrete proposals have not been tested here. It must be remembered that they would also be radically different in non-Swedish urban planning. Nor can the material presented illustrate the characteristics of and the differences between the future images discussed.

Urban Cores

Housing Centers

Overall there are six new urban cores with an internal trackbound line for internal communications, 12 old centers with hub characteristics and 22 new hubs. The names are not listed below though the relevant numbers are provided.

Traffic Structure with Housing Centers

Trackbound lines that run from north to south transit Stockholm Central Station.

Regional Line

Six new urban cores and nine new hubs. Runs from Handen in the south to Jakobsberg in the northwest. Connections to the Southern Mainline, the main line west to Västerås and the main line north to Uppsala.

Crosstown Line

Three old centers and 12 new hubs. Runs from Nacka in the southeast to Ropsten at the northeastern city limits.

Rapid Trolley Transit

Three old centers and six new hubs. Runs from Sollentuna north to Upplands Väsby.

Skarpnäck line SE

Extension to the southeast towards Tyresö.

Mörby line NE

Extension to the northeast as far as Österskär.

Nynäs Line Southern Suburbs

Crosstown line in the southern suburbs with extensive upgrading and new stations.

Roads

Fixing and extending car routes in both the northern and southern suburbs.

Suburban Centers

Housing Centers

Overall there are 18 regional centers with a major new development at Bromma old airport. The 117 new districts were presented in the chapter on urban structure. Those with limited expansion possibilities were described in Chap. 23.

The names are not listed below though the relevant numbers are provided.

Traffic Structure with Housing Centers

In the description of the traffic structure below the 16 centers linked to the track-bound traffic by bus lines alone are also listed. The various cross connections are not indicated here and several new districts that serve as connecting points between the lines are counted twice.

The compass indications are approximations.

Main line to Västerås

Runs west. Two regional centers, both with limited expansion possibilities. Six new districts, one with limited expansion possibilities and one connected only by bus.

Main line to Uppsala

Runs north. Three regional centers, one with limited expansion possibilities. Ten new districts, three with limited expansion possibilities and three connected only by bus.

Arlanda airport line

Runs north. Two new districts.

Roslagen line/Österskär branch, cut at Arninge

Runs northeast. One regional center plus one new district.

Roslagen line/Näsbypark branch, cut at Danderyd hospital. Mörby line extended.

Runs northeast. Two regional centers plus five new districts.

Hässelby line

Runs west northwest. One regional center. Eleven new districts, ten with limited expansion possibilities and one connected only by bus, the last not limited.

Hjulsta line

Runs north northwest. Seven new districts, three with limited expansion possibilities.

Akalla line extended

Three regional centers, one with limited expansion possibilities. Seven new districts, one with limited expansion possibilities and only connected by bus.

Ropsten subway

Runs northeast. Three new districts, two with limited expansion possibilities. The districts are reached either by bus or separate trolley line.

Saltsjö line

Runs east. Five new districts, one with limited expansion possibilities.

Skarpnäck line

Runs east of south. Seven new districts, one with limited expansion possibilities.

Crosstown line

Runs from Nacka in the east, south of City and up to Solna and Bromma in the north. One regional center. Nine new districts, two with limited expansion possibilities and one connected only by bus.

Connecting line to outer crosstown line north

Runs roughly north–south. One new district.

Outer crosstown line north

Runs roughly east–west. One regional center. Four new districts.

Farsta line

Runs south. One regional center. Three new districts, two with limited expansion possibilities.

Hagsätra line

Runs west of south. Five new districts, three with limited expansion possibilities.

Nynäs line

Runs south to the ferries to Gotland Island. One regional center. Eight new districts, one with limited expansion possibilities and one connected only by bus. Two new stations are considered.

Södertälje line

Runs southwest. Three regional centers. Six new districts, one connected only by bus.

Fruängen line

Runs west southwest. Four new districts, all with limited expansion possibilities.

Norsborg line

Runs west southwest. One regional center. Eleven new districts, four with limited expansion possibilities.

Outer crosstown line south

Runs roughly east–west. Six new districts.

Low-Rise Settlements

Housing Centers

In all there are 400 low-rise areas as shown on the map in Fig. 24.1. There are also 125 centers mainly located on trackbound communication lines, of which 18 are old centers with hub character. The low-rise areas are connected to the nearest trackbound station via a well-developed bus system.