universität wien

Diplomarbeit

Titel der Diplomarbeit

Climate Change and Energy Security – A Losing Deal? Impacts, Trade-offs and Adaptation Possibilities for Metropolitan Areas

A Scenario Approach for Long-range Energy Planning
in the Greater Vienna Region

Verfasserin

Kerstin Damerau

angestrebter akademischer Grad

Magistra der Naturwissenschaften (Mag. rer. nat.)

Wien, im Oktober 2008

Studienkennzahl lt. Studienblatt:	A453
Studienrichtung lt. Studienblatt:	Theoretische und Angewandte Geographie
Betreuerin:	O.Univ.-Prof. Dr. Helga Kromp-Kolb

"The trouble with our times is that the future is not what it used to be." **Paul Valery**

Abstract

As there is a growing need for a wider response to global (climate) change, the identification of the complex processes and mechanisms, and political strategies, which can lead to adaptation, becomes more and more important. And, as on global scale also in metropolitan areas like those of Vienna (Austria) scenario approaches are able to provide an analytical framework for a better understanding of that complexity. This study presents the first long-term scenarios for the metropolitan area of Vienna, drawing a picture of possible socio-economic and environmental development paths. Focus was set especially to the future of the local energy system, viz. how energy demand as well as supply could act and react in diverse thinkable storylines.

The approach is based upon the global SRES scenario groups A1B, A2 and B1. As a local down-scaling for the associated regional climate change had been done already, here the next step was to explore the possible socio-economic background and therefore energy consumption connected with those climate scenarios. Effective data and already existing research efforts on the local and short-term scale were brought into a global context and further extended to the end of the 21st century. The local storylines for Vienna were quantified by calculating energy demand and transformation (as well as associated greenhouse gas emission) scenarios, combined in a consistent and plausible way. LEAP (Long-range Energy Alternatives Planning), an integrated energy-environment modeling tool, was used to generate these scenarios. Further, an outlook of the local resource situation was given. Finally emphasis is also set on adequate sustainable adaptation strategies for a city like Vienna and the applicability of this approach to other comparable metro areas.

The aim of this study was to present different socio-economic developments considering climate change and therefore different energy futures of the greater Vienna region; the findings resulted in three local scenarios called *Convenience, Discount* and *Best Buy Scenario*. The assumptions made in the scenarios do not differ much in each branch (i.e. private households), usually less than 1% p.a. for each category (i.e. electric appliances), but the consequences for energy demand turn out to be remarkable - it ranges between a total plus of 31% up to 125% until 2100 depending on the development path. Also the energy supply side shows considerably diverging results; quantitative results, viz. energy outputs of the provider regarded here (*Wien Energie*) range between -35% and +18% at the end of the century. From a qualitative point of view the scenarios consider a more conventional or more alternative usage of resources and so lead to varying emissions, -2% to -28% CO_2 equivalent in 2100.

As the development chances for the greater Vienna region diverge strikingly in the three scenarios, they point out the implication of irreversible decisions as well as the importance of an integrated research addressing the (peri-)urban global environmental change regarding a long time horizon.

Zusammenfassung

Die globalen Veränderungen der menschlichen Umwelt zählen zu den größten Herausforderungen unserer Zeit. Dabei schafft das Verständnis der dahinterstehenden komplexen Prozesse und Mechanismen die Voraussetzung für notwendige Anpassungsmaßnahmen und führt daher auch zu einem verstärkten Ruf nach lokalen politischen Strategien.

Die Entwicklung von Szenerien bildet dabei auf globaler wie auch auf regionaler Ebene ein nützliches Analysewerkzeug, um komplexe Zusammenhänge näher ergründen zu können. In dieser Fallstudie werden für das gesamte urbane Gebiet der Stadt Wien (Österreich) erstmalig langfristige Szenarien präsentiert, welche sowohl die sozio-ökonomischen als auch die ökologischen Dimensionen möglicher Entwicklungspfade betrachten. Schwerpunkt bildet die mögliche Zukunft des Energiesystems, d.h. wie sowohl Nachfrage- als auch Angebotseite angesichts bedeutender Veränderungen agieren und reagieren könnten.

Als Basis für diesen Ansatz dienten die drei Szenariengruppen A1B, A2 und B1 der globalen SRES-Szenarien. Nachdem aus ihnen bereits lokale Klimaszenarien für Wien abgeleitet werden konnten, soll hier nun die Frage beantwortet werden, welche regionale sozio-ökonomische Entwicklung und damit auch welcher dazugehöriger Energieverbrauch wiederum hinter jenen stehen könnten. Aktuelle Daten sowie bereits bestehende lokale Forschungsergebnisse mit relativ kurzem Zeithorizont wurden in einen globalen Kontext gebracht und bis zum Ende des 21. Jahrhunderts weitergeführt.

Die quantitative Umsetzung der lokalen Szenarien erfolgte mithilfe von LEAP (Long-range Energy Alternatives Planning), einem integrativen Energie-Umwelt-Modellierungstool. Ergebnis sind konsistente Energieverbrauchs- und –bereitstellungsszenarien, dazugehörige Treibhausgas-Emissionsszenarien sowie ein qualitativer Ausblick auf die zukünftige Situation lokaler Ressourcenausstattung. Anschließend werden adäquate nachhaltige Anpassungsstrategien für eine Stadt wie Wien sowie die Übertragbarkeit dieses Ansatzes auf vergleichbare Ballungsräume diskutiert.

Ziel ist das Aufzeigen verschiedener sozio-ökonomischer Entwicklungen, welche den lokalen Klimawandel mit einbeziehen und damit auch unterschiedliche Voraussetzungen für das Energiesystem schaffen. Die Ergebnisse werden in drei lokalen Szenarien, *Convenience, Discount* sowie *Best Buy Scenario*, dargestellt. Die in den Szenarien getroffenen Annahmen weichen in den jeweiligen Nutzungsbereichen (z.B. Privathaushalte) nicht stark voneinander ab, meist weniger als 1% p.a. für jede Kategorie (z.B. Elektrogeräte). Ihre Konsequenzen für den Energiebedarf erscheinen jedoch erheblich – sie erreichten je nach Entwicklungspfad eine absolute Zunahme von 31% - 125% bis 2100. Auch die Energieangebotsseite weist beachtliche Unterschiede auf, einerseits qualitativ, da der Energie-Output des hier betrachteten Anbieters (*Wien Energie*) zwischen -35% und +18% bis zum Ende des Jahrhunderts variiert, sowie andererseits qualitativ, je nachdem ob eine eher konventionelle oder alternative Ressourcennutzung angenommen wurde. Dies führte zu divergierenden Emissionsszenarien und somit einer Abnahme von -2% bis -28% CO_2-Äquivalente bis 2100.

Indem die Szenarien teilweise beachtlich voneinander abweichende Entwicklungen aufzeigen, bestätigen sie die Auswirkungen irreversibler Entscheidungen sowie die Bedeutung integrativer Forschung auf dem Gebiet des langfristig zu betrachtenden globalen Umweltwandels in urbanen Räumen.

Contents

Table of Figures

I Introduction

As the impacts of a human induced climate change are already with us, the need for adaptation strategies rises day by day. Especially where people are concentrated, in our cities and towns, viz. where most of energy and resources are consumed and emissions peak, the consequences for society will be most evident. So making our cities and neighborhoods fit for these changes appears as the major challenge for urban management today and in future. The links between urbanization and climate change are complex, the understanding of those interactions necessary for any efficient adaptation (as well as mitigation) policy. In this case study, focus will be set on the exploring of possible development paths for urban areas, with emphasis on changes in the urban energy system and flows. What could the future look like? Which socio-economic assumptions and in consequence climatic changes lead to plausible interacting modifications? A city-wide assessment if the metropolitan area of Vienna shall draw a picture of the greater Vienna region with regard to the substantial interactions of society, economy and environment.

A look on the current trends in global energy markets seems to verify the fact that we cannot have the cake and eat it. While prices for fossil fuels are climbing and constrain economic efforts, the negative consequences of global change start to appear alarmingly, viz. the impacts on society and environment can already be recognized all over the world. But what could be the concrete consequences for a city like Vienna? The region can be considered as a complex system composed of numerous interacting, thoughtful (but possibly not all brilliant) actors and conditions as well as various feedback loops, embedded in a even more complex national and global environment. One of the key elements in this system is the urban energy system. To a high degree it determines the city’s economic and ecological performance. Both together are indicators for the sustainability of a city. It is highly depended of certain demand patterns within the society. The choice of appropriate resources and the scale of their implementation, associated with land-use and urban design, remains a major task and leads to the question of what the future challenges for the Viennese energy system could be? How may local socio-economic and environmental conditions influence the energy system when setting diverging global developments as background for site-specific considerations? Can it raise its capacities in order to respond in a flexible and sustainable way to upcoming requirements also in the long run, and hence secure a continuous energy supply?

In order to find satisfying answers, a long-term scenario approach was chosen to set the appropriate frame. It will be applied the first time in such a comprehensive and far reaching way for Vienna and its suburban areas. After giving an overview of Vienna's main socio-economic patterns and therefore energy needs at present, already generated climate scenarios for Vienna, based on the global SRES paths A1B, A2 and B1, will provide the initial point for three integrated local scenarios. Existing local scenarios concerning different issues like economy or population will mostly back these scenarios.

Based on these scenarios, the second and main step is to quantify the locally drawn storylines by calculating demand and transformation scenarios and to combine them in a consistent and plausible way – consistent in a double meaning: internally with local interacting social and economic developments as well as with the SRES scenario basis on the whole. Further, an outlook of the local resources situation will be given for every scenario. LEAP (Long-range Energy Alternatives Planning), an integrated energy-environment modeling tool designed by the Stockholm Environment Institute in Boston (SEI) was used to generate these scenarios.

While the main purpose is to present different socio-economic developments considering climate change and therefore different energy futures, emphasis is later also set on adequate sustainable adaptation strategies[1]. Anticipatory local energy policies are a fundamental precondition to the city's well-being during the next decades. The assumption that our environment is and will be designed mainly by a society's decisions that is influenced most of all by economic considerations led to a background philosophy for the whole approach: *shopping* our environment.

Moreover, the possibility of transferring some of the results and conclusions to other comparable metropolitan areas will be discussed.

As there is a growing recognition of the need for a wider response to climate change, the identification of the complex processes and mechanisms which can lead to an adaptation becomes more and more important.[2] The integrated long-term scenarios presented here tend to identify valuable as well as futile local policy strategies concerning energy planning, and thus, help to increase society's adaptation capacity to upcoming changes not only in the greater Vienna region.

---

[1] Mitigation strategies can be included automatically.

[2] Cf. McEvoy, 2007.

II Basic Assumptions

Before setting any specific development conditions concerning future pathways of the metropolitan area of Vienna, the underlying concepts and key assumptions of the chosen scenarios need to be defined. Having these assumptions in mind may ease the evaluation of further premises.

II.1 The Scenario Concept

As the whole approach will be based on the SRES (Special Report on Emissions Scenarios) storylines[5], the general definitions and the concept of scenario generation were adopted in line with the SRES approach. "Scenarios are images of the future, or alternative futures, they are neither predictions nor forecasts"[6]. They should serve as a tool for integrating the current interdisciplinary understanding and uncertainties. Internally consistent storylines and their quantifications, scenarios, offer the opportunity to enhance our understanding how complex systems work, behave and evolve over time and space. Therefore, key relationships that have been understood, interdependencies as well as driving forces of socio-economic and environmental change can be integrated in the form of scenarios and provide an appropriate tool for adjustment strategies and necessary mitigation policies on every spatial scale.

"By 2100 the world will have changed in ways that are difficult to imagine. As difficult as it would have been at the end of the 19th century to imagine the changes of the 100 years since."[7] There is an infinite number of thinkable alternative futures, their consequences and possible tipping points. The SRES scenarios cover a wide range of the dynamics of plausible developments, directed at an enhanced understanding of the complex interactions among diverse driving forces. Hence, the regional scenarios for the metropolitan area of Vienna presented later also intend to explore logical and consistent future pathways. They may help to assess current political and economic situations and thus help to develop necessary future adaptation strategies. The 'histories of the future' created here do

[5] Storylines are defined as narrative descriptions of scenarios, or short "histories" of possible future developments.

[6] Nakicenovic et al., 2000, p. 62.

[7] Nakicenovic et al., 2000, p. 4.

not aim to over- or understate possible changes (as extremes have been already provided by other scenarios), so they also exclude catastrophic futures. They rather want to draw plausible developments, neither giving probabilities for their outputs nor personal preferences. Although possible negative events will be mentioned in chapter IV, they do not make part of the storylines. The different scenario outputs shall serve the reader to draw his own conclusion about the desirability of certain near- and long-term future conditions.

Main driving forces for the whole socio-economic system, which will be quantified first as key data for the LEAP calculations (see section II.2) are population growth, economic development (and linked land-use patterns) as well as the two-way interacting environmental circumstances. In order to assess possible futures, assumptions about the development as consequence of certain feedback loops within the considered system, and further between the system and its (global) environment have to be made. These economic growth prospects are among the highly uncertain driving forces. There is a weak, slightly negative, correlation between population and economic growth. Also population forecasts, which cover longer time spans, remain doubtful, as can be seen by comparing previous expectations with real population shifts. But both, along with primary energy demand (PED), are fundamental determents of emissions, and thus future climate conditions. For the global SRES scenarios long-term population projections from the UN and IIASA had been integrated. For the economic developments the most far reaching projections available came from the Worldbank (1997) and end in 2020. A similar situation appears on regional scale. For the city of Vienna as for the Republic of Austria, respectively, population forecasts were available until 2030, trends until 2075. Economic projections were found until 2030. But there is a need for even longer-term economic considerations, primarily associated with long-term energy and environmental impact analysis. The current available energy projections for Vienna based upon an energy model stretch to 2015 (SEP, 2006), and as classical scenario collection by Kratena and Wüger (2005) until 2020. But the growing understanding of socio-economic-environmental interdependencies, especially concerning climate change, requires the framing of more integrated regional scaled strategies in order to control and meet the upcoming energy demand. Just relying on the current short-term projections without having long-term developments in mind could result in the necessity of spontaneous firemen’s approaches to solve future (energy) problems. Usually they cause higher costs[8], as they come along with deeper insecurities. Many of the decisions our society takes today, lead to

[8] Cf. e.g. Pearce, 1990; Dixit and Pindyck, 1994.

irreversible development trajectories, and therefore should be well considered and anticipate coming developments.

So even if the uncertainties about future developments are still high, due to our incomplete understanding and thus modeling of the interactions among demographics, economic growth, environment, socio-institutional and technological change[9], and even if many of the scenario assumptions can only be taken as rough estimates, particularly in the long run, creating consistent scenarios is a useful tool for a more interdisciplinary approach and may further contribute to more sustainable policies.

II.2 Key Data as Calculation Basics for LEAP

As capital of the Austrian republic the city of Vienna and its surroundings are already a very attractive living and working area for more than two million people. Working with LEAP to model future demographic, economic and at least energetic conditions for the whole metropolitan area of Vienna, made it necessary to define its borders and further to have a look on its basic natural and political characteristics.
Vienna is situated at the foot of the north eastern end of the Alps stretching from the Vienna Woods to the Viennese basin. It lies on both sides of the Danube river, the sea level ranges from more than 500 m to 150 m – the average height of the city is 171 m above the sea level.

Since 1954 the city's boundaries comprise 23 districts (Bezirke). With a total area of 415 km² it forms the smallest province of Austria. But as the city is economically and socially in constant close interaction with its surroundings, the development of the whole metropolitan area will be taken into consideration. The dimensions of the whole area are defined as the city itself plus the northern and southern suburban areas lying in the province of Lower Austria[10], including 166 municipalities (see *Figure II-1*, App. II) around the city of Vienna, creating an overall area of

---

[9] Morgan and Henrion (1990), Funtowicz and Ravetz (1990) distinguish between different types of uncertainty. There is uncertainty in quantities/ data, uncertainty about the model structure, uncertainties arising from disagreeing experts and uncertainty about the completeness of the whole approach (Nakicenovic et al., 2000).

[10] They have been defined on NUTS3 level by the Austrian Statistical Office (Statistik Austria).

4612 km². The city requires the highest national energy demand; the whole area covers two thirds of its energy demand with fossil fuels (PGO, 2008).

The Greater Vienna Region

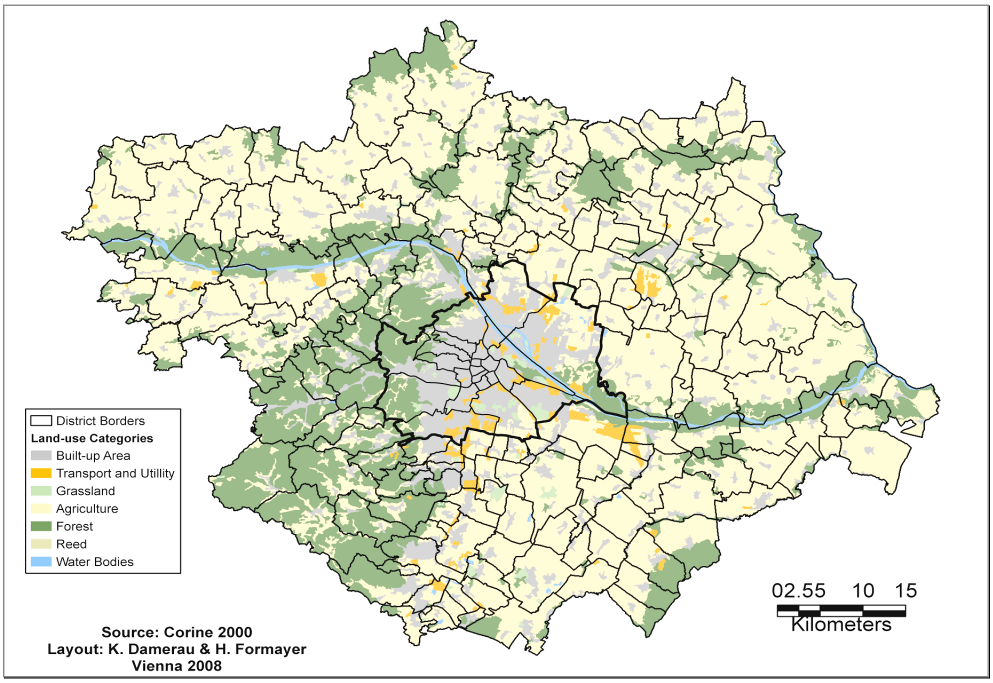


Fig. II-1: Metropolitan Area of Vienna, Administrative Units and Land-use

2005 was chosen as *base year* using official statistical data, where available. Key assumptions (occasionally differentiated by administrative area) of the demography, economy and land-use were made, as close to reality as possible.

In 2005 2.25 million people lived in the metropolitan area of Vienna, and the population growth rate was 0.9% p.a.[11] Average density of the population was 488 pers./km² with a strong concentration towards the city center. In 2005 there were 1.06 million households with an average size of about 2 persons. Over the last decades the absolute number of households increased while the average size was decreasing.

The economic situation of the Vienna region might be characterized by an absolute gross regional product (GRP) of 74,784 million € in 2005, with an average annual growth rate of 2.5% since 2001. Most of the growth was due to the service branch. Data of the share of economic sectors in the gross value added show that 70% of the GRP of Vienna derive from the tertiary sector, and even 80% regarding the whole metropolitan area.

[11] 01/01/2005, calculated by the use of prognoses of Statistics Austria.

Data of the land-use structures in 2005 for the city of Vienna show that almost half of the city's area itself is grassland, considerable parts are also used for agricultural purposes. The suburban areas are dominated by agricultural land. The major part of the wooded area is dedicated conservation area.[12] Population concentrates especially in the southern parts (see also map above).
Additional information can be found in Appendix I. Primarily, data from Statistics Austria as well as the department for statistics of Vienna (MA 5) were taken, just a small part had to be calculated when data were not available for the year 2005.

Having now created a rough socio-economic picture of the Vienna region, the next step is to point out its actual and future climatic conditions, as they are assumed to be important for the city's development opportunities.

[12] These information derive from CORINE, using LANDSAT 7 data of 2000 and are the most recent available (see also IV.1).

III How to Customize the Urban Climate

By now cities are the most frequently chosen living space of our society. In Austria today 66% of the population live in urban areas[13], 2.25 million of these in the greater Vienna region. And while living in more or less compact settlements, they permanently redesign their own environment. The stronger the human impact gets, the more natural energy and hydrological balances will be affected. Big agglomerations have an impact on primarily the local, regional and even global ecosystem as they are centers of our socio-economic development. The city of Vienna and its surroundings form one of these important centers facing global change. It changes its local natural conditions day by day. Emissions of heat, vapor and other air pollutants are altering the local climate in the short and greenhouse gases (GHG) the global climate in the long run.

The first part of this chapter focuses on the characteristics of a typical urban heat island (UHI) and its consequences for the Vienna region today. The second part will give an idea of the future conditions when global climate change contributes to local urban warming. Considering the commonly accepted fact that we influence our climatic future today on every spatial scale, as it will influence our socio-economic well-being on every spatial scale in return, leads to the conclusion that we should enhance (and further implement) our understanding of exactly those interactions.

III.1 Current Characteristics of the Viennese Climate

Showing maritime influences from Western Europe as well as continental impacts from the east, the city of Vienna is characterized by temperate climate conditions. But like for every bigger urban area, when having a closer look, its climate emerges as a puzzle of many different microclimates. Its morphology and the Vienna Woods cause a pattern of higher wind speeds as well as enhanced precipitation in the western parts and along the Danube river, due to the Vienna Woods, and relatively dry but still windy areas in the eastern extensions of the Pannonian basin. Additionally, these natural variations are modified by the city’s morphology created by its residents. A high density of multi-storey buildings, street canyons and paved squares in the core city and more and more compact settlements towards the suburban areas lead to a building environment with altered radiative, thermal, moisture and aerodynamic patterns.
Especially the city center is characterized by the so called heat island effect with a strong shift in the natural heat and hydrological balances. Surface materials used in housing, roads and other infrastructure, along with changes to the morphology of the city’s surface, modify energy and water exchanges as well as airflow.

[13] Source: http://ww2.unhabitat.org/ [10/07/2008].

The extent of urban warming is highly variable over time and space. Urban mean temperatures may be 1-3°C higher than the rural surroundings. In Vienna the city center shows an average temperature of 11.6°C, over the years 1961-1990, whereas in the eastern suburbs the average is 9.9°C.[14] The difference between the center and the western parts of the urban area is even higher due to the additional altitude gradient of the temperature. The biggest intra-urban temperature differences are expected to occur under clear sky and low wind speed conditions (in Vienna especially during summer nights). In general this can lead to a difference of more than 12°C, minimum temperatures in the center are at least 4°C higher than in the outskirts. Days of freezing stop one month earlier in Vienna. (Oke, 2001[15], Auer et al., 1989).

Modified by the Alpine foothills, the main wind direction in northeastern Austria changes from west to west/northwest or southeast with height. Speeds are accelerated along the Danube and the Wien Valleys. The roughness of the city's surface slows the wind down (mean annual wind speeds across the urban area range between 10-15 km/h). But, caused by street canyons and high developments, some winds can be canalized, enhancing wind speed, and therefore reduce the heat island effect.[16]
Soil sealing and thus greater runoff reduces evapotranspiration, thus reducing moisture in the city. The increased concentration of nuclei and some additional, industrially induced water vapor could lead to more precipitation downwind of the center, in the eastern parts of the metropolitan area. Due to topography the highest precipitation can be measured in the Vienna Woods with 725 mm p.a. in average. Comparing the records of the inner city and the eastern suburbs quite similar numbers are found, viz. 530 mm p.a. in the center and 550 mm p.a. in Groß-Enzersdorf; in fact, these reduced precipitation sums were to be expected as a result of the Pannonian influence, but about 100 mm p.a. are due topography.
35% of the precipitation falls during the summer months. In winter, a much smaller part of the precipitation falls as snow in the city compared to the rural areas; summer droughts of at least 14 days are twice as likely to occur in the eastern parts as in the Vienna Woods.[17]

So the city creates its own climate, symbolized by an urban heat island with a usually warmer and drier surfaces, and enhanced roughness. It is "a modified

---

[14] Data taken from ZAMG for stations *Hohe Warte* (loose housing density), *Innere Stadt* (high housing density), *Groß-Enzersdorf* (Pannonian basin), and *Mariabrunn* (Vienna Woods, cold air basin) 1961-90/ 1985-1992.

[15] See: Oke, T.R.: Canyon geometry and the urban heat island. Comparison of scale model and field observations. Int. Journal of Climatology, 1, p. 237-54, 1981, in Oke, 2001.

[16] An increase of the wind speed of 1 m/s reduces the urban temperature by 0.3°C (Langer, 2000).

[17] Data taken from Auer, I., Böhm, R., Mohnl, H.: Klima von Wien, 1989; years 1950-80 were analyzed.

climate caused by the interaction of construction and its consequences (incl. waste heat and emissions of air pollutants)" (WMO, 1983[18]).
Hence there is a strong human impact on local climate with numerous positive and negative feedback loops, which interact with the natural systems, e.g. milder winters or drier summers. These effects are hard to quantify, but a comparison of local urban and rural conditions can serve as appropriate measure.

A strong relationship between the geometry of street canyons and the density of developments in the city center on the one hand and the maximum heat island intensity on the other has been shown (cf. Oke, 2001). The so called sky view factor (a measure to quantify the openness of a site within an urban development) has important implications for incoming and outgoing radiation (solar and terrestrial) and thus heating and cooling patterns.
The overall climatic morphology can be described by a peak (warmest spot in the center), the plateau (warmer urban area with a smaller temperature gradient, together they form the UHI) and a cliff at the edge to rural countryside; the temperature gradient here can rise up to 4°C/km. The uniformity of the plateau can be interrupted by differences in intra-urban land-use with lower albedos or higher humidity such as green space (like the Prater or Rathauspark), open areas or water bodies (mainly the Danube) which create cooler spots within the UHI (Oke, 2001).
The larger an area and the more densely it is covered with buildings, the higher the warm-up of the city. In middle-European cities like Vienna the UHI is especially well developed in midsummer and midwinter (Fezer, 1995). The stronger the UHI appears, the higher the consequences for the environment and people's health (i.e. smog, closeness).

III.2 The Deal with Climate Change – Local Futures

As the goal of this approach is to draw possible regional energy scenarios in consequence of future climate changes that interact with the socio-economic conditions, the regional climate shifts presented now will provide the basis for assumptions concerning the future interacting of society, economy and environment. A frame for this purpose will be set by the SRES storylines, which were generated on global scale and used in the third and fourth assessments of the IPCC.

III.2.1 SRES Storylines

Because regional climate change considerations for Vienna described in section III.2.2 are based upon the global socio-economic and technological scenarios of the

[18] WMO: Commission for Climatology and Applications of Meteorology. Abridged final report 8th session. WMO-No. 600, 1983, after Matzarakis, 2001.

SRES storylines, it seems useful to summarize background information about the A1B, A2 and B1 development paths. All further assumptions for the local energy scenarios developed later have to be consistent with these global storylines.

In 2000 Nakicenovic et al. published the SRES report as a new basis for the following IPCC reports. Altogether 40 different scenarios were developed and summarized in four families, creating qualitative storylines for the global socio-economic, technological and thus climatic future: A1, A2, B1 and B2. For the presented model results three groups were chosen, A1B, A2 and B1:

The A1B storyline projects a future world with very fast economic growth including a strong commitment to market-based solutions, and a global population that will peak around 2050 and decline thereafter. Low mortality and fertility rates along with small family lifestyles are typical. A rapid introduction of new and more efficient energy technologies is the result of considerable investments and innovation rates in education, technology and institutions at national and international level.
The technological changes set for the A1B scenario group are a balance across all energy sources; there are abundant (conventional) energy and mineral resources. The final outcome is a balanced mix of technologies and supply sources, with technology improvements assumed such that no single energy source will be overly dominant. The energy intensity will decrease just 1.3% p.a. in average. Though an active management of natural and environmental services will enhance ecologic resilience, energy intensive lifestyles will still be dominant and cause enormous emissions of GHG and other pollutants. Energy prices will decline especially concerning those for alternative energies in the long term, renewables become more and more cost-effective – the global energy system in 2100 could rely predominantly on renewable energies.
Major assumptions are global convergence among regions, capacity building and increasing social and cultural interactions because of an increasing mobility of people, ideas and technologies. In consequence, this comes along with growing incomes and thus more cars, denser transport networks and continuing urban sprawl as well as serious ecological impacts.

A very heterogeneous world is specified in the A2 storyline, based on themes like self-reliance and preservation of local identities. A continuously growing global population is envisaged, due to a slower fertility rate decline, as a consequence of slower economic development primarily orientated on the regional scale. Trade flows, per capita income growth as well as technological change occur more fragmented and slower compared to the other storylines. There will be less emphasis on economic, cultural and social interactions between regions along with less international cooperation efforts, social and political structures diversify. Technology diffusion appears slower than in the other storylines. Some high-income but poor resource regions invest in advanced post-fossil technologies, but there is still a fuel mix and high coal use among the different regions – with the result of high overall emissions.

As in A1, the B1 storyline creates a convergent world. The difference is the rapid changing of economic structures towards a balanced service and information economy going along with high and successful investments in the reduction of material intensity, the introduction of clean and resource-efficient technologies as well as equity, social institutions and environmental protection. Population developments are the same as in A1, but for different reasons. Due to a high level of environmental and social awareness, a globally coherent approach to a more sustainable development turns out to be successful. A smooth transition to alternative energy systems is assumed, as conventional resources decline.
Cities are compact and designed for public and non-motorized transport, suburban developments will be tightly controlled and efforts made towards a low-input, low-impact agriculture. There will be global solutions to economic, social and environmental sustainability, but, as the other scenarios, without additional climate initiatives; still relatively low emissions are to be expected. (Nakicenovic et al., 2000).

All of these storylines cover a wide range of main driving forces, primarily demographic change, economic development and technology as well as energy systems, land-use changes and agriculture. Together they lead to different GHG future emissions and thus climate patterns. Presenting a more global and economic dimension versus a more regional and environmental one, they are trying to describe a complex system with high scientific uncertainties, which is inherently unpredictable. Still they show value-free, plausible, alternative future developments without giving any probabilities. Later these storylines will be downscaled logically to a regional scale and be quantified in three different scenarios.
The SRES scenarios are non-intervention scenarios, viz. they do not include any additional policies or measures directed at a reduction of GHG emissions. Now following these assumptions, what could the future climate of Vienna look like? What changes are to be expected according to A1B, A2 and B1?

III.2.2 Local Quantifications of the Climate Associated with the SRES Storylines

To show the local climate implications of the possible global climate developments in the 21st century, the REMO/UBA model was used to calculate meteorological parameters for Vienna up to the year 2100.[19] Air temperature, solar radiation, precipitation and wind speed changes were chosen to describe the future climate patterns for the A1B, A2 and B1 scenarios. A reference data set for 1961-90 exists for the REMO/UBA model, showing considerable deviations in daily and monthly

[19] See: Formayer, H. et al. (2007): Räumlich und zeitlich hochaufgelöste Temperatur-szenarien für Wien und ausgewählte Analyse bezüglich Adaptionsstrategien, Wien.

values compared to the measured data available. But the changes between the reference data and the scenario outlooks by the same model are useful for climate changes considerations. In this paper those basic changes were applied to three representative meteorological data sets for Vienna to simulate the expected local changes in a differentiated spatial manner (meteorological stations *Hohe Warte* as main reference, as data quality is highest for this station, *Innere Stadt* as more representative for the UHI and *Groß-Enzersdorf* to characterize the eastern suburban area). In order to make best use of available (incomplete) data sets the climate periods considered were set from 2011-2040 (representative climate 2025, applied for the first period in the following scenarios), 2041-70 (representative climate 2055) and 2071-2100 (representative climate 2085).[20]

III.2.2.1 Temperature Changes

No matter which storyline was chosen for future climate calculations they all show a significant increase in average temperature. As *Figure III-1* demonstrates, in 2025, that is the period 2011-2040, the mean increase ranges from 0.3 (A2) to 0.5°C (A1B/B1), in 2055 already from 1.2 (B1) to 2.0°C (A1B) and in 2085 even from 2.3 (B1) to 3.5°C (A1B). The graphs show a clear trend with a significant increase of the temperatures as well as an obvious difference between the scenarios from the mid-century on.

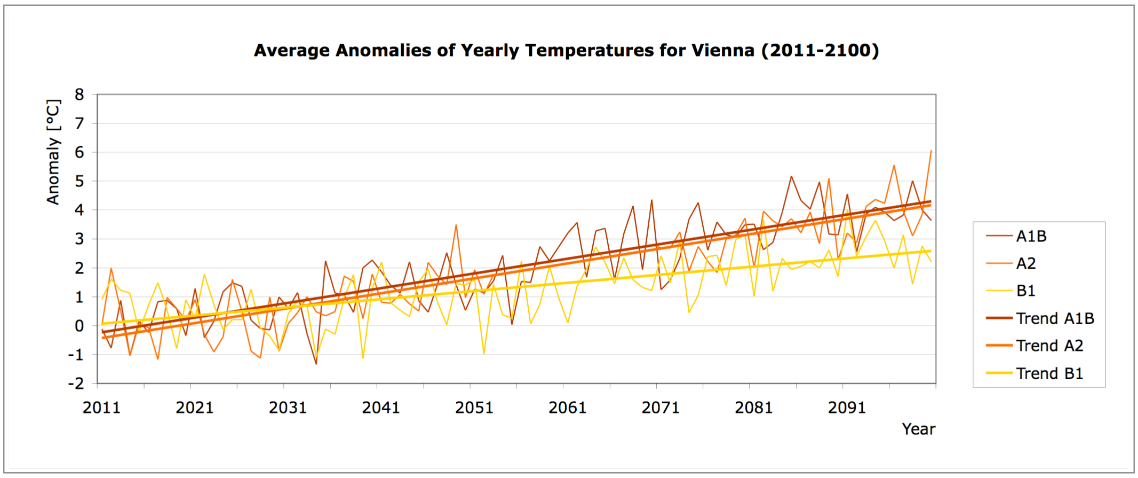


Fig. III-1: Average Anomalies of Yearly Temperatures for Vienna (2011-2100)
Source: own design based upon REMO/UBA results

A more detailed look at the monthly temperature changes for scenario A1B is presented by *Figure III-2* (A1B), which shows a slight cooling during the first period in March, but for all other periods and months a temperature rise, with the highest relative increase in winter and the highest absolute temperatures during summer time, especially for the inner city.

[20] Note: There are still data missing for the calculations for Scenario A2 in the second period.

Scenario A2 (*Figure III-3*) shows a very similar development, but temperature increases are less significant and absolute monthly temperatures remain a little under those for A1B.
A greater difference is found for the B1 scenario (*Figure III-4*). The cooling for March extends to the second period and relative increases are lowest, except for the month of January. In sum, the weaker increase of monthly temperatures according to the global scenario B1 remains highly visible and seems to be the result of different economic and technological developments and therefore GHG emission rates.

III.2.2.2 Seasonal Precipitation Changes

Because precipitation patterns are rather complex and highly variable over time and space, the model results are neither as clear cut nor as reliable as those for temperature changes. Therefore, seasonal values are used, rather than monthly values.

Figure III-5 shows a long-term decrease of rain during summer and autumn. During the late century also a slight reduction in spring could occur. In winter an increase of precipitation is to be expected in the short as well as in the long run. However, due to the rising temperatures, snowfall becomes less probable.
For the A2 scenario (*Figure III-6*) precipitation changes less but shows from period to period a steady increase from autumn until spring. After higher changes of precipitation sums in the first period, the variation until 2100 will be small.
In the case of B1 (*Figure III-7*) precipitation patterns during winter and spring remain quite stable. After an increase in fall and winter in the first and second period, precipitation sums drop again. Only autumn shows a significant change in the long run.
There is no information about type, frequency or intensity of single precipitation events yet.

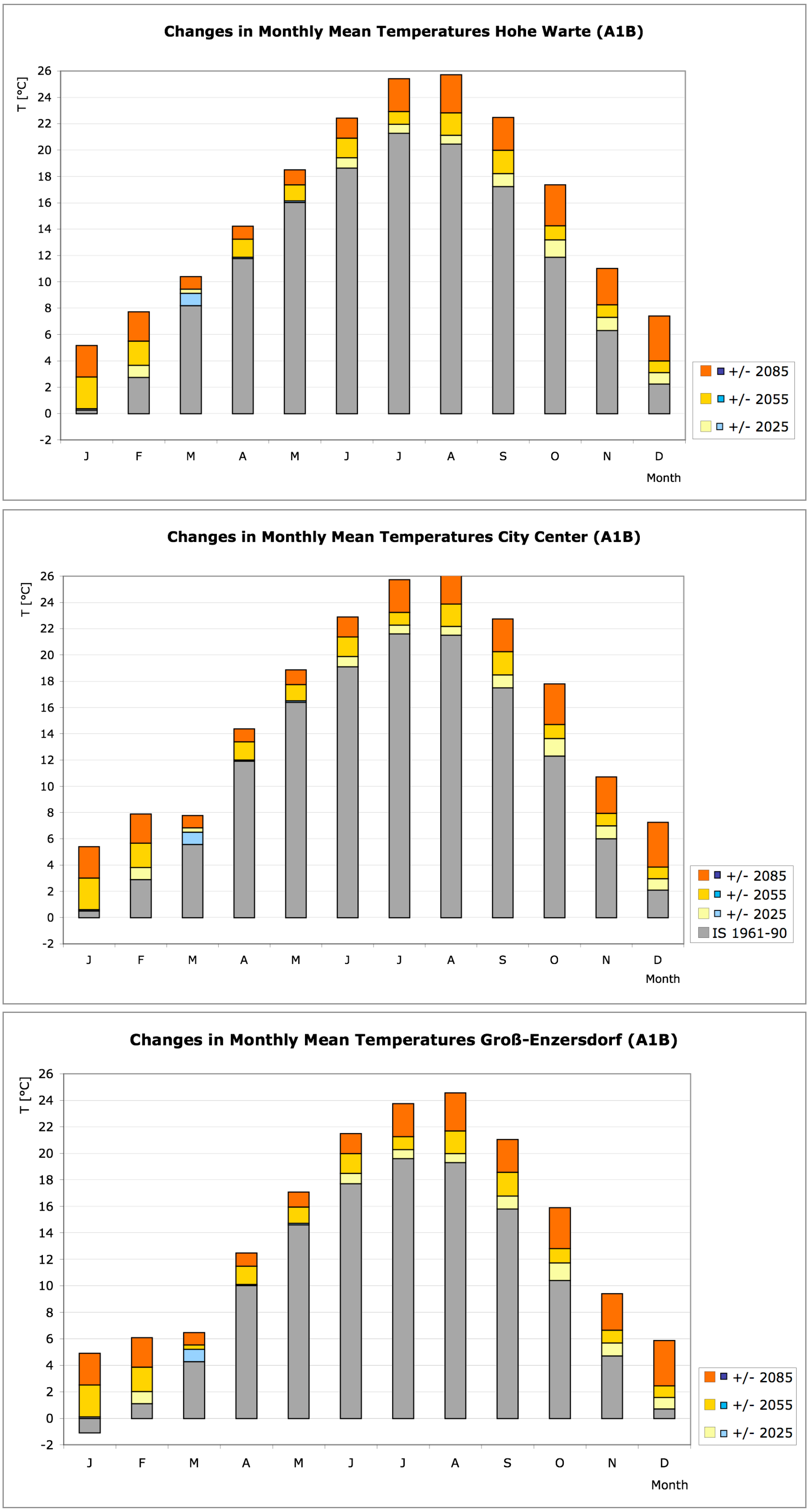
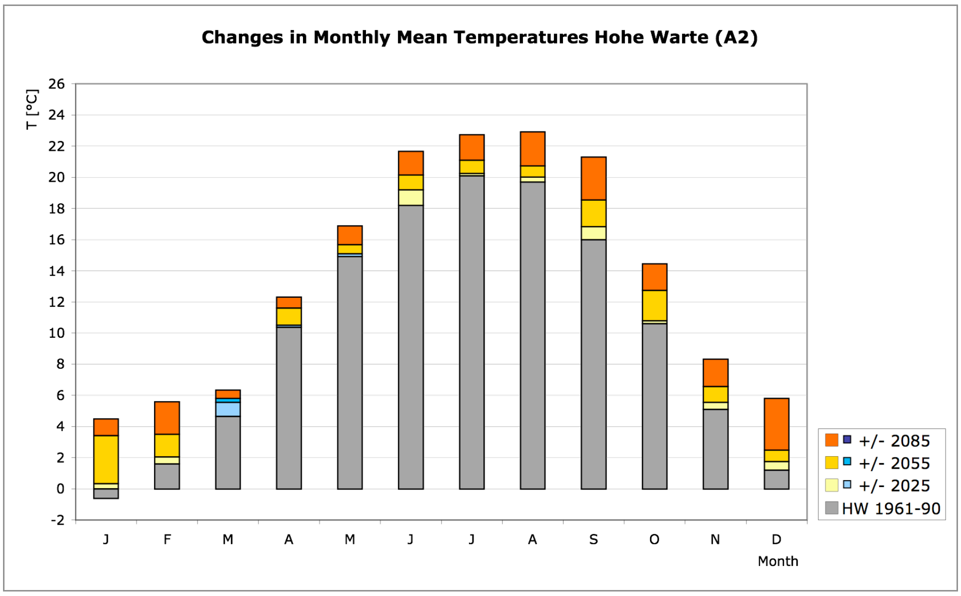
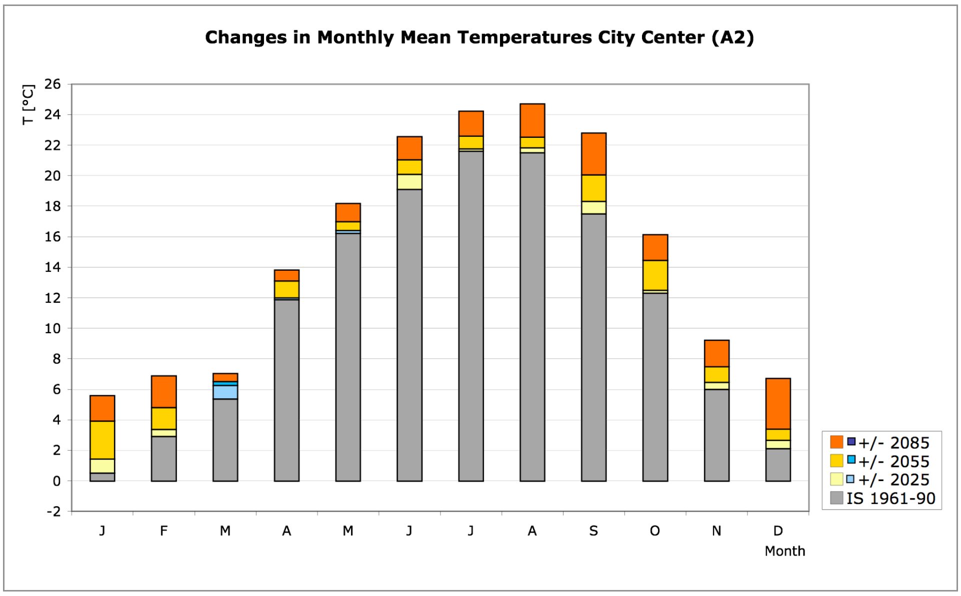


Fig. III-2: Changes in Monthly Mean Temperatures for Vienna according to A1B
Source: own design according to REMO/UBA results. Note: values for increases (orange) have to be read at the upper end of the colored field, for decreases (blue) at the lower end.





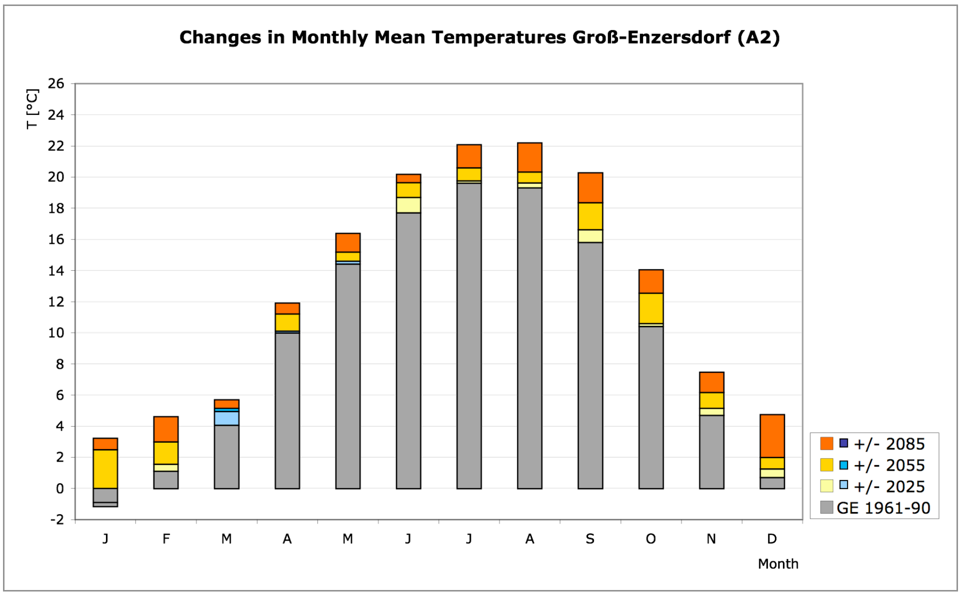


Fig. III-3: Changes in Monthly Mean Temperatures for Vienna according to A2
Source: own design based upon REMO/UBA results. Note: values for increases (orange) have to be read at the upper end of the colored field, for decreases (blue) at the lower end.

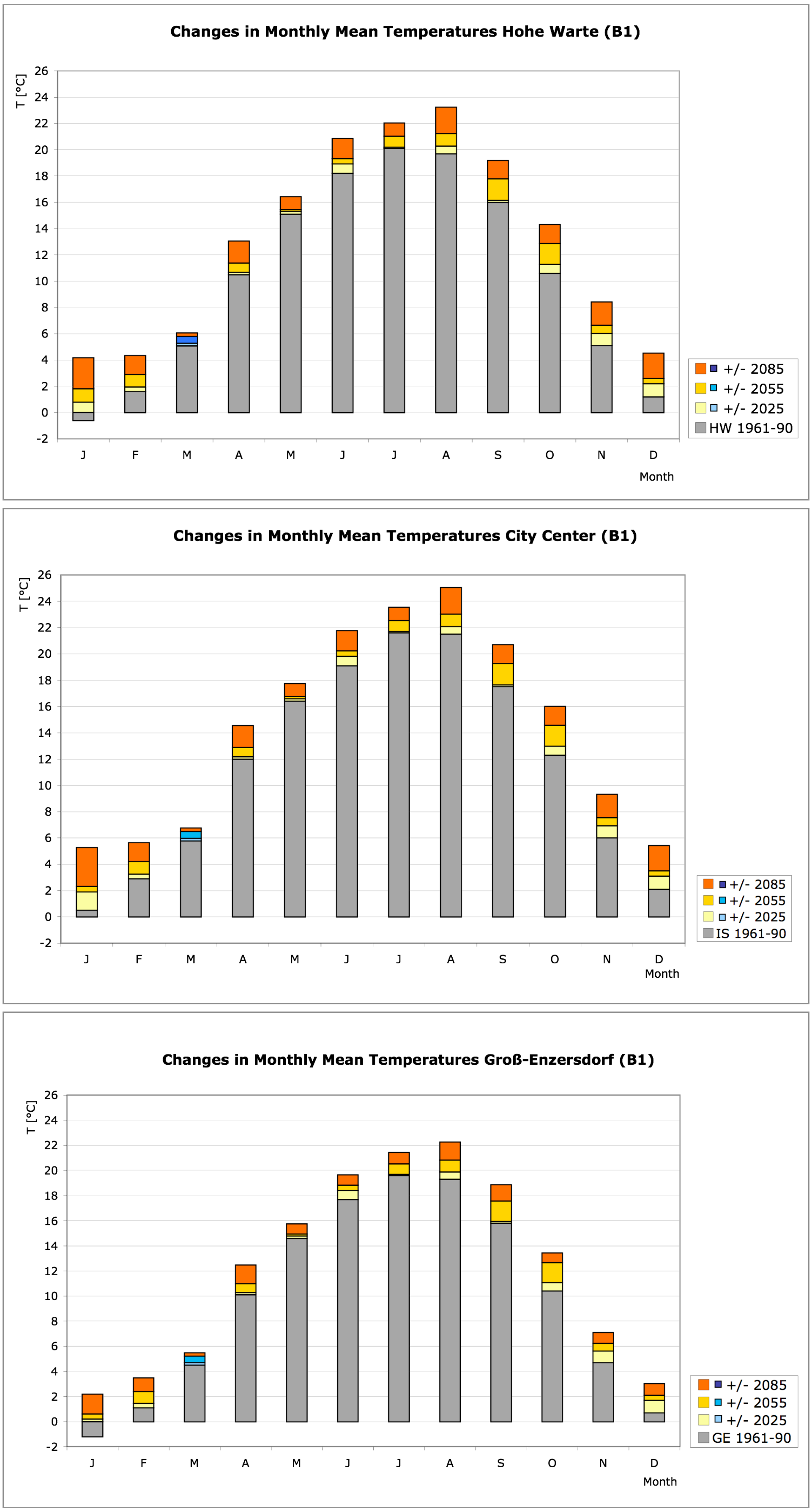


Fig. III-4: Changes in Monthly Mean Temperatures for Vienna according to B1
Source: own design based upon REMO/UBA results. Note: values for increases (orange) have to be read at the upper end of the colored field, for decreases (blue) at the lower end.

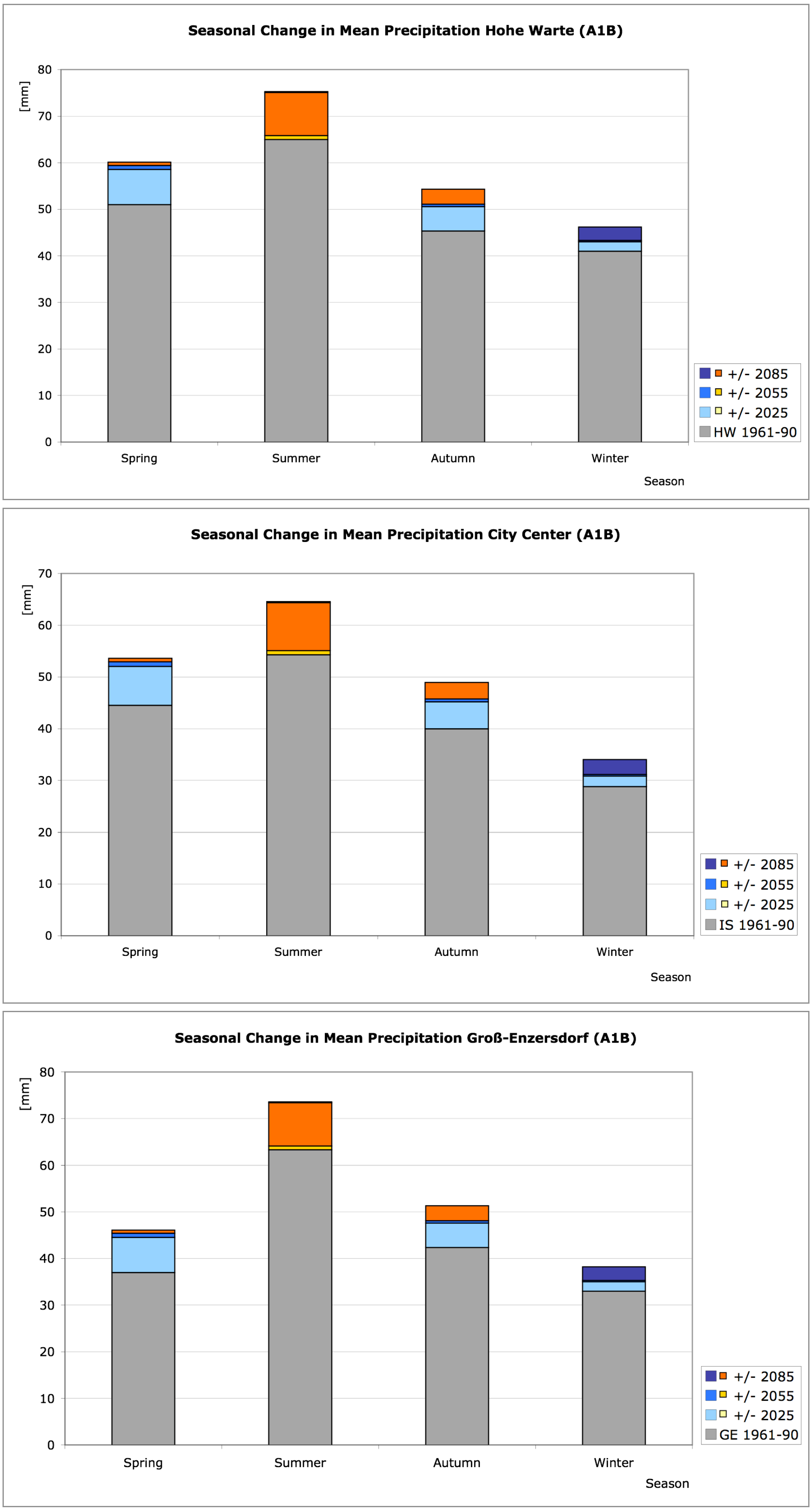


Fig. III-5: Seasonal Change in Mean Precipitation according to A1B
Source: own design based upon REMO/UBA results. Note: values for increases (blue) have to be read at the upper end of the colored field, for decreases (orange) at the lower end.

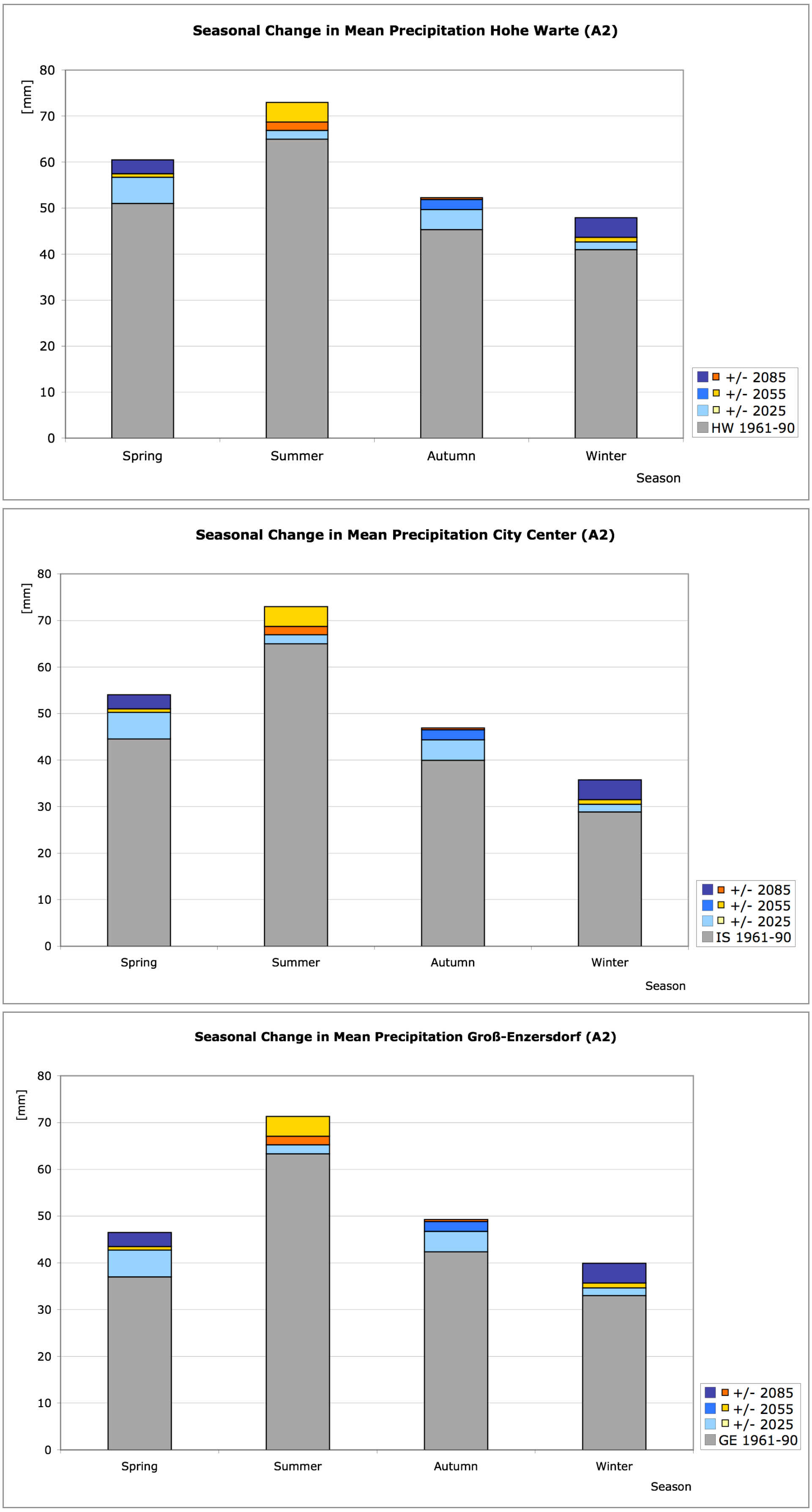
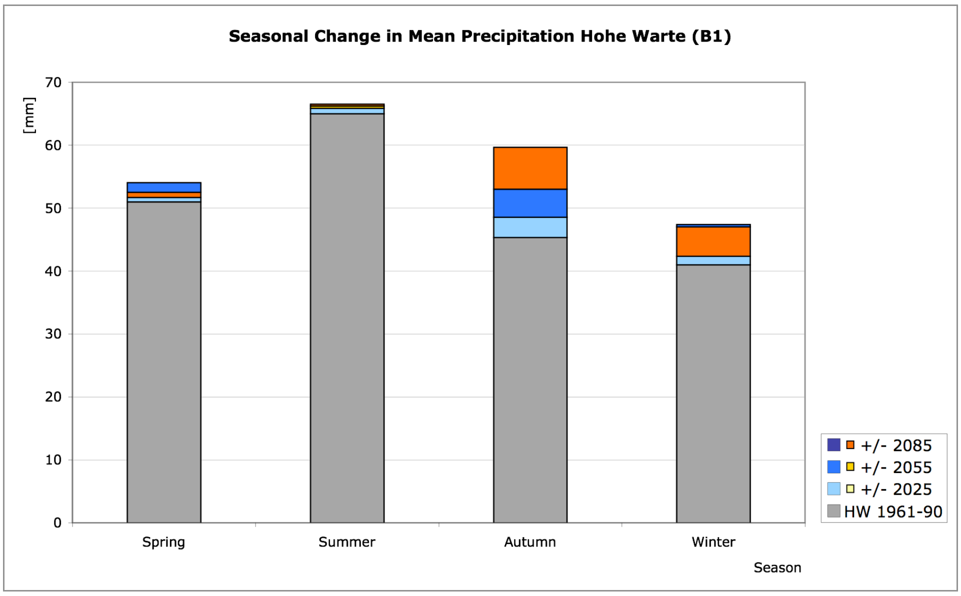
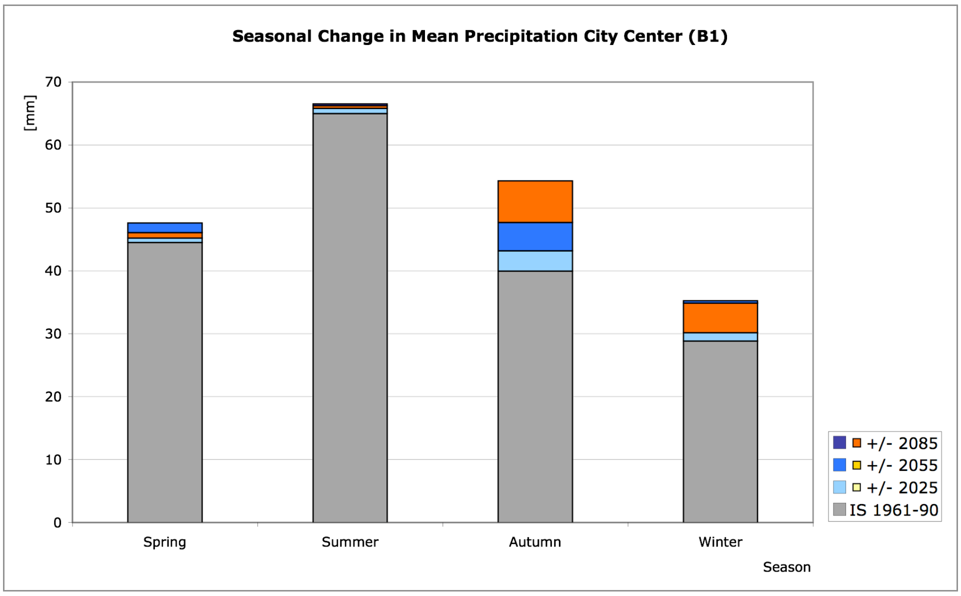


Fig. III-6: Seasonal Change in Mean Precipitation according to A2
Source: own design based upon REMO/UBA results. Note: values for increases (blue) have to be read at the upper end of the colored field, for decreases (orange) at the lower end.





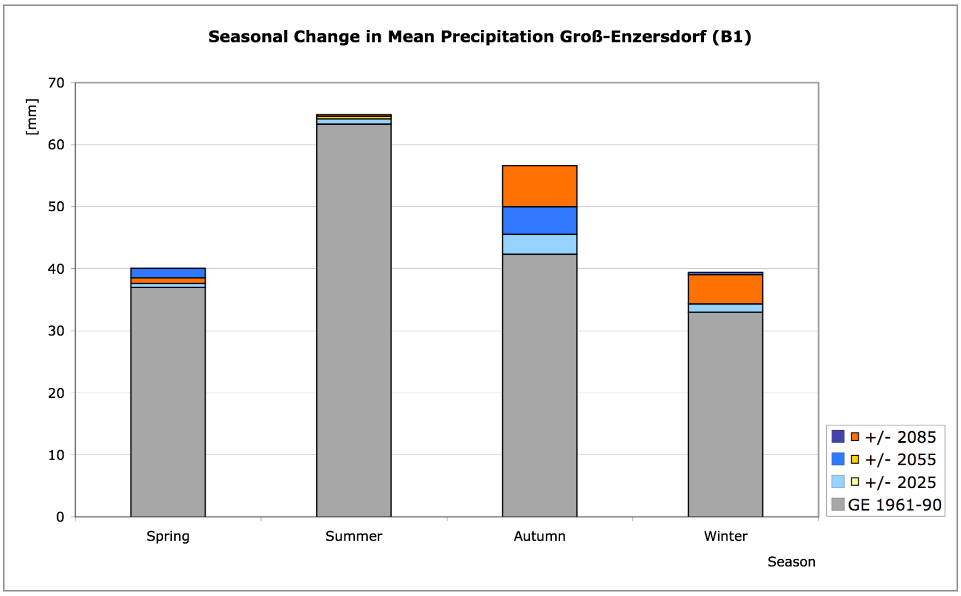


Fig. III-7: Seasonal Change in Mean Precipitation according to B1
Source: own design based upon REMO/UBA results. Note: values for increases (blue) have to be read at the upper end of the colored field, for decreases (orange) at the lower end.

III.2.2.3 Solar Radiation

Solar radiation is highly dependant on cloudiness. But changes in cloud cover are still hard to model. Hence the results of the radiation calculations presented here remain highly arguable. Comparison of observed and model control data on average shows an overestimation of solar radiation by 10% by the REMO/UBA-model.
Data for the main reference station *Hohe Warte* were selected to show possible radiation changes associated with the storylines. *Figure III-8* presents the percentage anomalies for all three periods and scenarios. The results are in agreement with the precipitation changes for all scenarios in spring and autumn: As A1B and A2 are connected with an increase in rain, the radiation sums drop significantly. For B1 there are weaker changes. Especially in summer time changes remain uncertain. The model assumes nearly cloudless skies, and thus maximizes radiation. The model results for summer are therefore upper limits.[21]

III.2.2.4 Future Wind Patterns

Due to the geographical setting Vienna can be characterized as a *windy city*. But the seasonal patterns can change over time depending on different development paths. Overall the changes calculated by the model show little consistency over the year and over time, so they too should be viewed with caution. *Figure III-9* shows a decrease for average wind speeds during summer and autumn. Noticeable accelerations are just expected for the months of March and April; comparing the three stations, the speed reduction in January at *Hohe Warte* stands out. For A2 (*Figure III-10*) an even more heterogeneous picture shows up. Low mean wind speeds contrast to higher ones from December to April. The B1 path (*Figure III-11)* is connected with the weakest changes. But here, as in the other scenarios, lower wind speeds during summers as well as higher speeds in spring are to be expected.

[21] The assumption of little cloud cover during summer time is due to high uncertainties concerning possible convection. The systematic shift of the frequency distribution of radiation sums for the summer months (June to August) to higher values induced by the model is shown in a graph in Appendix I.

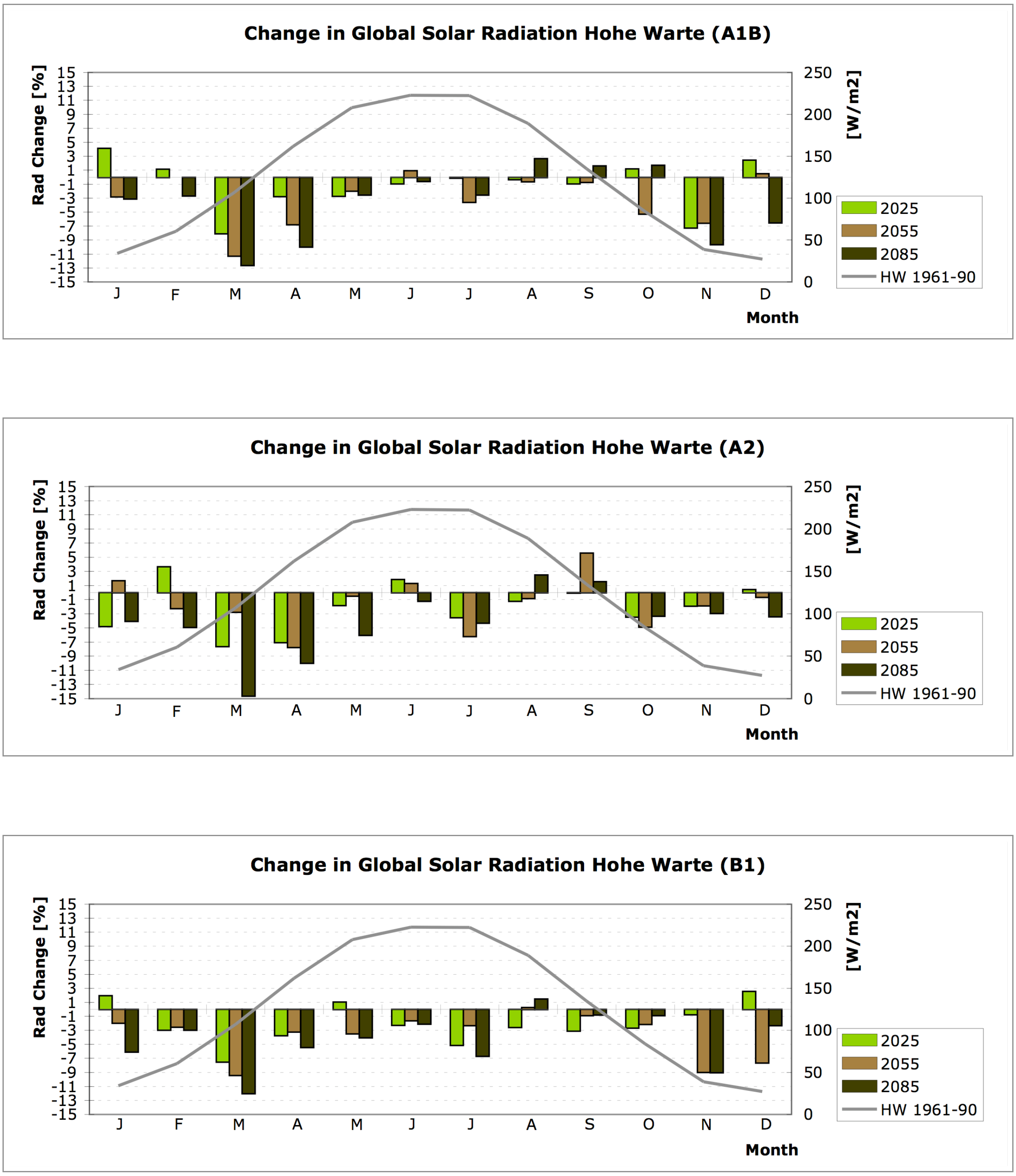
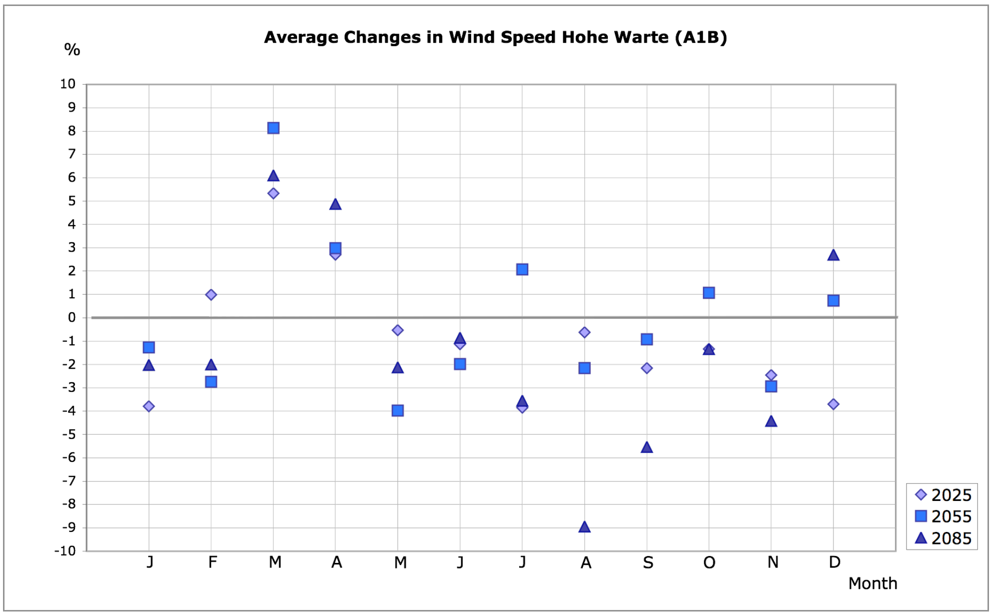
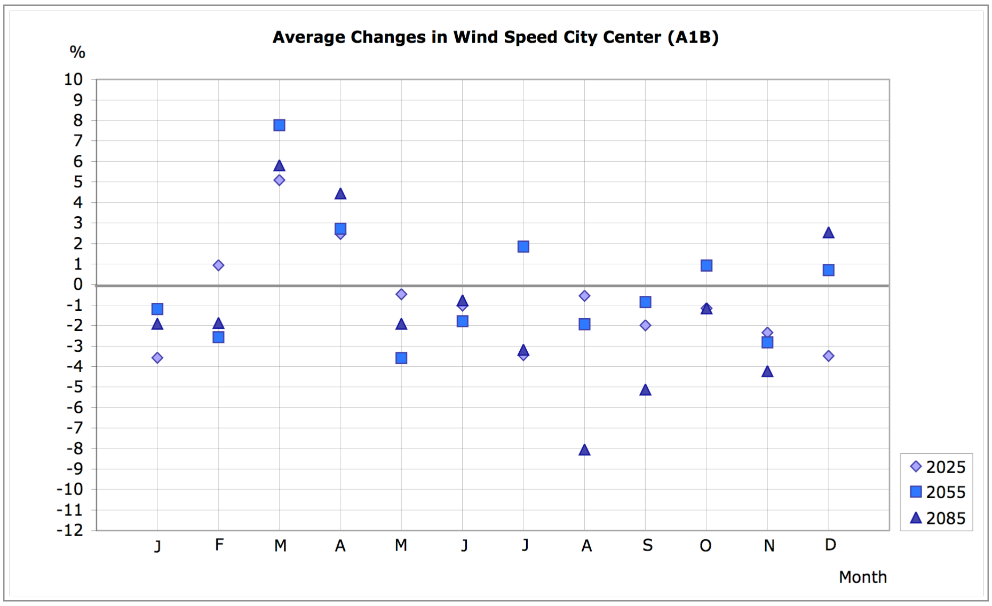


Fig. III-8: Change in Global Solar Radiation. Source: own design based upon REMO/UBA results





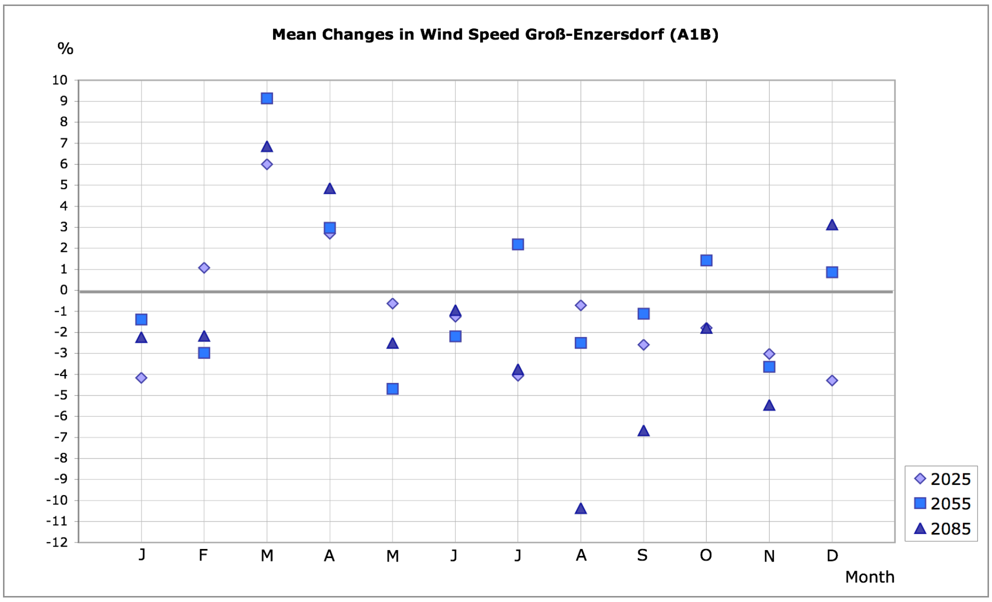


Fig. III-9: Average Changes in Wind Speed according to A1B
Source: own design based upon REMO/UBA results.

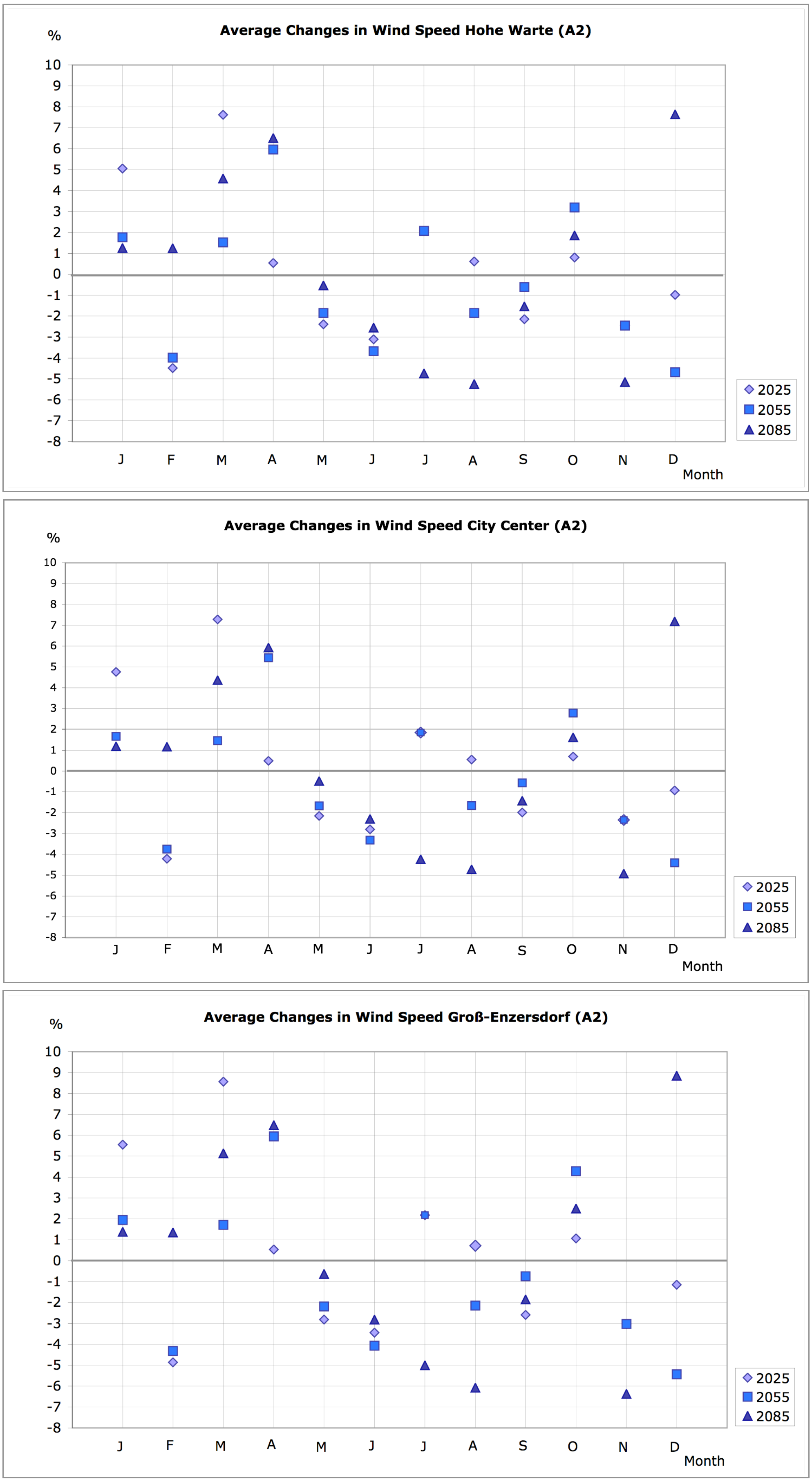


Fig. III-10: Average Changes in Wind Speed according to A2
Source: own design based upon REMO/UBA results.

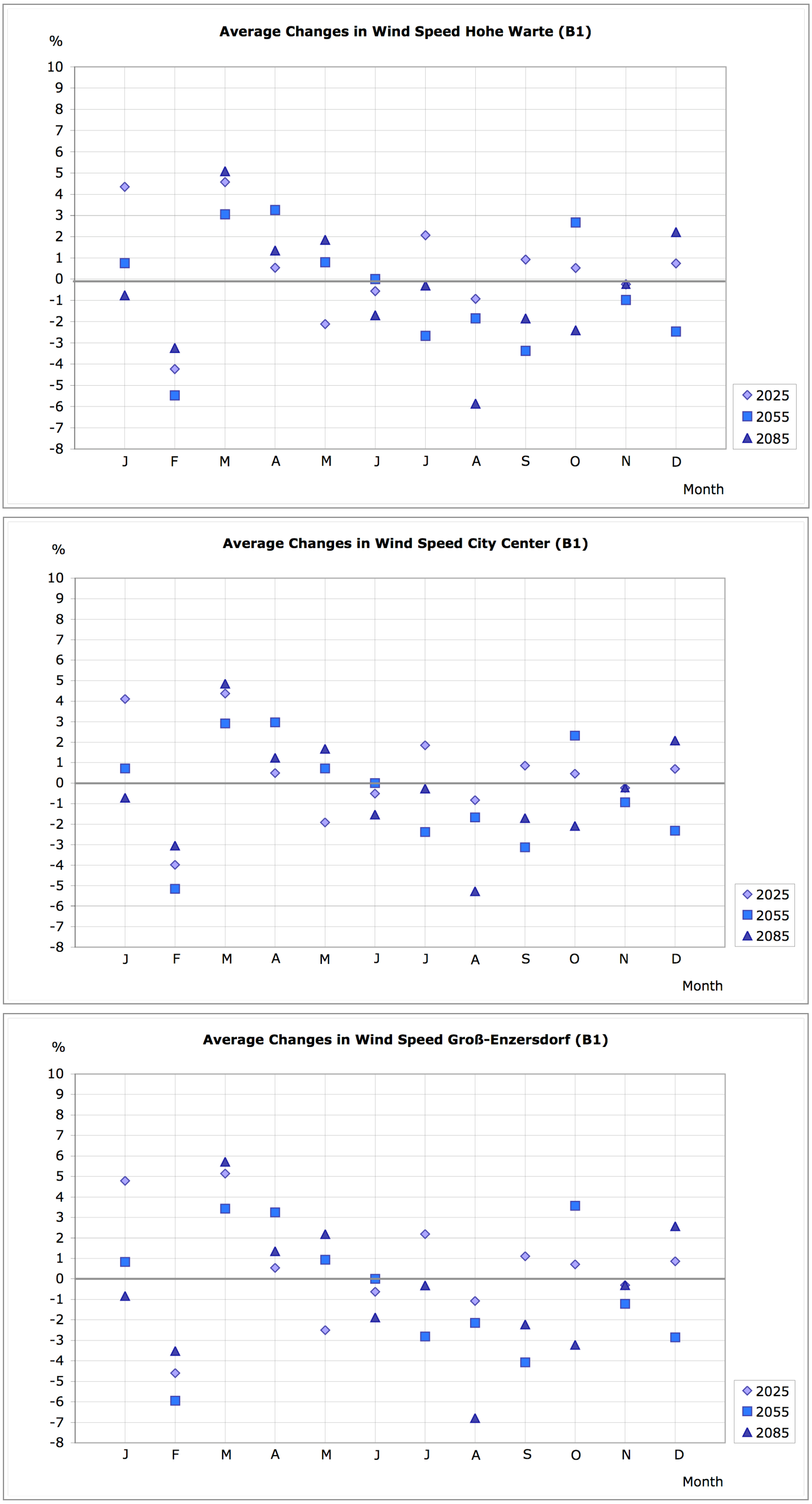


Fig. III-11: Average Changes in Wind Speed according to B1
Source: own design based upon REMO/UBA results.

III.3 To Be Kept in Mind

The previous graphs provide an overview of what climate conditions are to be expected over the 21st century, according to the most recent regional climate change models. However, they still comprise major uncertainties that lead to the difficulty of making (short-term) decisions under uncertainty (McEvoy, 2007; see also section V.1). But not addressing the basic problems due to the insecurities will be neither cost-efficient, nor safe or healthy. Not forgetting some uncertainties, these scenarios can improve our knowledge about complex socio-economic-environment systems (and their associated climatic outcomes) and help to develop a more comprehensive planning and design when developing urban areas in future (Spirn, 1984). As every city, Vienna is facing two interacting phenomena: On the one hand there are the locally produced climate patterns, the typical UHI, predominantly as direct result of transportation[22], manufacturing activities, the heating of buildings and electricity generation.[23] On the other hand, the same activities contribute to global climate change and thus to its regional consequences. Both together produce a steady change of the local climate as here exemplified for metropolitan area of Vienna. Only the second are considered in this study.

The scenario results, as already explained in section III.1, go along with certain social and economic developments on the global scale. These worldwide trends will consequently affect the potential future performance of Vienna, even if not all developments have to be paralleled in the smaller scale. Different development paths could be followed on different spatial scales, allowing a region a more or less stringent adaptation to global developments. The regional scenarios presented in the following should give an idea of different long-term developments, in order to gain a better understanding of the interdependencies between local and global actions. For example, Vienna could follow a B1 philosophy, while most parts of world develop according to A1B. This would not change global climate noticeably, but it would make a difference for socio-economic changes in Vienna. Resulting regional climate patterns would correspond to those of A1B, as shown above, with all the consequences for the environment, but the implementation of a "B1 philosophy" in Vienna could at least enhance its economic potentials and therefore its adaptation capacities to an A1B climate.

[22] Which requires 31% of the final energy demand (FED) in Vienna (SEP, 2006; Statistics Austria 2003).

[23] The higher the urban density (person/ha) the lower the gasoline use (which represents a large part of the current energy use); but the higher the height/ width ratio of center street canyons the higher the heat island intensity (Pearlmutter, 2007) (see also section V.1).

IV *Shopping* the Future – The Local Scenarios

"Prediction is very difficult, especially for the future."
Niels Bohr

Assuming that our living space is made up of a great number of complex systems, the energy system represents one of them. They all are interacting and in parts overlapping over space and time with other systems like politics, industry or the transport sector as they again interact with society, economy or climate on a higher and more effective organizational level. Together they form one coherent composite: our environment.[1] Due to the fact that these systems are considered as complex[2] they even have to reproduce instabilities in order to adjust continuously to their inside conditions as well as to the surrounding systems (Luhmann, 1989); they are located somewhere between chaos and stability. Thus, the development of a complex adaptive system cannot be foreseen.[3] In order to get a wider understanding of these systems and their feedbacks, viz. the interrelationships between microscopic processes and macroscopic patterns (cf. Levin, 2002), their interdependencies will be analyzed and development directions shall be identified.

So coming back to the subject of this study: the energy system (of a city) can never emerge as one standardized entity as it has to reinvent itself over and over again. In order to keep its ability to adapt to never-ending new circumstances, it has to remain flexible in two ways, inside and outside. As one cannot *predict* the future, looking in the rear-view mirror in order to get an idea of the road lying ahead, seems to be an unsuitable approach (but usually done in business-as-usual scenarios) to draw a picture of future developments. Therefore the following scenarios try not to rely too much on past events; rather they attempt to describe the interactions of certain dynamics under (completely) new circumstances.
Nonetheless, there will be some trends lying behind, *megatrends*, that had been observed over the last years/ decades and seems very likely to continue also in future. So the scenarios presented here will be underpinned by:

---

[1] Cf. Gell-Mann, 1994 and 1995; Levin, 2002.

[2] "We are surrounded by complicated [social] worlds. These worlds are a composite of multitudes of incommensurate elements, which often make them hard to navigate and, ultimately, difficult to understand. […] Complexity is a deep property of a system, whereas complication is not. A complex system dies when an element is removed, but complicated ones continue to live on, albeit slightly compromised. Removing a seat from a car makes it less complicated; removing the timing belt makes it less complex (and useless). Complicated worlds are reducible, whereas complex ones are not." (Miller & Page, 2007, p.9).

[3] "In ecological and socio-economic systems alike, patterns emerge at higher levels as result of adaptive dynamics at lower levels of integration. The nature of these systems as highly nonlinear complex adaptive systems means that prediction is limited […]" (Levin, 2002, p.15).

- the ongoing European integration and its 20-20-20 policy[4] (as short-term *megatrend*),
- a further economic globalization including the shift to more IT-based industry/ -technologies aiming at less vulnerability and higher adapting capacities of the society,
- a continuing liberalization of the European energy markets[5] with the goal of market-determined pricing, along with a globally rising energy demand and mobility requirements; as well as peak oil - sooner or later,
- an increase in single households, ongoing urbanization and individualization; an aging population[6],
- climate change and its consequences for the environment.

The three scenarios are intended to present plausible and more or less moderate future developments; they do not include (global) catastrophic events like (spontaneous) huge methane emissions, a significant weakening of the Gulf Stream or world wars, even if the possibility of such events have to be kept in mind.

In summary, the goal of the following scenarios is to identify the local trends linked to global development paths. Though the future remains inherently unpredictable, the historical dynamics along with the current trends indicate the risk of adverse impacts of global (climate) change (Nakicenovic, 2007). The scenarios intend to help to respond with anticipatory (energy) policies in order to meet future energy needs. No probabilities will be given, as well as specific normative guidelines like price stabilization, reduction of environmental impacts or energy import dependencies over the whole time – if they result they are just the spin-off of proactive economic and ecologically conscious policies.
To facilitate the identification of the following scenarios (while paying tribute to a postmodern mentality) they are called "Convenience", "Discount" and "Best Buy Scenario". Before presenting the specific assessments and calculations for each scenario, an overview of their main assumptions is given.

To calculate these scenarios the planning system LEAP was applied, an energy-environment model tool that allows bottom-up as well as top-down assessments

---

[4] The Member States agreed on the so called "20-20-20 until 2020" directive. It implies a reduction of CO_2-eqivalent emissions by 20%, 20% less energy use and a percentage of 20% renewables in the energy share. Specific country goals have yet to be decided. The Republic of Austria has similar goals in its national policies, including an augmentation of the renewable portion in the energy mix from 23% in 2004 to 45% in 2020.

[5] Liberalization leads further to an unbundling of energy generation, transmission and distribution.

[6] Currently Vienna's aging projections remain under those for the total population of Austria – due to relatively high migration gains. The volume of this migration flows depend strongly on the political and economic circumstances and therefore make prognoses difficult (Lutz, Scherbov and Hanika, 2003).

and whose scenarios are based on a comprehensive consideration of diverse driving forces like population, economy or technology and how they may influence the energy production, transformation and consumption pattern of a certain region.[7] Because of its high flexibility individual analysis requests can be easily accommodated. Very detailed assumptions regarding specific energy technologies and (economic and environmental) costs can be made. A general overlook of LEAP's key characteristics and calculation flows can be found in Appendix III.
Due to the wide scope of this paper, often general assumptions concerning space, time and technology features had to be made. Nevertheless, considerable interdependencies and feedbacks in the long run will be pointed out. The following scenarios can provide a basis for a more detailed analysis – considering longer time spans and a higher number of driving forces than in the past.

As LEAP provides a flexible and consistent framework for testing hypothesis, first a main structure for building the local scenarios had to be developed, whereas top-down considerations (i.e. population growth) were adopted in conjunction with bottom-up approaches (i.e. technology efficiency rates). The demand and the supply side of the local energy system were regarded separately. On the demand side development was distinguished by the branches private households, transport, agriculture, commercial and industry, each shown separately for the city of Vienna itself and the suburban areas. Input parameters were population number, area used for transport and utilities or agricultural purposes respectively, for the service sector and industry the gross regional product was taken as driver.
On the supply side of the Viennese energy system local electricity and heat capacities, each differentiated by technology as well as distribution losses within the grids, constituted the input into the system. Only data of the local energy provider were included.
Overall results (output of LEAP) are long-term energy demand and supply scenarios for the metropolitan area of Vienna. A comparison of the different scenario results at the end of this chapter demonstrates the divergent development options of the region. Further, associated GHG emission scenarios were calculated, as LEAP allows easy linking of these environmental parameters.[8]

A general introduction to each of the three scenarios will be followed by specific calculations. Their demand sub-scenarios illustrate the development in the final energy use for all branches. In order to cover the whole metropolitan area of Vienna, several assumptions concerning Vienna's surroundings had to be made, e.g. the transport sector. These will be explained later.

[7] Note: The first period of the LEAP scenarios covers a time span of more than 30 years (2005-2040) due to the fact that 2005 was set as base year, the other scenario periods as well as those of the added climate periods last 30 years.

[8] All settings and assumptions of the three scenarios can be found in Appendix III.

For the following energy transformation sub-scenarios, just the production capacities of *Wien Energie*, the municipal energy supplier, will be outlined and its development options presented. Although *Wien Gas* and *Wien Strom* (together: *Wien Energie*) provide certain suburban communities[9], they are presently not able and will not be able in future to meet the full Viennese demand. Already in 2005 half of the electricity supply had to be *imported* to the region. For the purpose of this study imported energy means that the energy is not provided by *Wien Energy*. The mainly fossil fuels *Wien Energie* imports into the city and transforms to electricity and heat are not considered as "imports". The areas which are not covered with the distribution grids of *Wien Energie* are generally served by the EVN, the Lower Austrian energy provider[10]. EVN and other providers active in the greater Vienna area are not explicitly treated in this study. This is due to data and time restriction and is deemed an acceptable simplification, as *Wien Energie* is by far the largest single provider for Vienna. However, to get a more profound insight into the local energy potentials, the total amount of currently installed capacities within the greater Vienna region should be regarded, independently of the energy provider, and a more rigorous definition of import and local production should be considered.

Because the region defined here does not form one administrative unit, the classical energy balance calculations offered by LEAP were not feasible. Classical import/ exports structures could not be identified. And due to the ongoing liberalization of the European energy markets with the goal of one European single market, this approach becomes increasingly questionable also in future. Assuming that the growing energy demand will be met (more or less) completely by imports from other national and international energy providers, the gap between local energy production and demand is and will be filled in future. In any case, this gap is likely to grow, depending on the different assumptions in the following scenarios, even if local capacities are extended.

Concerning the supply with adequate energy resources, LEAP offers the possibility to calculate resource scenarios for primary and secondary resources, based on assumptions about price development. In view of the volatile but tremendously increasing prices for fossil fuels at the moment, any assumption would not be more then a (bad) guess. As mentioned above, one cannot predict the future, especially not for a whole century. Therefore, instead of presenting cost-based resource sub-scenarios, the potentials of the available fossil and renewable (and cost-free) resources will be outlined. This can be justified, as the scenario calculations

---

[9] 15 municipalities and two cadastral municipalities are served with electricity by *Wien Strom*. *Wien Gas* provides natural gas for 67 municipalities outside the city's boundaries of Vienna and for another six located in the province of Burgenland.

[10] The company expanded strongly during the last years and is currently also very active in Romania and Bulgaria.

presented here are only intended to analyze the complex interactions between different driving forces to enhance understanding and make planning easier.

IV.1 The Convenience Scenario

There is a problem, there is uncertainty, and there is impatience. Despite the public (and political) will to solve upcoming problems, solutions get postponed. But the energy demand is met fast and simply, one could say convenient for everybody. The 'trial and error' slogan describing the approach in this scenario, leads to investments in all branches. The later the cost or benefit of an investment occurs, the less important it appears (his was termed "time preference" by Pearce (1990)), especially if the possible outcome remains quite uncertain. The Convenience Scenario based on the A1B path, a global convergent development with a steady, but quite unhurried replacement of old technologies with new (sustainable) ones. Under these general circumstances, Vienna is expected to follow neo-liberal politics. As no direct climate policies are included in the SRES scenarios, there is no normative ecological goal in this scenario either. Some governmental aid to foster technology research and investments will be given, also to cope with the European 20-20-20 policy in the short run, but efforts remain rather weak, long-term ambitions get delayed.

Because of numerous investments in all fields, the local economy keeps growing strongly similar to the last several years. There will be no structural change of economic patterns during the first period until 2040, and the trend to shift to the third sector remains. At the beginning of the second period (2041-70), both, peak oil and climate change implications start to occur and will slow down the economic performance of the region significantly. The temporal assumption concerning peak oil goes along with the estimates made in the SRES report (accordingly, peak gas is estimated around 2060). This is in agreement with some older of the EIA calculations[11], not with the latest peak oil studies. This assumption obviously requires a smiling fortune regarding the detection of more fossil fuels as well as considerable advancements of extraction technologies. In this case, the negative impacts of peak oil and of climate change on the local scale coincide (REMO/UBA calculations for A1B see III.2). Their serious effects will additionally decelerate the local economy, and only during the last period (2071-2100) melioration is to be

[11]The EIA published in 2003 a study concerning the future oil supply. It presents a world oil production forecast assuming different annual demand growth rates and resource levels; i.e. by an annual demand growth of 2% and the mean expected ultimate recovery level peak oil occurs around 2037. The whole forecast ranges between 2021 and 2112 (Wood, Long, and Morehouse (EIA), 2003).

assumed again, due to improved adaptation technologies and greater use of sustainable technologies.[12]

Looking at the society's development, initially the population growth of the whole metropolitan area will continue. This goes along with the official Austrian scenarios. A great part of the population growth is due to migration gains in the city as well as in the city's surroundings. The population of the suburban area increases most intensely during the first period. But because of the loss of economic attractiveness of the metropolitan area, population growth will slow down (a delay of the response to the economic development is assumed). During the last period until 2100 population numbers begin to slowly rise again.

The lifestyle of the majority of the society described here is characterized by slow changes of habits concerning for instance mobility, diets or recreational activities. No fundamental change of the environmental consciousness is assumed. As individualization is one of the *megatrends* in all scenarios, the number of single households will rise further.

Despite the steady improvement concerning efficiencies and new technologies that allow a stabilization of energy prices on a high level (oil and gas remain important energy sources for a long time, while costs of alternative technologies decline continuously), no radical change in energy use is expected during the first period (as in the baseline scenario by Kratena and Wüger and, respectively, Veigl).[13] With a moderate trend to a higher proportion of electricity in overall usage, the total absolute energy demand will rise. Because of the economic downturn in the middle of the century, the final energy demand almost stabilizes. Technological enhancements enable a stronger decoupling of (economic) development and energy demand especially during the last period, but they will not stop a recurrent increase in the overall demand.[14]

Emissions and thus environmental impacts remain high long after the mid-century. The A1B scenario and its local implementations come along with the most dramatic ecological consequences. Even if adaptation technologies improve continuously, the (financial) costs for economy, especially in the field of agriculture and human health as well as for the biosphere rise significantly and lead to lasting restrictions

---

[12] Note: The assumptions concerning the economic development are just overall valuations, viz. if there is a remarkable decline of the economic development over one period (30 years and more), it is assumed that serious recession and even economic crises are very likely to occur within the same time span. As the economic system is very dynamic, regular short-term ups and downs seem inherent.

[13] The SRES scenarios also include the use of nuclear energy sources. These potentials will not be taken into consideration for these local scenarios, as current national policies currently exclude this possibility for energy production.

[14] The goal of the European energy policy is an improvement of the energy efficiency by 2% p.a. This value was further adopted in the baseline scenario by Kratena and Wüger - but not for private households and the service sector! The real rate reached about 1% p.a. between 1990 and 2003; for the Convenience Scenario it ranges in total between 0.7 and 0.5% p.a. (for electric appliances).

for the regional development. Not only the global consequences for the climate have to be mentioned here, also local environmental effects like tropospheric ozone production, noise levels and concentrations of particulate matter would accumulate noticeably (see IV.5).
The quantitative assumptions describing the scenario outlined above are described in the two sub-scenarios in the next sections.

IV.1.1 Demand Sub-Scenario

In the Convenience Scenario the overall population continues growing quite strongly by 0.7% p.a. over the first period, to a great part due to migration gains. Because of decreasing economic attractiveness in the second period, population growth slows down to annually 0.5%. Until 2100 population numbers begin to rise again a little up to 0.6%. These assumptions go along with current population estimates by Lebhart and Klotz until 2035 (2007) and Hanika until 2050/75 (2007).[15] These developments cause a shift in the proportion of people living in and around the city. In 2005 2,248,960 people live within the whole area, 73% in the city itself, 13 and 14% in the northern and southern suburban areas. Slowly the urban percentage will decline to 70% in 2040 and finally to 65% in 2100.
Suburbanization dynamics will remain strong, especially in the northern areas. Hence, along with the population growth, changes in land-use patterns occur. Higher densities in and especially around the city of Vienna are estimated, the proportion of built land increases.[16] Further, a stronger use of agricultural areas for biofuels is to be expected.
A basic assumption in all scenarios is that all households are electrified and have heating possibilities. An average urban household needs 15,000 kWh/a.[17] The

---

[15] Concerning the ÖROK/ Statistics Austria prognoses of 2004, it matches the ‘growth scenario’ until 2031.

[16] ÖROK, MA 18, PGO and other studies state that also in future suburbanization will remain a strong trend and gains the highest increase by migration flows coming from the city. It depends on the economic performance of this region as well as many other issues (decisions can depend on previous land-use patterns, service supply, accessibility etc. (Loibl, 2004), which form a complex interaction and allow forecasts just for up to 10-15 years. From then on, only estimates, in this case scenarios, are feasible. Thus, their basic scenarios estimate the strongest population gain in the close suburban areas as well. Mayer, Lutz and Loibl (among others) report the highest increase will occur in the northern/ north-eastern communities (due to planned traffic developments and already high housing densities in the southern and western parts (up to 1000 residents/km²), which seem to have reached their peak already) and further those in the Vienna Woods.
The development concept of the suburban area envisages an ongoing rise especially in the district capitals; 80% of the 166 municipalities were planning new housing in 2001, whereas loose developments are preferred – the single-family house on the outskirts remains the ideal for lifestyle, as Mayer’s study of 2004 could attest. So far, a post-suburbanization trend appears only slightly in the southern parts of Vienna’s suburbia (confirmed by Helbich, 2008), and confines the percentage growth of economic activity in the suburban areas to different degrees in all scenarios.

[17] Calculated according to data released by Statistics Austria.

amount of energy needed by suburban households had to be estimated, as there are no official data available. According to the London Energy Study Report 1993[18] the amount of energy used by an urban household in the outer parts of cities lies 30% above that in the inner parts (due to the settlement structures). The difference between high and loose housing densities concerning heating requirements reaches about 10% in Vienna (Auer et al., 1989). These results were adopted for the present[19], but from the mid-century it was assumed, that this gap begins to close. Further, it is supposed that the share in private energy uses (i.e. lighting, heating, electrical devices) is equal to that in Vienna (these data were taken from SEP, 2006). Today the losses between final and useful energy demand reach an average of 40%. The efficiencies for electricity use (now about 35%) and heating purposes (about 85%) are assumed to rise slowly during the first period, and from the mid-century there will be stronger improvements due to technological progress. Concerning the per capita rise of energy demand, there will be a strong growth for electricity, especially for cooling reasons.[20] Heating rates will decrease slowly until 2040; henceforward it declines steeper due to rising average air temperatures. So the rise in private absolute and per capita energy demand for electric devices competes in this scenario with the improvements in technology and the falling heating demand[21] because of local climate change. The following figures illustrate the Convenience Scenario.

---

[18] LRC (1993): London Energy Study Report, LRC, London. Cited in Santamouris, 2001.

[19] So far, there are no detailed energy data for the Viennese suburbia. The Climate Alliance of Austria provides a CO_2 tool, which allows calculating emissions and thus energy data on a municipal scale. A better possibility to get more exact data for future calculations could be offered by a current national project, "Energy Systems of Tomorrow" which aims to generate energy data on district level.

[20] Note: at the beginning all scenarios start with an annual growth rate in energy intensity for cooling by 2%. The BAU scenario published in the SEP (2006) assumes an increase of 2.3% p.a. until 2015.

[21] Heating requirements vary strongly due to high spatial and temporal variabilities of the weather in wintertime; the energy demand for heating purposes can vary by 700 heating degree days (HDD) for an average of 3200 HHDs (1951-80). HDDs are a measure to reflect the energy need for heating (also cooling, in this case CDDs) purposes. They are defined as the difference between a reference value of 20°C (the room temperature to be reached) and the mean outdoor temperature for every day, with temperature not exceeding 12°C as a daily average. These degrees are added for the winter season from October until April and provide a rough estimate of seasonal energy requirements (in Vienna).
In future, this variation is likely to decrease as one consequence of rising temperature caused by climate change. This could ease the energy planning a little (at least in this case). The number of HDDs is reduced by the UHI; it can reduce the heating period up to eight days/ year (Auer et al., 1989). The larger and the denser urban areas are, the more this period can be shortened. In view of a rising population pressure in the metropolitan area of Vienna, this is another important factor in reducing the heating demand.

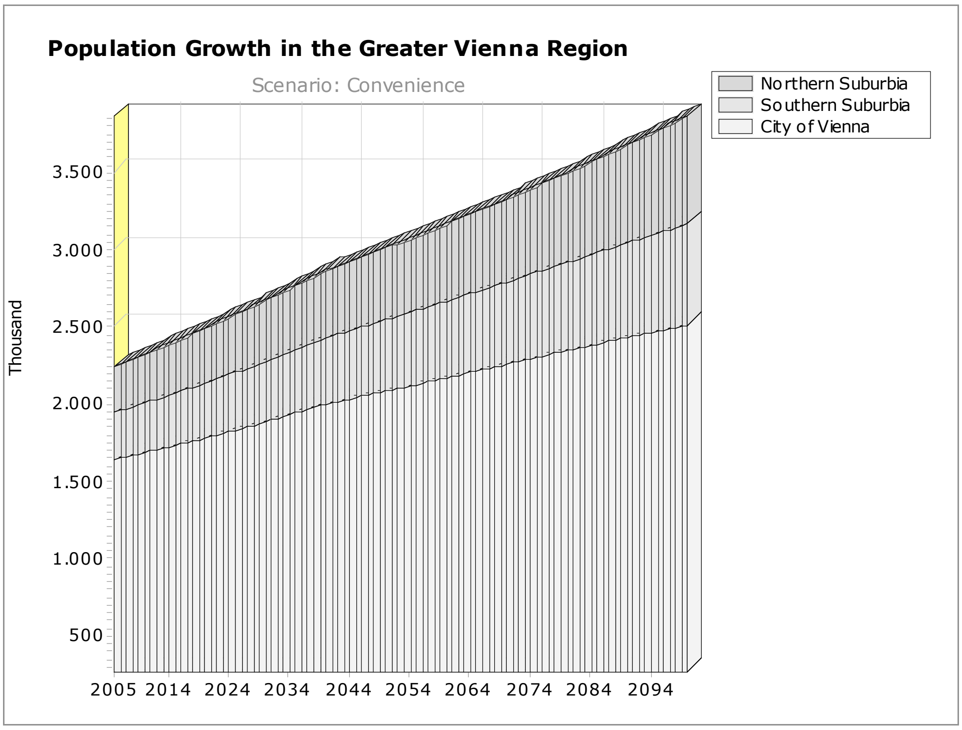


Fig. IV-1: Population Growth in the Greater Vienna Region (Convenience)

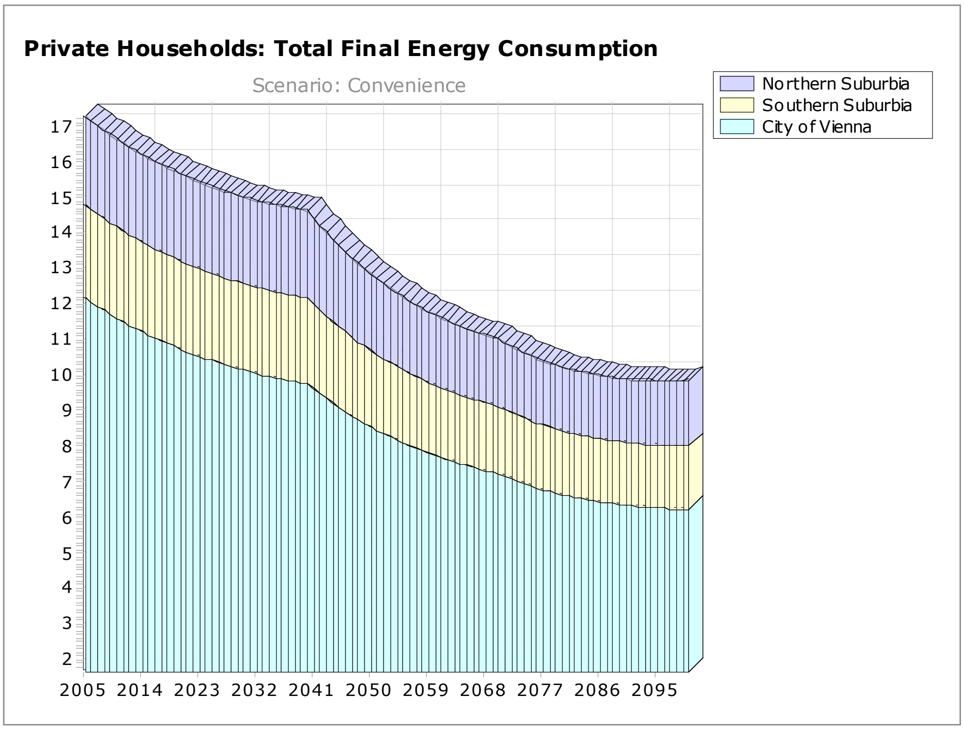


Fig. IV-2: Private Households: Total Final Energy Consumption (Convenience)

Estimates of the energy demand in suburbia had to be made regarding the transport system. The energy needed presently per hectare for transport and utilities in Vienna was taken to represent the energy needed in the outskirts, while assuming a slightly lower intensity of use.[22] Again, there is a slight proportionality shift in the area: in 2005 the percentage of the transport area within the city's boundaries amounts to 98% and will fall to 96% until the end of the century. In the beginning, due to population growth, the intensity as well as the overall area of transport grows. This trend weakens from the middle of the century, not because there is less need, but due to technological improvements (from 2040 the there is a notable shift of fuel shares towards more electricity). During the last period, the intensity of energy used per hectare of transport area begins to decrease a little (population growth levels out, there are more efficient technologies).

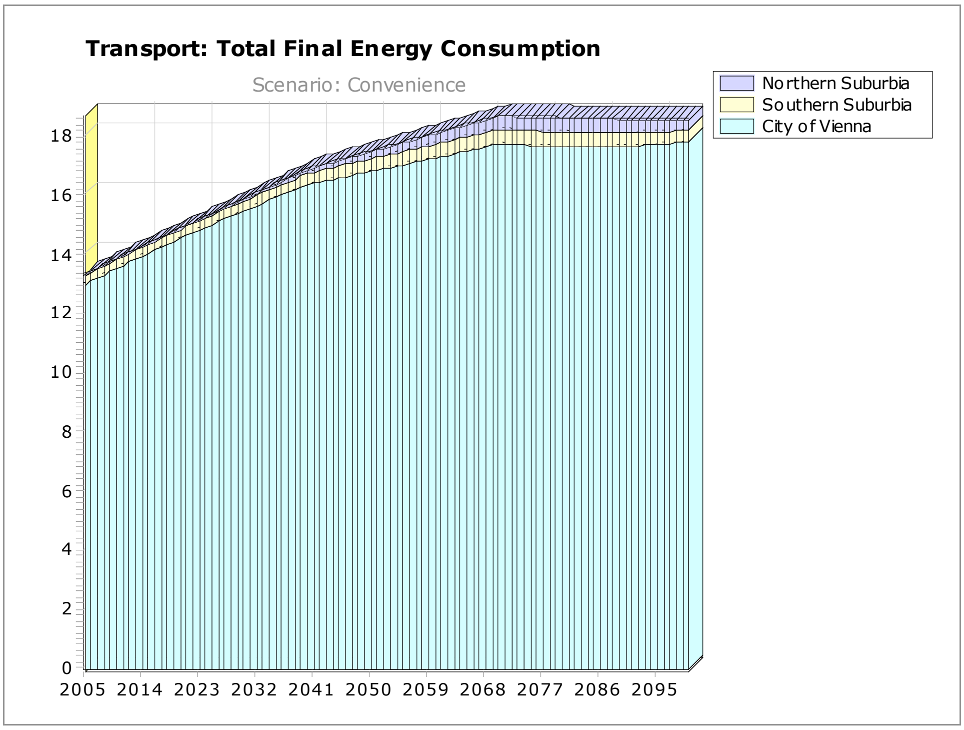


Fig. IV-3: Transport: Total Final Energy Consumption (Convenience)

To calculate the overall energy demand in the area in agriculture other parameters were needed. The basic assumption was that type and intensity of cultivation in the surroundings are similar to those within the city's boundaries. The data found for agricultural energy use and share within Vienna, were extrapolated to the whole area used for agricultural purposes; that amounts to more than 95% of the suburban areas.[23] The proportional share of energy of the three areas appears as in the chart below and is the basis for all three scenarios presented here.

[22] 5% as estimated value.

[23] Land-use data for Austria are collected every ten years through the European project CORINE. Currently available data derive from LANDSAT 7 of the year 2000 and were adopted here for the base year 2005, assuming that no large changes occurred within this time span.

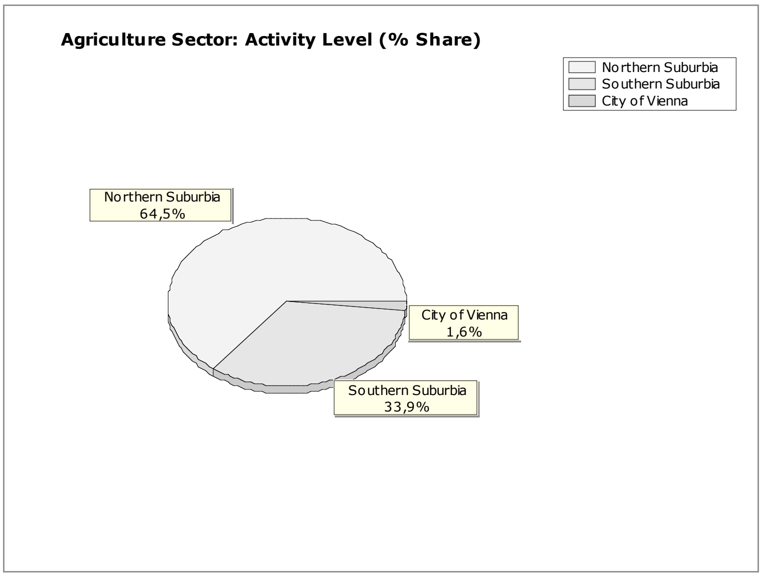


Fig. IV-4: Percent Share of the Primary Sector (Convenience)

The whole agricultural sector consumed about 11,000 GWh in 2005 over an area of 408,000 ha. Due to the ongoing suburbanization trend, this area will decrease a little until 2040; during the third period it rises again slightly, due to growing resource needs. Energy efficiencies will be improved, but as the predominant percentage is needed for heating purposes with already high efficiencies, savings will be small. From the mid-century it is presumed that a respectable part of the land will be used (simultaneously) for biofuel cultivation. But no observable changes concerning the energy intensities per hectare are to be expected over such a long time horizon. Under these circumstances the overall energy demand for the primary sector shows a decline (*Figure IV-5*).

As this study intends to give an overview and does not claim total accuracy, these data seemed sufficiently precise.

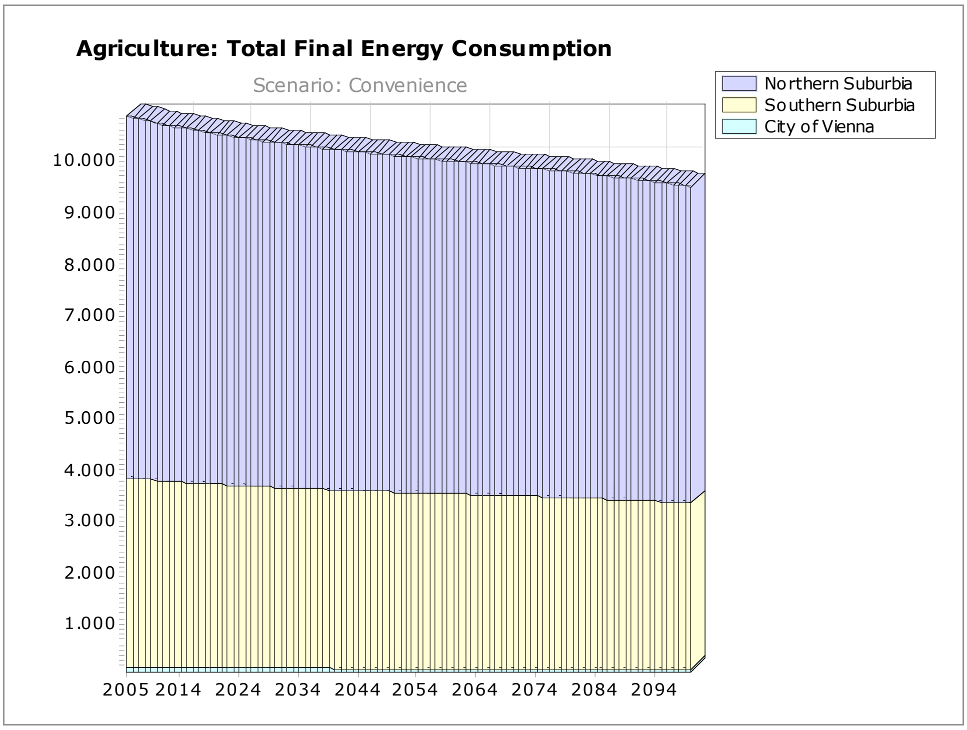


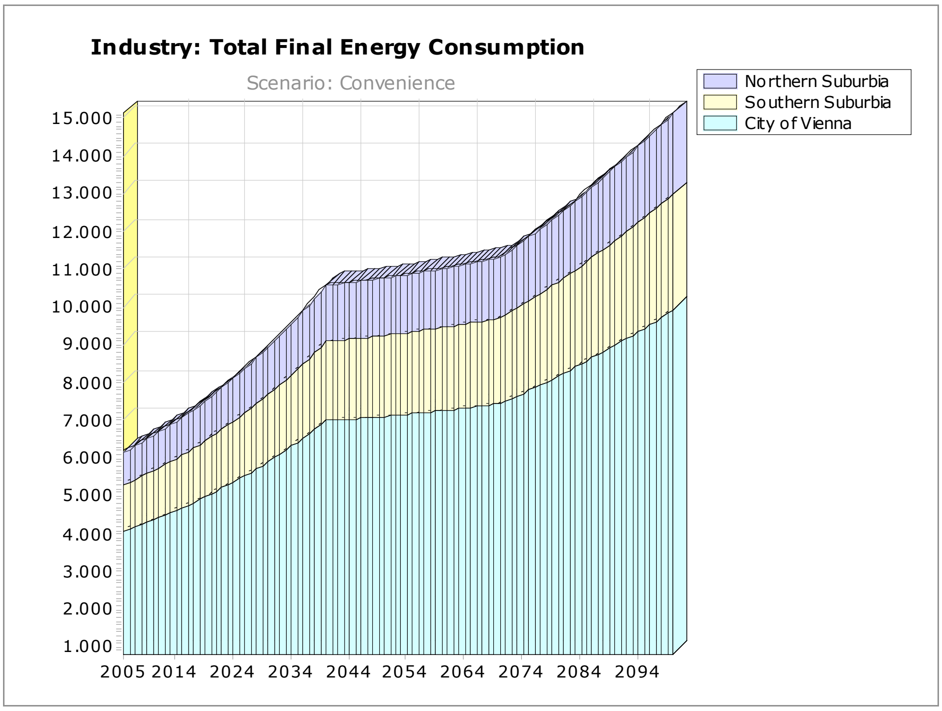
Fig. IV-5: Primary Sector: Total Final Energy Demand (Convenience)

As mentioned above, economy keeps growing quite strongly until 2040 (on average!). The GRP of the agricultural sector is not expected to rise as it makes up just a minimal percentage of the overall GRP. The main part of the economic development (about 80%) in the region derives from the commercial sector. For the following demand sub-scenarios commerce and industry were regarded separately. To estimate the energy demand for the suburban areas in 2005, the energy intensity needed for the city's economic performance was again extrapolated for the outskirts; assuming economic structures are similar within the whole region.

To reach an overall annual economic growth of 2.5% during the first period, the commerce sector continues to grow by 2.8% p.a., industry by 1.3% p.a. The proportional share of the GRP will shift a little in favor of the suburban area, also because of a slow post-suburban trend in the future (cf. Helbich, 2008). Energy efficiencies will improve as in the previous sub-scenarios. While the industry requires a strong portion of the energy share for heating purposes (as private households do), the service sector mainly relies on electricity and will therefore gain more by the assumed efficiency improvements. To define the growth in energy demand to reach the assumed GRP in future, it is supposed that by a rise of 1% of the GRP, an almost equal rise in energy demand occurs. These results were found by Jones, 1992[24] and were set for the commercial energy intensity concerning

[24] Jones, B.G. (1992): Population Growth, Urbanization and disaster Risk and Vulnerability in Metropolitan Areas. A Conceptual Framework. In: Kreimer, Alcira and Munasinghe (eds): Environmental Management and Urban Vulnerability. World and Discussion Paper No. 168, World Bank, Washington. Cited in: Santamouris, 2001.

electric appliances and lighting; for industry an additional rise in energy intensity was only assumed for electric devices. Stronger increases are expected for cooling purposes, a decrease regarding heating requirements. Due to a steady "decoupling" of economic growth and energy demand and the energy efficiency enhancements of the last years, these assumptions were already downsized for the first period and even more so for the second and third period of the Convenience Scenario because of technological progress. *Figures IV-6* and *7* illustrate the growth in energy demand.



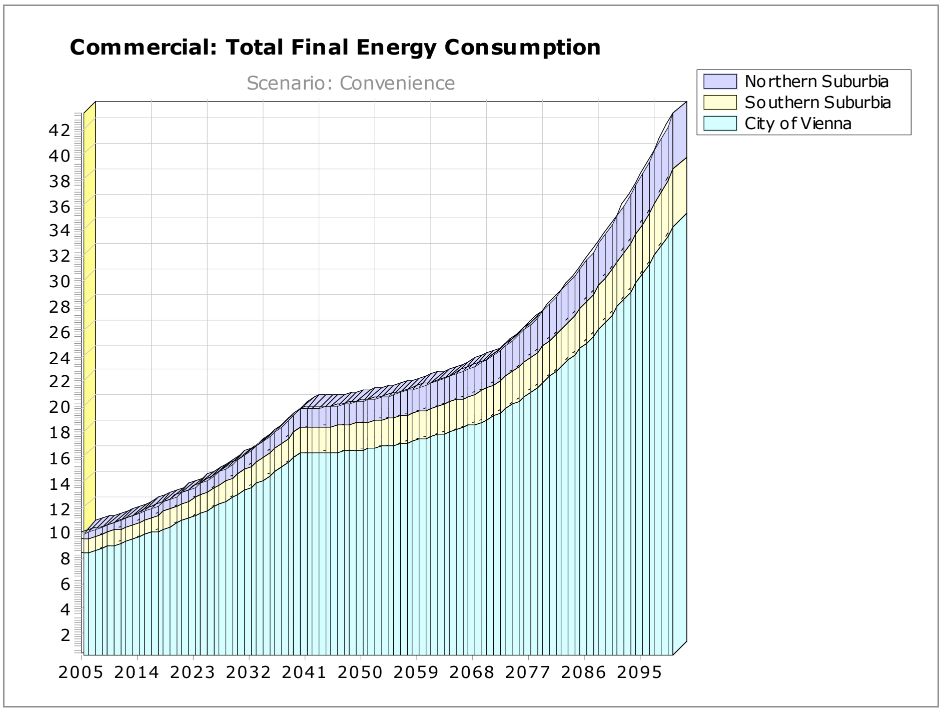


Fig. IV-6 + IV-7: Secondary and Tertiary Sector: Total Final Energy Consumption (Convenience)

So summing the growth of the final energy demand according to the Convenience Scenario up, there is a tremendous growth most of all due to economic development and delayed energy efficiency efforts. Private household energy demand declines absolutely and per capita, but is still competing with a rising population, including an ongoing suburbanization trend. Also the agricultural sector shows a decreasing energy demand, as transport comes up with growing numbers.

Energy scenarios by Veigl, published in April 2008, relying on the baseline scenario by Kratena and Wüger 2005, calculated a rise of the PED by 1.2% p.a. until 2020. The growth in energy demand until 2020 in the Convenience Scenario turns out to be about 0.6% p.a., that is half of that of Veigl. Both scenarios expect stagnation in oil consumption and rising numbers for renewables as well as natural gas (and possibly coal) for heating purposes. Regarding the three periods of the scenarios presented here, final energy demand rises by 0.8% p.a. until 2040, then by 0.1% yearly and from 2070 until 2100 by 0.8% p.a., as population and economy rises more strongly again. The useful energy demand grows by 0.5% p.a. during the first years, in the second period it stagnates and then rises again by 1.2% p.a.; both growth rates converge during the second period. The fact that PED is lower than the useful energy demand indicates remarkable efficiency improvements in the last period.

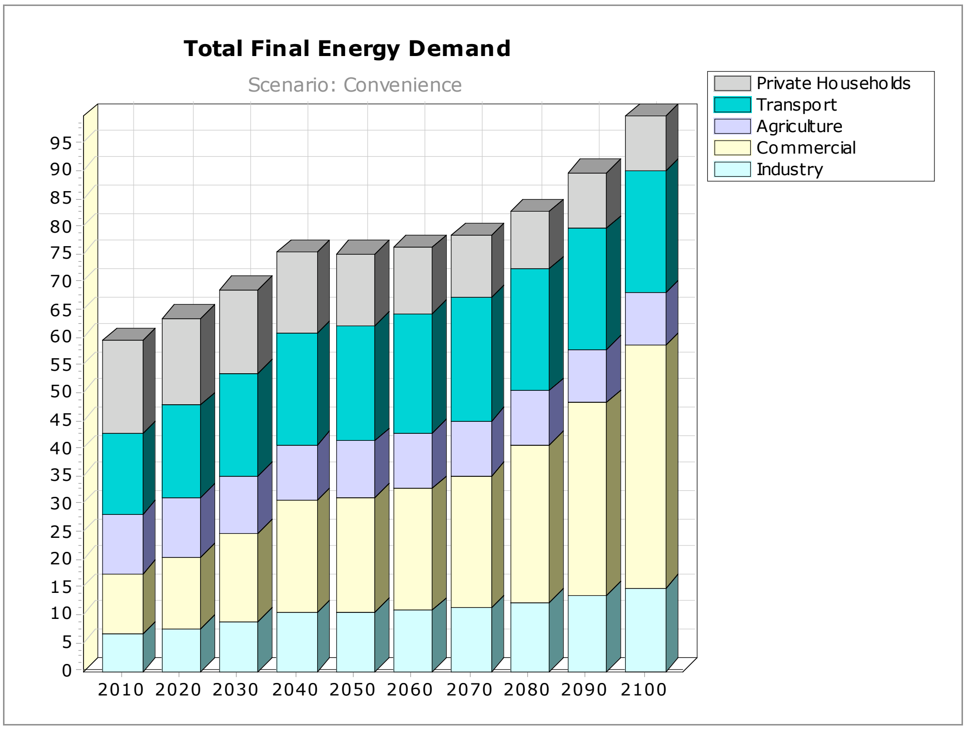


Fig. IV-8: Convenience Total Energy Demand

IV.1.2 Transformation Sub-Scenario

As mentioned above, a complete LEAP energy balance cannot be presented here, though a rough overview can be given. It relates the increase of the energy demand as in the previous demand sub-scenarios to the supply necessary to meet this demand.[25]

1000 GWh	2005	2040	2070	2100
Total Primary Supply	66	91	91	112
Electricity Generation	-3	-3	-1	-1
Heat Generation	-4	-10	-9	-10
Transmission and Distribution	-2	-2	-2	-2
Total Transformation	-8	-15	-12	-12
Private Households	17	15	11	10
Transport	13	20	22	22
Agriculture	11	10	10	10
Commerce	10	20	24	43
Industry	6	11	11	15
Total Demand	58	76	78	100

Fig. IV-9: Energy Balance for Convenience Scenario

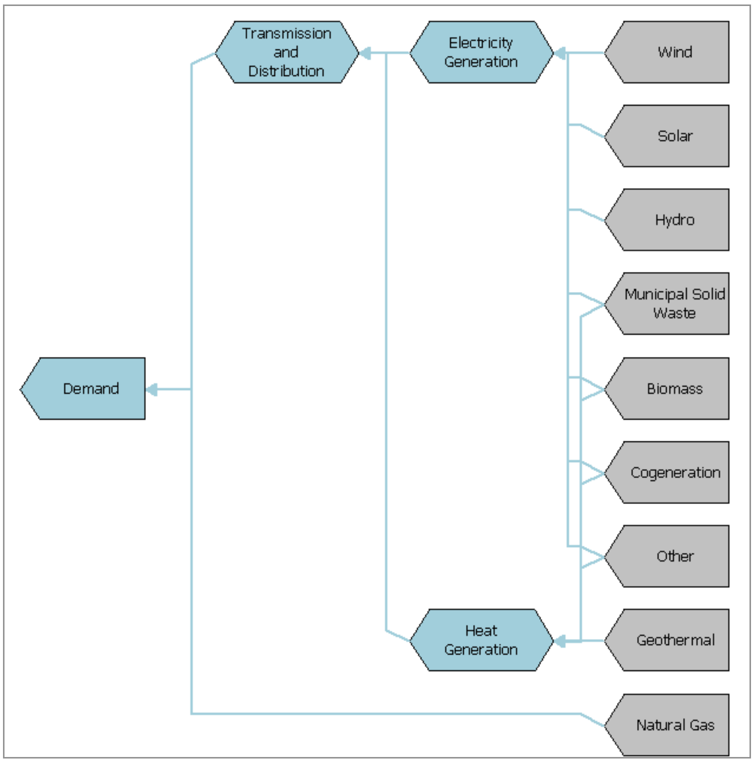


Fig. IV-10: Schematic Energy System and Flow (Wien Energie)

[25] The usage of gas is included in the electricity and heat generation processes (see also *Figure IV-10*).

Parts of the supplied energy derive from *Wien Energie.* An overview of the energy system and energy flow is given by *Figure IV-10*. The following graphs show resource choice and development in production capacities including technology specific efficiency improvements according to the Convenience Scenario.

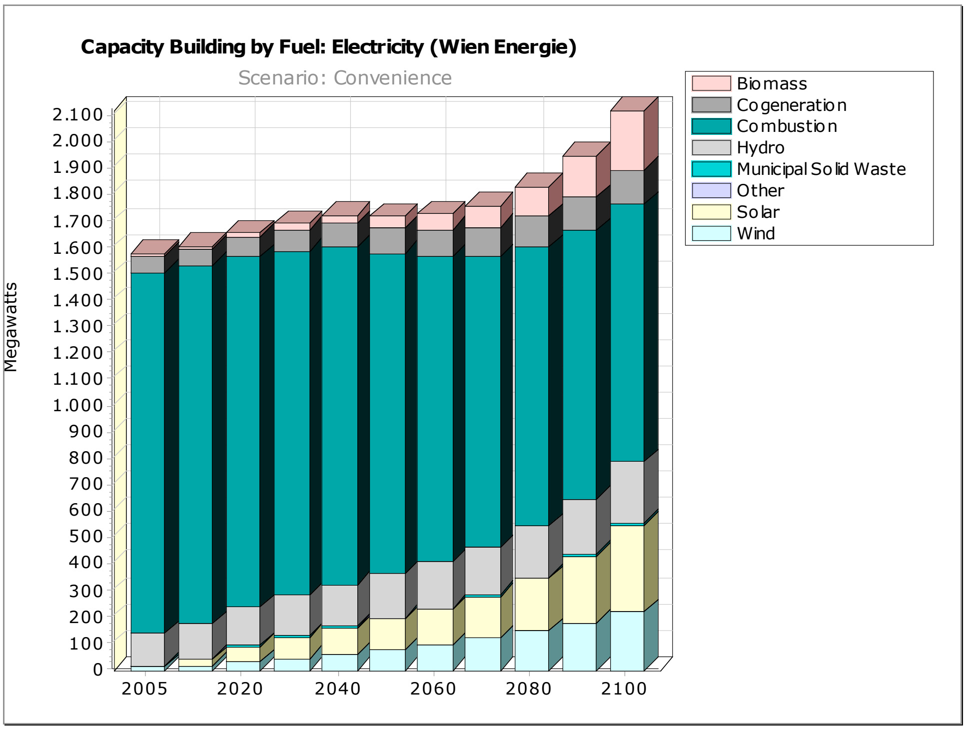


Fig. IV-11: Capacity Building by Fuel: Electricity (Convenience)

There will be investments in all energy resources. Steadily the renewable capacities are expanded, on the one hand by empowerment of already existing plants and on the other by new ones.[26]

As potentials of renewable resources are spatially limited by the city's boundaries, it is assumed that investments will be made primarily in the suburban area. Spatial planning is one of the major preconditions to implement the production and use of renewables, i.e. defining locations for biomass plants or wind parks; renewable energy should be a permanent issue in regional development strategies (PGO, 2008).[27]

---

[26] There are already several (national) studies about the necessity and applicability of energy alternatives. Different governmental and academic organizations are working on this issue and an attempt was made to gather most of them for this paper in order to integrate their results in the three scenarios.

[27] Urban sprawl and conflicts of land-use interests could diminish realizable renewable energy potentials in future remarkably. Spatial planning makes up an important instrument to counter such developments. The interest of this policy field is strongly growing in Austria at the moment; i.e. the Lower Austrian spatial planning law allows to banish areas from renewable energy production, the definition of grassland even includes the concrete banishment of wind parks (Lower Austrian Raumordnungsgesetz 1976 LGBI.Nr. 13/77, idF LGBI.Nr. 72/07 according to ÖROK, 2008).

Capacity building concerning cogeneration will slow down a little from the mid-century due to a continued high reliance on fossil fuels of this technology. Solar energy for electricity purposes is introduced as new technology. Photovoltaic cells are already in use, but still too small to figure in overall statistics. Efficiencies will enhance slowly during the first period, but they speed up from 2040 for biomass and solar technologies and allow a much higher process share in the electricity generation. Due to a rising demand for electricity services, the providing of *Wien Energie* increases by about 20% until 2100.

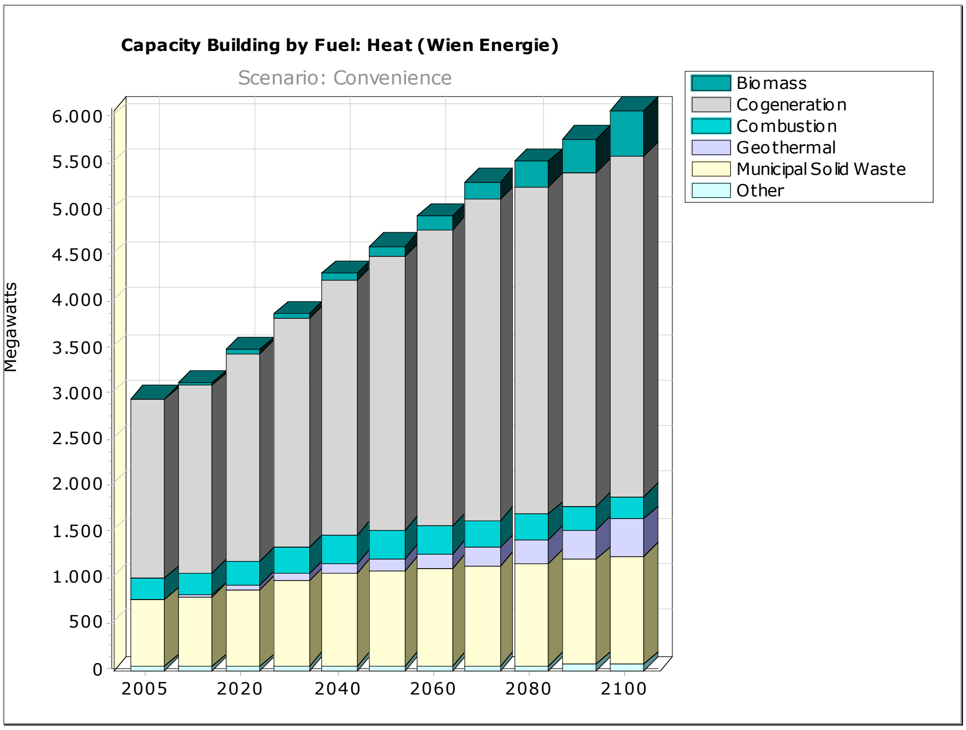


Fig. IV-12: Capacity Building by Fuel: Heat (Convenience)

Regarding heat requirements, the per capita need will decline during the whole scenario, especially from the mid-century. But due to investments in promising cogeneration (with a little slowdown during the last period) as well as renewables there will be growing capacities in heat generation. Within cogeneration growing shares for biomass are assumed. But still fossil fuels will be needed, also for other technologies, here summarily called combustion[28].

There will be strong efforts concerning the efficiency of biomass usage. Also geothermal energy generation will play a noticeable role in future; as efficiencies for geothermal as well as for cogeneration are already high, there will be just small enhancements; for the other technologies moderate improvements are assumed.

[28] Use of (peak) boiler requiring fossil fuels for the generation process.

Losses in the energy grids of *Wien Energie* are already small, even today[29], but they will be reduced further. Together with efficiency improvements the proportional losses during energy transformation and distribution can fall from at least 12 to 10.5% (see also *Figure IV-9*).

Of course, there are other (new) technologies as listed in the charts above, i.e. electricity from geothermal or solar thermal systems, and their potential could rise, as applications to façades or in transport and utility areas are explored. As the Convenience Scenario expects limited investments in those technologies, they remain just one of many possibilities summed up in the category other.
The development of the total energy outputs of *Wien Energie* are presented in the following table.

	2005	2040	2070	2100
Electricity Output (1000 GWh)	9,8	11,8	11,5	13
Heat Output (1000 GWh)	7,6	7,4	4	2,5
Total Energy Output by *Wien Energie*	17	19	16	16

Fig. IV-13: Energy Outputs by Wien Energie

But comparing these results with the rising energy demand, the allocation of both will grow significantly. Lower heat outputs indicate that the full heating requirements within the greater Vienna region will be met[30]. Thus, the gap will be caused primarily by electricity requirements. Imports will fill this gap, but in view of the global scenario assumptions for A1B, a high reliance on fossil fuels remains for a long time, also within the capacities of *Wien Energie* – with all the environmental consequences. Further, peak oil influences the import opportunities severely and causes energy prices to rise even more steeply from 2040.

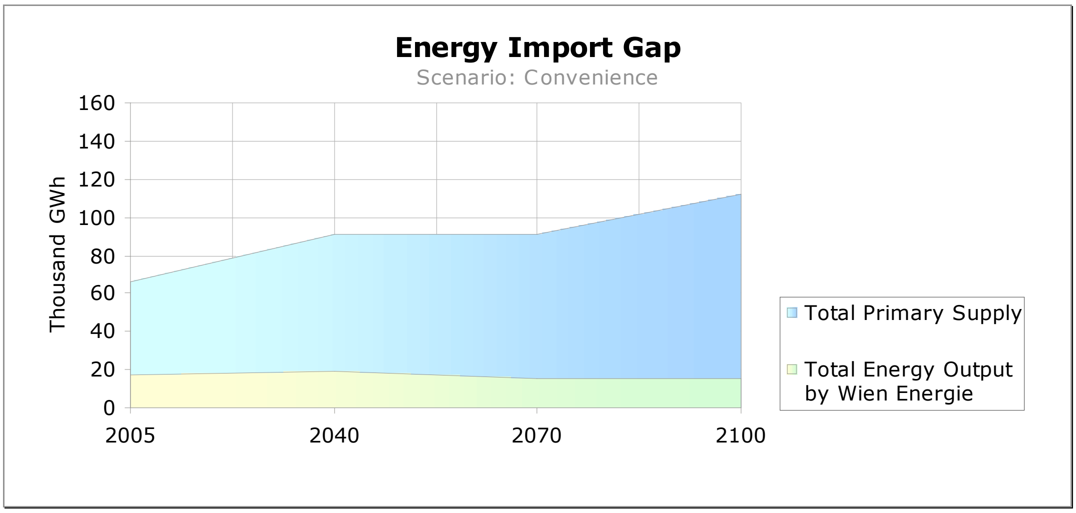


Fig. IV-14: Convenience Energy Import Gap

[29] 5% for electricity and 7.5% for heat in 2005.

[30] Note: "surplus" capacities can be used for cooling purposes.

IV.1.3 Convenience Resource Potentials

Energy prices for fossil fuels will rise, accelerated by peak oil at the end of the first period, and are followed by peak gas and peak coal (as well as peak nuclear). The consequences are illustrated by the economic and later the population developments. In return there will by higher investments in alternative energy resources. Technologies with the highest local potentials are photovoltaic, geothermal, hydro and wind energy, as stated in two current state-of-art studies (by PGO, 2008 and ÖROK, 2008). All of these resources are available cost-free, but what about their future potentials? How does local climate change according to A1B influence their potentials?

Geothermal, evidently, is free of any external influences and high potentials are found in the Vienna region[31]. But for the others considerable changes are to be expected. The local capacities of hydro power are quite limited and already highly efficient; just re-powerments of the already existing plants will add little to the electricity generation. But due to an A1B climate there could be remarkably more precipitation in spring and wintertime. As long as the energy demand peaks in winter that implies an advantage for this technology. In contrast, higher temperatures during summer can also cause less rainfall. Probably there will be a shift of the demand peak - less energy demand for heating purposes in winter and higher demand in summer for air conditioning. Thus, other renewable energy sources have to be used in order to meet the electricity demand in summertime. Photovoltaic cells offer a good solution. The model results explained in section III.2.2 do not show significant increases in radiation during summer; nevertheless summer is the season with the highest radiation rates.[32] As considerably lower radiation rates were calculated for spring, the usage of solar energy during this time of year seems less attractive.
Remains the wind option. There is already a lot of wind in Vienna. Following the local A1B scenario the average wind speeds will drop for most months. Just in spring and in December after the mid-century the mean wind speeds go up and thus increase the energy potential. But still, wind energy offers a valuable

---

[31] PGO considers the geothermal potential as „absolutely attractive" in the areas around the municipalities *Stockerau and Schwechat, Marchfeld* as well as in the Viennese districts *Donaustad*t and *Simmering.* The temperature gradient reaches 30°C/ 1,000m in the Viennese basin. (PGO, 2008). Also ÖROK (2008) states significant potentials concerning hydrothermal and near-surface geothermal energy.

[32] Highest solar radiation rates are reached in July with about 220 W/m² in average and the highest share of direct radiation. (*Hohe Warte*, 1961-90), The REMO/UBA model integrated these rates, viz. clear skies for the summer months, though future cloud patterns remain highly uncertain (see III.2.2.3). So calculation results for this season are highly questionable, but anyway summer time will remain the season with the highest potential for solar energy. Further, when installing the photovoltaics (or even solar thermal applications) the best locations are to detect; direct radiation rates show remarkable variations depending on orientation and inclination.

possibility for electricity generation.[33] Although the installation of new power plants is limited by legal restrictions within the cities boundaries, there are profitable opportunities in the suburban areas.[34]
Biofuels remain another promising option despite climate changes, if the agriculture sector manages to adapt.
In conclusion, the region offers several advantageous potentials[35] for renewable energy technologies also in the future, although diverse seasonal characteristics and shifts have to be taken in consideration. Overall, potentials are still favorable, even if implementation takes a long time in the Convenience Scenario.

IV.2 The Discount Scenario

'What happens if the optimists are not right and we behave as if they were?'[36] Just as Rome wasn't burnt in a day, a 'do nothing approach' would probably not immediately lead to a crash. Trying to buy the future in a discount manner, as if resources were cheap and endlessly available, will work out for some time (as it did the last decades). Shortages, negative outcomes or even surprises often do not show up immediately, whether you look at the quality of a product or ecological impacts. But impatience and a questionable system of norms and values at present make short-term thinking in terms of economic efficiency highly attractive.
The Discount Scenario is based upon the A2 path, viz. a fragmented global development. Within this path, it is assumed that the Vienna region lags behind - this assumption is made to broaden the scope of possible future local developments. (Economic) policies rely on the market, and environmental endeavors like the European 20-20-20 directive are just taken as good advice. There is no noticeable awareness regarding ecological issues or the future energy demand – time preference and near-term cost-effectiveness dominate.

---

[33] Note: Usually the peak demand does not match with the highest wind energy supply. Hydropower offers more continuity; solar power can be stored and is therefore more reliable.

[34] At the moment there are twelve wind parks installed within the city's boundaries, especially in the south-eastern and northern outskirts. High population densities and conflicts of interests limit the number of these plants. Still, for a city with dimensions like those of Vienna, it is a remarkable number and re-powerment is a valuable option for capacity building; maximum potential for Vienna is seen at 30 plants. In the whole suburban region already 268 wind parks exist, high potentials are expected in the districts of *Bruck an der Leitha, Gänserndorf, Korneuburg* and *Mistelbach.* These are the results of a PGO study, a state-of-the-art bottom-up approach. In contrast, an ÖROK study appears as a top-down assessment. Their calculated wind potentials vary as a consequence of different distance ranges to built-up areas. Lower Austria could provide a third of the total Austrian wind potential.

[35] The present PGO study presents the current potentials for biofuels, wind and geothermal. More information concerning renewable energy potentials (including also solar and hydro) can be found in the ÖROK study, which is to be released in spring 2009.

[36] Pearce, 1989, p.10.

Regarding economy, there are only low investments and therefore little progress in research and development. With no structural change, the economic growth slows down to less then 2% p.a. on the average during the first period until 2040. Peak oil accompanies this development from the beginning. In contrast to the Convenience Scenario, current studies of the IEA[37] or ASPO are referred to here; they estimate the maximum oil production occurring somewhere between now and 2012/2015. This conflicts with the SRES estimates in general (for the A2 path peak oil was estimated in 10-12 years from now), but together with the EWG study mentioned in the next scenario, this assumption seems to be more up-to-date and reliable than the EIA assessment cited in the previous scenario. The high GHG emissions resulting in the A2 path could be also ascribed to an assumed global increase of coal production. With the second period that is from the mid-century, the consequences of climate change become apparent locally and again affect the economy. The annual economic growth drops painfully. Depending on the city's performance during the second period and the continuous lack of technology investments, the city struggles hard to recover in the last third of the century. Only a weak melioration seems achievable.

Population numbers keep growing, but due to the instable economic conditions, migration flows remain under the *Convenience* assumptions. High unemployment rates slow demographic dynamics; the aging population becomes also more important for the city of Vienna[38].

There is no change in lifestyle preferences at least until 2050. Despite high energy prices, impacts of pollution and climate change on human health increase within the city area, a consequence of the 'traditional' production and transport habits. This pushes people continuously towards the outskirts. Suburbanization remains a strong trend even during the second scenario period. According to this development, the inner city density rises slowly, while in suburban areas the proportion of built environment increases considerably, with all the consequences concerning environmental pollution there.

As already mentioned, due to peak oil and strong dependencies on imports of fossil fuels, the energy prices climb severely. The increase of absolute and per capita demand and the usage of traditional resources impact the global climate seriously also long after 2100. The gap between final energy demand (FED) and energy supply grows moderately compared to the previous scenario, but energy shortages or even blackouts seem imaginable now and then. A shift to a higher proportional need for electricity is to be expected. Only the economic decline limits this development.

---

[37] See Birol (IEA), 2008.

[38] In contrast to the other scenarios.

The consequences of the A2 Scenario for the local climate can be seen in section III.2. The future climate change is quite as serious as for A1B, but with two big differences: the local environmental impacts are much higher and the economic decline constrains the development and application of adaptation strategies and technologies more strongly.

IV.2.1 Demand Sub-Scenario

Influenced by the insecure economic performance, the overall population will grow by 0.5% p.a. during the first period and thus remains under that of the Convenience Scenario. After 2040 it slows further down to yearly 0.3% and almost stabilizes until the end of the century at 0.2% p.a. Comparing the first 25 years with other current forecasts published by ÖROK in 2004, they remain within the boundaries of the presented alternatives.[39] As in the previous population assumptions there will be a shift in the percentage of people living in suburban areas. As there are no significant lifestyle changes, viz. an ongoing usage of resources and materials, at least until 2050 and a further worsening of the environmental conditions in the inner city parts, suburbanization trends remain quite strong and at the end of the century lead to a urban population share of less than 60% within the city (with a 'melioration' during the last period).

As in all the scenarios, all private households are electrified and have heating possibilities. In contrast to the *convenient* development, the difference between the urban and suburban energy consumption of households as described by the London Energy Study Report continues over a long time, a weak melioration is seen in the third period. Over the whole time span there are only small efficiency improvements – at the beginning due to a lack of efforts, later because of economic constraints; there will not be more than an average enhancement of 0.6% p.a.[40] The demand for electricity will rise enormously, again - particularly for cooling purposes, whereas heating rates decline as in the Convenience Scenario (note: similar development of air temperatures). Still the weak technology improvements together with a decelerated population growth are able to attenuate the ongoing energy demand growth as shown in *Figure IV-16*:

---

[39] See Hanika et al. (2004): ÖROK-Prognosen 2001-2031. Teil 1.

[40] Compare: 1% p.a. from 1990-2003 (Kratena and Wüger, 2005).

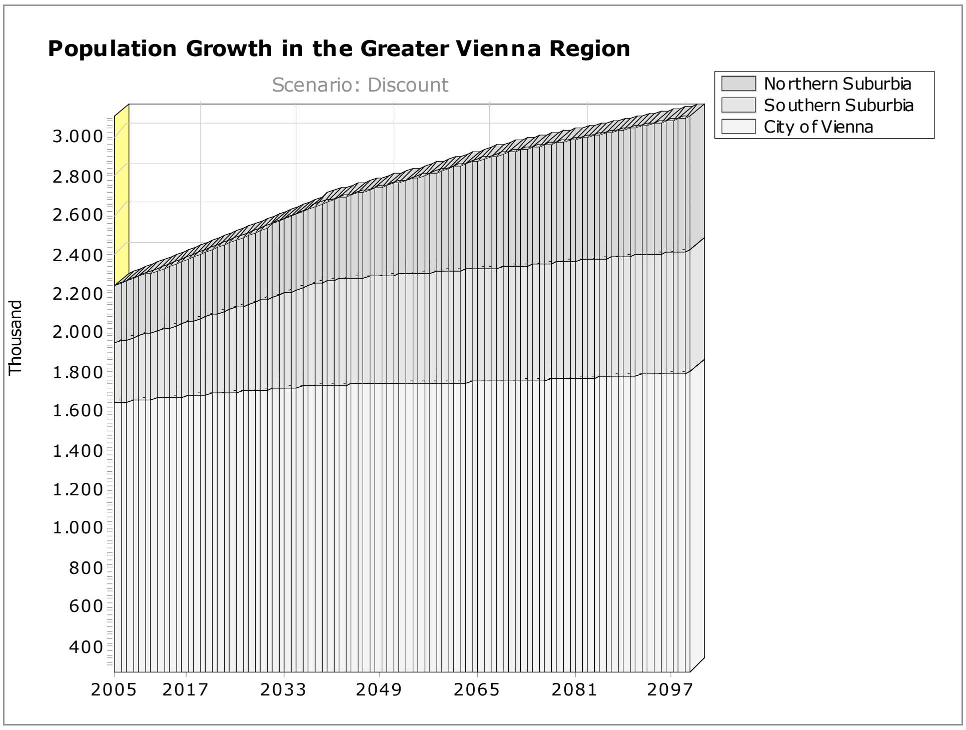


Fig. IV-15: Population Growth in the Greater Vienna Region (Discount)

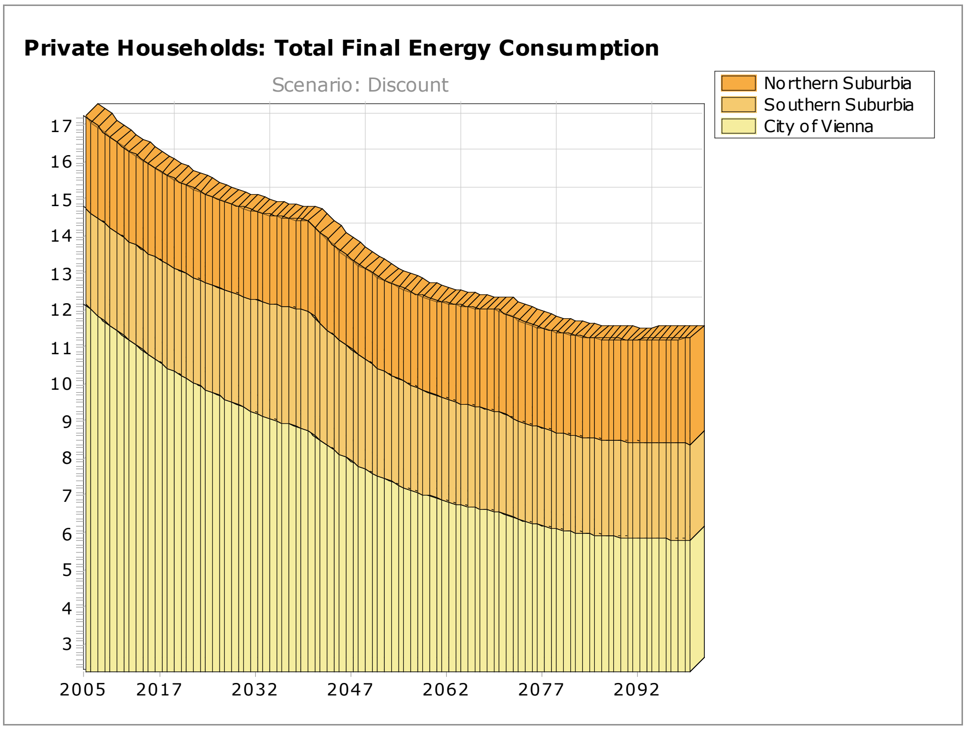


Fig. IV-16: Private Households: Total Final Energy Consumption (Discount)

In the Discount Scenario transport and utility areas will be developed more intensively in the surroundings than in the previous scenario; in 2100 the percentage of those areas located in the city fell to 93%. The energy demand continues to grow by about 1% p.a. during the first period – despite high gas prices, but falls thereafter. The difference of energy intensities per hectare between the city and the suburbs declines steadily.

There are just weak shifts towards a higher share of electricity in the fuel mix – gasoline and diesel remain overwhelmingly important for the private transport sector. Thus, after the first years, the energy demand declines rapidly to small growth rates. Public transport becomes more and more important, but not as much as in the Convenience Scenario. Today the city's public transport makes up 35% of total transport; in the Convenience Scenario it reaches 50% in 2100, in the Discount Scenario 42%. There is also an increase of the public transport in the suburban areas, but in both scenarios it remains far behind the city.

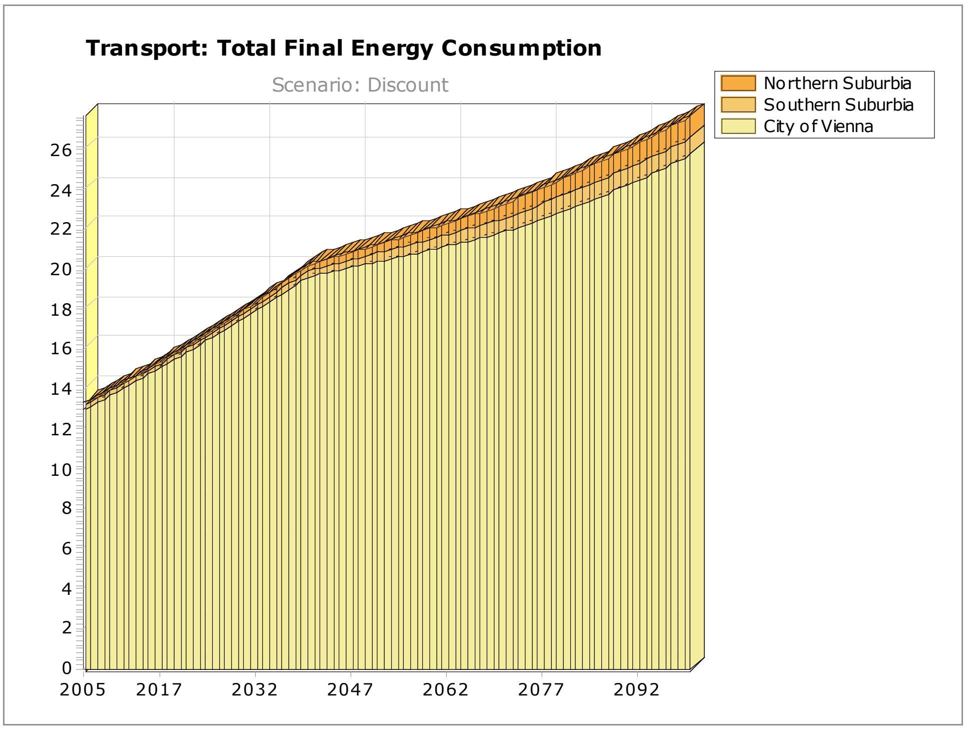


Fig. IV-17: Transport: Total Final Energy Consumption (Discount)

The continuing suburbanization trend causes a small but steady decrease of the agricultural areas until 2070, then it levels out. Energy intensities remain stable and the lack of efficiency efforts is noticeable. Overall, the final energy consumption declines a little less than in the previous scenario. Though biofuels will play a more important role in energy generation, no significant increase of the land used for biofuels is expected.

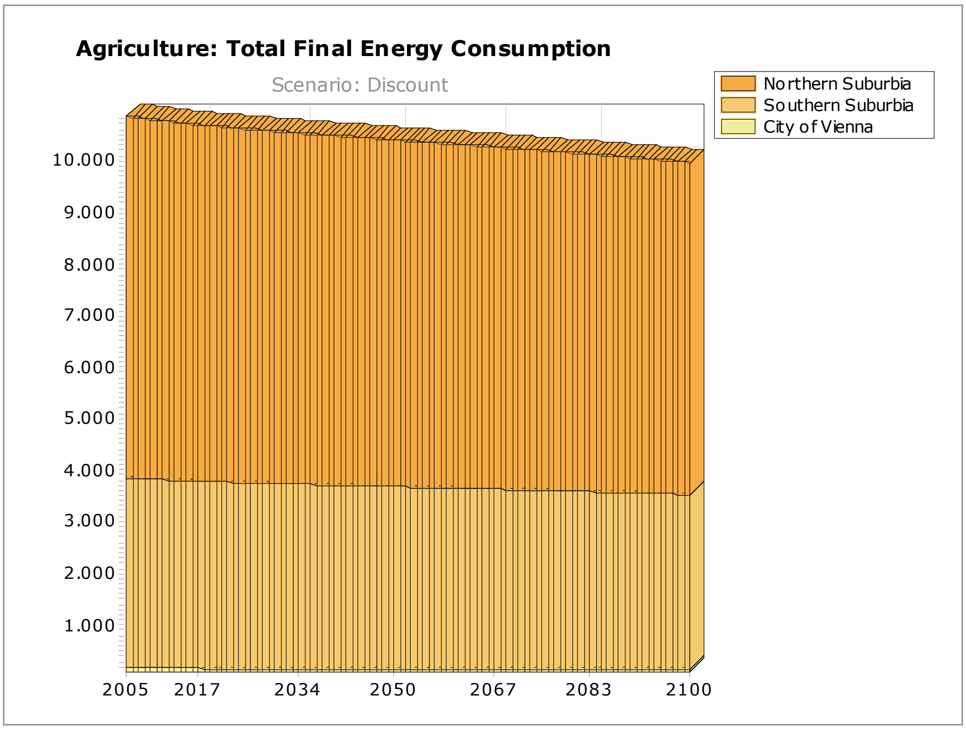


Fig. IV-18: Agriculture: Total Final Energy Consumption (Discount)

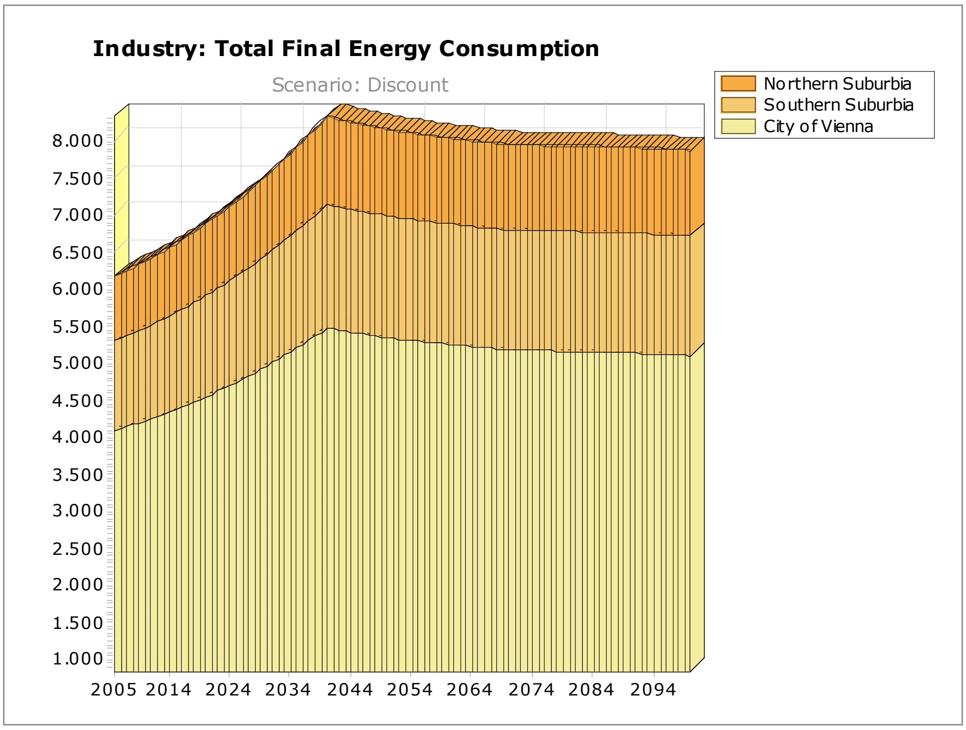
With no structural change and low investments the yearly GRP growth slows down to 1.5%. Peak oil is assumed to occur already at the beginning of this scenario. With the second period the economic performance drops again to only 0.5% growth per year. It improves a little (0.7% p.a. on average) at the end of the century, but still struggles due to the lack of well timed investments and high dependencies on fossil fuels.

Also here, the major contribution to the GRP comes from the service sector. It continues to grow by 1.6% p.a. during the first period. This is already much less than the current growth rates. Together with resource shortages the local climatic conditions of the mid-century lead to a real downturn; the service sector continues to grow by annually 0.6% and 0.8% for the following periods. The industry sector also suffers from the lack of affordable energy as well as from negative climate change impacts[41]. Starting with a 0.9% growth on average it sinks to just 0.1, later 0.2% p.a. The proportionality shift of the economy towards the suburban area turns out a little stronger than in the previous scenario, due to a stronger (post-)suburbanization trend. Energy efficiencies will improve more slowly than in the previous sub-scenarios.

As already assumed before, a rise of 1% of the GRP leads to an almost equal rise in energy demand (again, only electric devices (and lighting) were taken into consideration). But in this case there is little effort towards "decoupling" the economic growth and energy demand and it will not occur before 2040. The heating

[41] Due to higher temperature and extreme weather events.

demand develops as in the first scenario and drops significantly, especially from the mid-century.



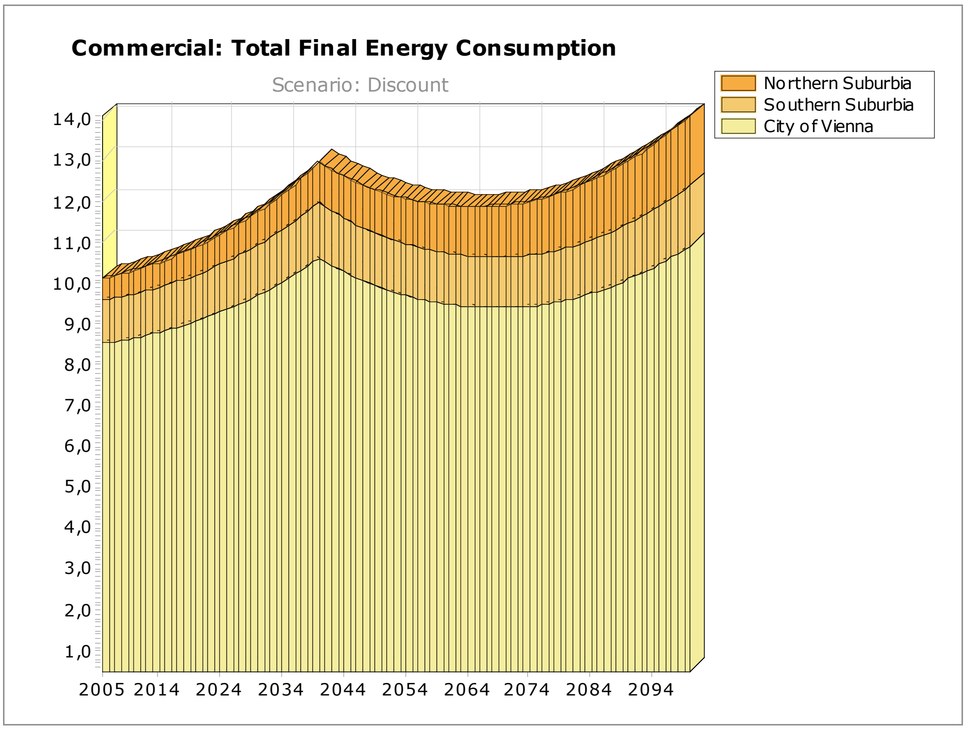


Fig. IV-19 + IV-20: Secondary and Tertiary Sector: Total Final Energy Consumption (Discount)

So summing up the growth of the final energy demand, the Discount Scenario also shows a significant increase of energy demand - about one third at the end of the century. Despite the rising per capita demand of energy and no real efficiency efforts, these results remain far behind those of the Convenience Scenario. The demand of private households shows a weaker decline, the private transport sector continues growing, and a poor economic performance limits (in comparison) the increase of energy needs severely.

The FED rises by 0.6% p.a. during the first period, then stabilizes for a long time, as in the Convenience Scenario (due to economic circumstances), and rises again a little to 0.3% p.a. towards the end of the century. The useful energy demand does not show a perceptible annual growth at the beginning, it later drops to -0.5% and increases again during the third period to 0.1%, where finally the growth of final and useful energy demand seem to merge (in this scenario average efficiency improvements lag far behind current efforts. They are the result of instable economic conditions and opposing preferences).

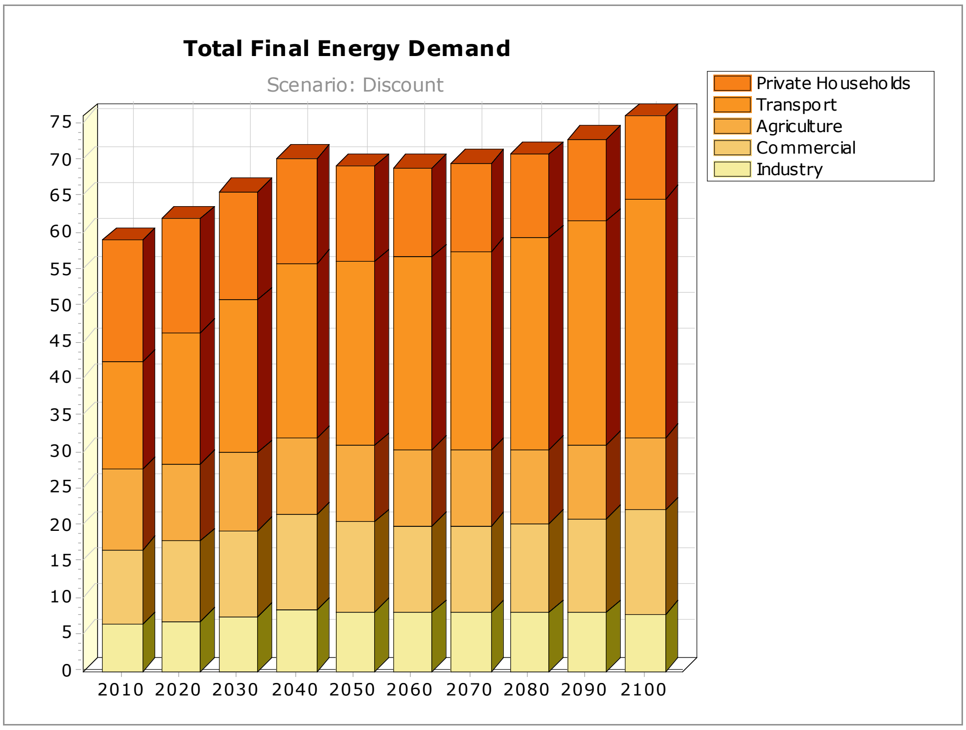


Fig. IV-21: Total Final Energy Demand for Discount

IV.2.2 Transformation Sub-Scenario

The increase in energy demand due to the socio-economic development in the Discount Scenario remains considerably under that of the Convenience Scenario, but the economy remains the strongest energy consumer. According to its substantial downturn from the mid-century the overall energy demand grows more slowly.

1000 GWh	2005	2040	2070	2100
Total Primary Supply	66	84	81	86
Electricity Generation	-3	-2	-1	0
Heat Generation	-4	-9	-9	-8
Transmission and Distribution	-2	-2	-2	-2
Total Transformation	-8	-14	-11	-10
Private Households	17	14	12	11
Transport	13	24	27	33
Agriculture	11	11	10	10
Commerce	10	13	12	14
Industry	6	8	8	8
Total Demand	58	70	70	76

Fig. IV-22: Energy Balance for Discount Scenario

The current situation and political commitments in mind, this scenario also considers enhancing energy efficiencies. But as efforts were weak over the last years (cf. SEP, 2006), also the following improvements will turn out quite small, and later when the necessity for investments becomes even more obvious, they will be impeded by the economic circumstances. Also energy grid losses will decrease but little as the table above shows the whole transformation process still claims almost 12% of the total primary supply in 2100.

The energy system and flows of *Wien Energie* are basically the same as in the *convenient* version (*Figure IV-10*); re-powerment and replacement of old plants will take place, some new capacities are built. But alternative resources will just make up a minor part in the energy generation process. Cogeneration continues to provide the major part of electricity. Trying to keep up with the rising electricity demand, the local energy company expands its capacities. A large part of the resources used for the cogeneration process derive also in the following years from fossil fuels.[42]
However, in the Discount Scenario *Wien Energie* will not be able to expand its electrical capacities noticeably, and from the second period they will even decline due to resource restrictions Perceptible enhancements of technology efficiencies will be made for biomass and solar, also cogeneration will gain a little through efficiency improvements.

[42] Putting the SRES scenario A2 as global frame, a shift to a higher usage of natural gas and (again) coal, which does not play a significant role for the current energy generation processes anymore, is imaginable.

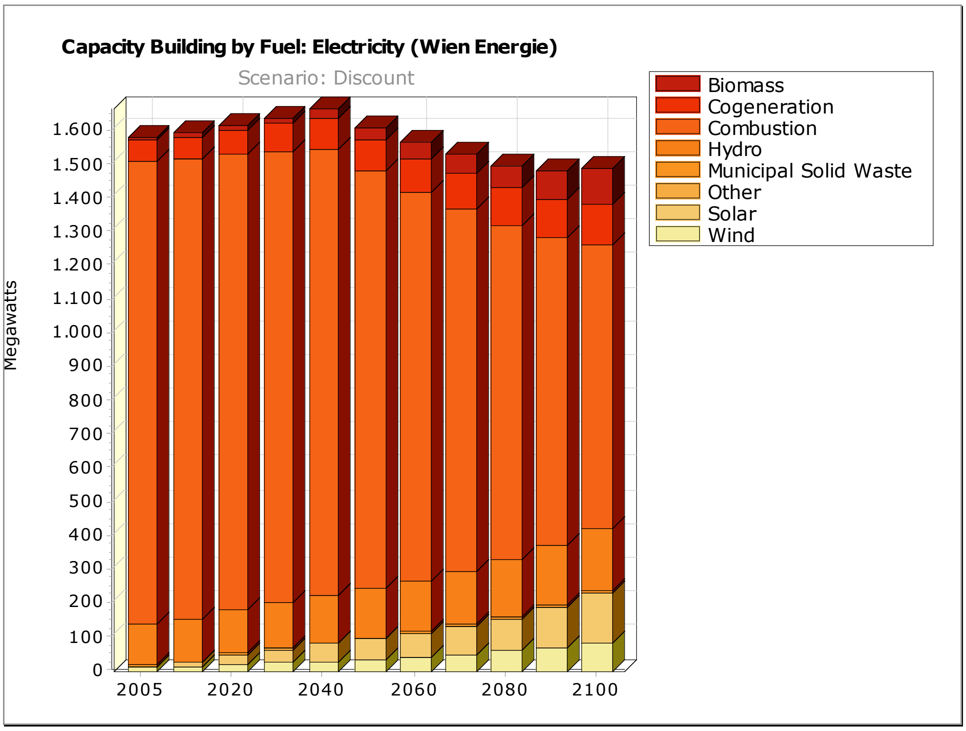


Fig. IV-23: Capacity Building by Fuel: Electricity (Discount)

The very similar increase of mean temperatures in the Convenience and Discount Scenarios again leads to a steep decline in the heating demand, especially from the second period onward. Cogeneration and the combustion of municipal solid waste remain the main technologies; biomass and geothermal just soothe the growing environmental conscience.

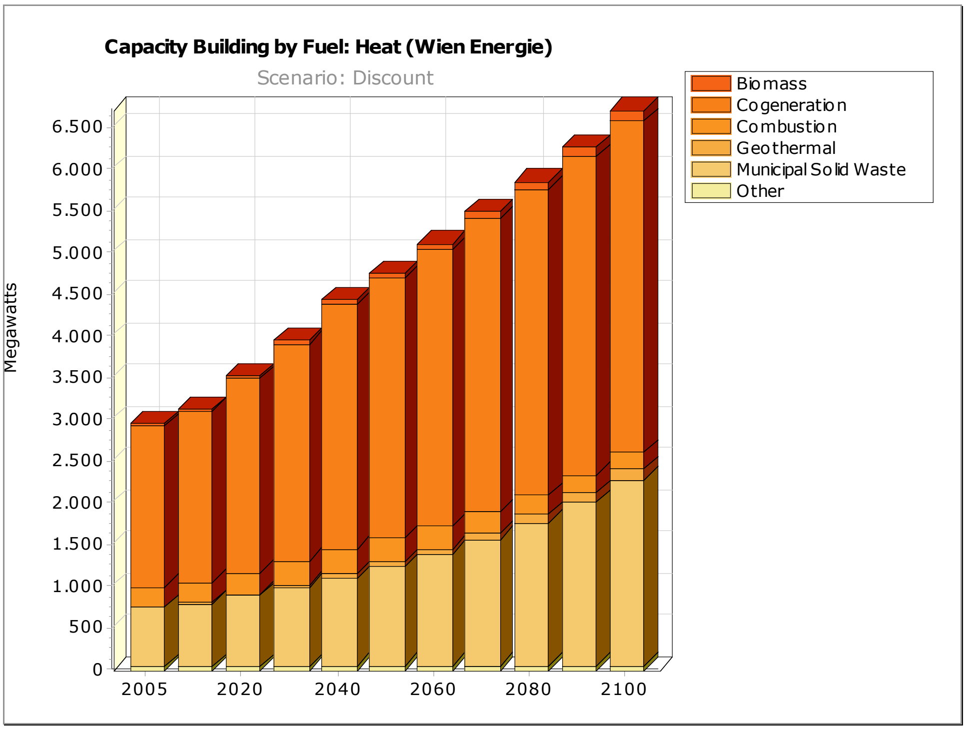


Fig. IV-24: Capacity Building by Fuel: Heat (Discount)

So, according to this scenario, *Wien Energie* does not succeed to augment their overall capacities, it even declines from the second period onward. The reliance on fossil fuels is still very high, thus high energy prices burden all branches.

	2005	2040	2070	2100
Electricity Output (1000 GWh)	9,8	11,8	10,4	9,5
Heat Output (1000 GWh)	7,6	5,7	2,6	1,1
Total Energy Output by *Wien Energie*	17	18	13	11

Fig. IV-25: Energy Generation by *Wien Energie*

In this scenario the gap between energy provided by the local service and the demand will not widen after the second period as in the previous scenario. So compared to the gap in the Convenience Scenario the development does not seem that dramatic. But global conditions will make it much harder to fill the gap, no matter whether from national or international capacities. An interpretation of the associated resource situation follows in the next section.

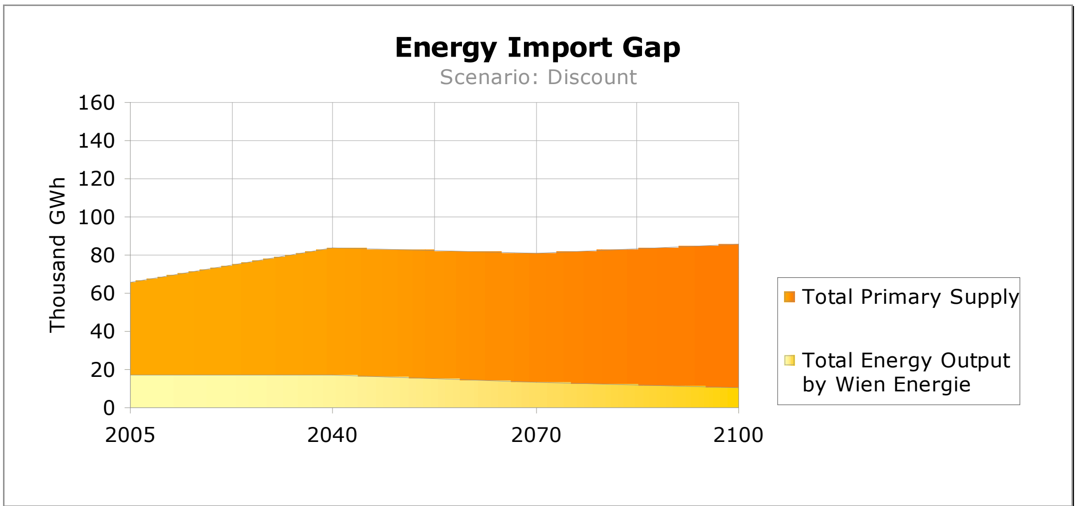


Fig. IV-26: Discount Energy Import Gap

IV.2.3 No Discounts on Resources

In the present century, fossil fuels act like a drug for our development. Some efforts will be made to break the habit, as the limits of availability become clearer and as alternatives are explored, but Vienna, as well as Austria, remains "addicted" in this scenario. Peak oil (as first resource peak) is assumed to occur in the early years of this scenario; private people and economic growth struggle with high and instable energy prices. An overreliance on a happy energy ending keeps them going. Of course, recent scientific knowledge about possible environmental developments and energy futures are heard, but the implementation of necessary adaptation measures will be postponed over and over again. So according to the discount philosophy, shortsighted actions and reactions which seem the cheapest possibility will set back the long-term chances for a sustainable development;

despite high oil and gas prices renewable technologies remain more expensive because serious efficiency improvements fail to appear.

The interdependencies concerning economic development and resource costs and availability will remain high during the whole scenario and result in a poor economic performance along with growing social problems. High energy prices foster a further segregation of social groups – people who can afford energy and those who can not. Such developments can already be observed in Europe. And taking into account that a considerable part of the Viennese population will, also in future, be (often underprivileged) migrants and elderly people, these prospects are not enticing.

But of course, the Discount Scenario cannot ignore the introduction of renewables completely as some renewable energy studies (mostly on national scale) already exist or are currently in progress. There will be some usage of renewable energy potentials – but as described before, on a small scale. Real progress is still a long way off. In the transformation graphs they show up noticeably from the middle of the century with a slow but steady rise. In this scenario the gap between available knowledge and implementation is largest.

Estimates of future potentials of the unloved renewables can be made based on the results of chapter II. In consequence of climate change the hydrological situation seems to improve on local scale, a least for hydropower plant operators. Only in summer time there is a decrease from the second period on, during the other seasons higher precipitation sums are expected. However, only seasonal averages are presented here – the monthly variations could turn out to be high. But an expansion of the current capacities (probably outside of the city's administrative boundaries) seems profitable.
Solar radiation declines very strongly during spring time also in this climate scenario and makes the use of photovoltaics less attractive for this season. But the rest of the year conditions remain rather unchanged, and in view of the reduction of summer precipitation energy output could be high at least during the summer months.
Concerning wind energy the general development appears similar to that in A1B, but the decrease of the mean wind speed during summer is a little weaker, and the acceleration in winter and spring time very high. The geothermal potential is assumed the same as in all scenarios (based on PGO, 2008, and ÖROK, 2008).
Altogether, the renewable potentials even seem to increase according to an A2 development and will not hamper a more sustainable energy generation in the end. Though imagining those climatic changes from another point of view, probably they are not so beneficial. Higher air temperatures intensify the urban heat island effect in summer (growing due to higher population densities) and lead to more heat stress for all organisms. Accelerated wind speeds in an already windy city (maybe even more storms) might increase risks or damages but will certainly be quite unpleasant.

IV.3 The Best Buy Scenario

Like the previous scenario, also the third scenario takes up the motto 'what goes around comes around'. But, completely contrary assumptions will be made here. Long-term thinking together with flexible and sustainable planning strategies change development conditions right from the beginning. Some daring investments under uncertainty are made, even if cost-efficiencies will not turn out immediately. *Best buys* show their value in form of long-term pay-offs. Positive outcomes of the scenario presented here take time. It is based on the B1 path, viz. a convergent global development. A high awareness of environmental issues leads to a rapid and fundamental structural change. Liberal politics with strong social and ecological commitments and regulations will foster this change (the 20-20-20 policy is an integral part during the first period).
The economic development will strongly be influenced by high investments in alternative technologies; the tertiarization trend accelerates. Due to the re-organization the local economy constrains its own productivity a little, despite instantly occurring, moderate pay-offs. But as result of the previous anticipatory measures and policies, its positive long-term effects occur from the mid-century on and enforce growth again. The use of new and in the mean time affordable technologies allows flexible and sustainable adaptation to climate change, the impacts of which appear weaker than in the other two scenarios. The Vienna region is envisaged as a highly competitive region, more independent in its energy supply. For this scenario, peak oil is assumed to have occurred around 2006 (EWG, 2007) and is one of the primary reasons for the big change in public consciousness. Future economic constraints remain relatively low and level out the economic performance with a GRP still growing strongly.

The attractive economic conditions also lead to an increase of population. Especially during the second period population numbers rise significantly - many new jobs in branches like regional energy production and in the adaptation sectors prove to be a high attractor. This growth is merely slowed down by stable but low birth rates. Until the end of the century population growth declines again a bit.
As consciousness and thus habits of the society change, also suburbanization slows down permanently with a lower increase of households in the northern and southern outskirts - the suburbanization trend levels off.[43]

Energy prices already have started to climb remarkably and indicate that peak oil is taking place now. The present energy market occurs instable and thus fosters a structural shift of the energy systems in this scenario, although, prices of alternative, but still immature technologies remain quite high during the next years. But strong efforts due to the presumed high investments and scale effects will bring them down to a moderate level. Efficiency improvements stabilize the

[43] Note: This means that also in this scenario higher housing densities are to be expected.

absolute and per capita energy demand from the mid-century; dependencies on energy imports decrease continuously.

Following the B1 climate scenario on the global scale, climate changes are also smaller in the greater Vienna region (see II.2), and thus the consequences for the local economy, health and environment will be much lower. Further, locally produced environmental problems like particulate matter loads or noise will by reduced substantially by the usage of upgraded technologies; living quality will rise.

To sum up, the economic and environmental advantages, of such a development will not appear instantly. The first period is characterized by a big and fundamental restructuring, but the great pay-offs are assumed to occur at the latest from the second period onward. In the long run it will turn out as the cheapest and most comfortable way of dealing with future challenges. It seems to be the *best buy*.

IV.3.1 Demand Sub-Scenario

The high attractiveness of the region causes population numbers to grow intensely. Most of the increase will be made up by national and international migration gains. During the first period this causes a growth by 0.6% p.a. Comparing the absolute results of this scenarios in 2031 with those of the ÖROK scenarios[44], it matches almost exactly with their so called 'growth scenario'. Because real economic advantages show from the mid-century, the population growth accelerates again, to 0.9%. A high number of new jobs in branches like research, technology, regional sustainable energy production and the corresponding adaptation sectors are the incentives for this development. Low birth rates can stem the increase a little. Until the end of the century population growth levels at 0.7% p.a., while the greater Vienna region remains a high attractor. But unlike the other scenarios, suburbanization slows down permanently. The near stagnation of this trend, where a constant 70% of the population remain within the city, can be explained by a fundamental change in awareness and habits of the society. The single family house surrounded by nature with two cars at the doorstep will not be considered as the ideal lifestyle anymore. Also in the Best Buy Scenario the trend towards single households continues, but short distances between different activity areas are appreciated. This trend has already been observed during the last years. Nevertheless, most of the current assessments still include high suburbanization rates for the next decades (as do the other scenarios presented here). One advocate, who takes the current development more serious and foresees a re-

[44] 2031 is the last calculated year in the ÖROK scenarios.

migration to the city, is the demographer Lebhart[45]. A precondition for this development is a great change of living preferences; some sound long-term reasons can be given for the assumptions above. In the short run the rising energy and transport costs will probably constitute the main driver, as they might well for the observed very recent trend.

Again all households have access to electric devices and heating facilities. The demand gap between urban and suburban households closes soon in consequence of strong efficiency improvements.[46] The overall efficiencies for electricity and heating are enhanced from the beginning; they experience an upgrade by 77% for electric and 9% for heating appliances (the latter already possess high efficiency rates.). Again, the strongest rise in per capita demand is assumed for electricity, and air condition shows the highest growth rates, although they remain significantly under those of the other scenarios during the second and third period. This results especially from the much lower mean temperature rise in the corresponding climate scenario. On the other side, heating rates do not decrease as strongly until the end of the century as in the previous scenarios.
The illustration of the private demand scenarios outlined above leads to stunning results: Although population numbers rise most intensely, the overall energy demand falls steadily to almost 40% by 2100 (see *Figures IV-27 and 28*).

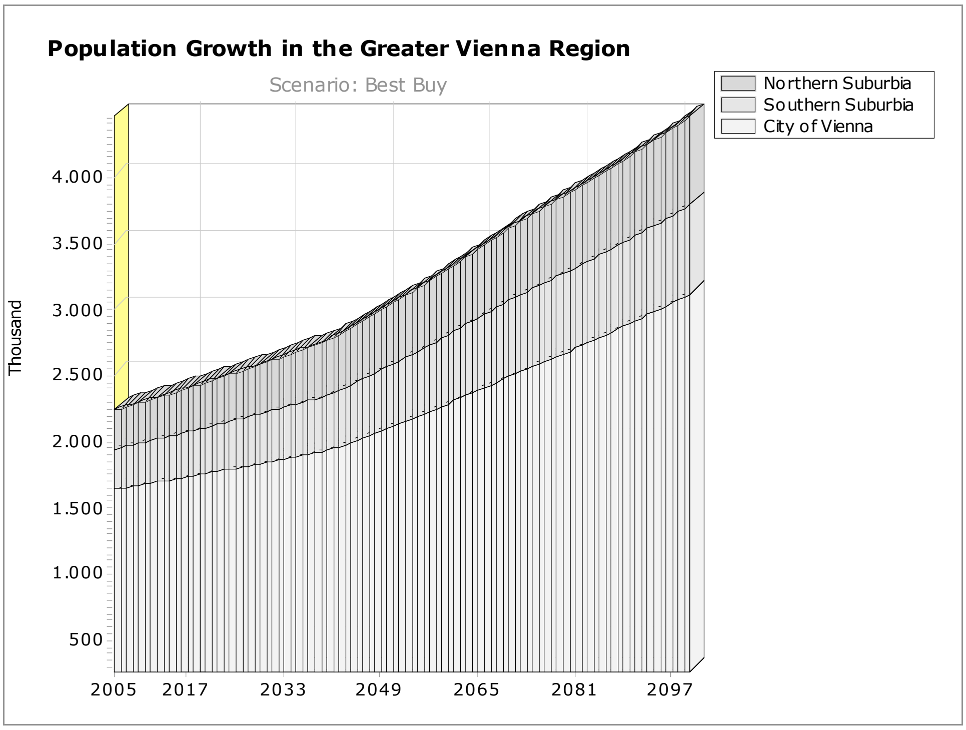


Fig. IV-27: Population Growth in the Greater Vienna Region (Best Buy)

[45] Confirmed by Lebhart, 07/18/2008.

[46] Energy-saving houses become standard.

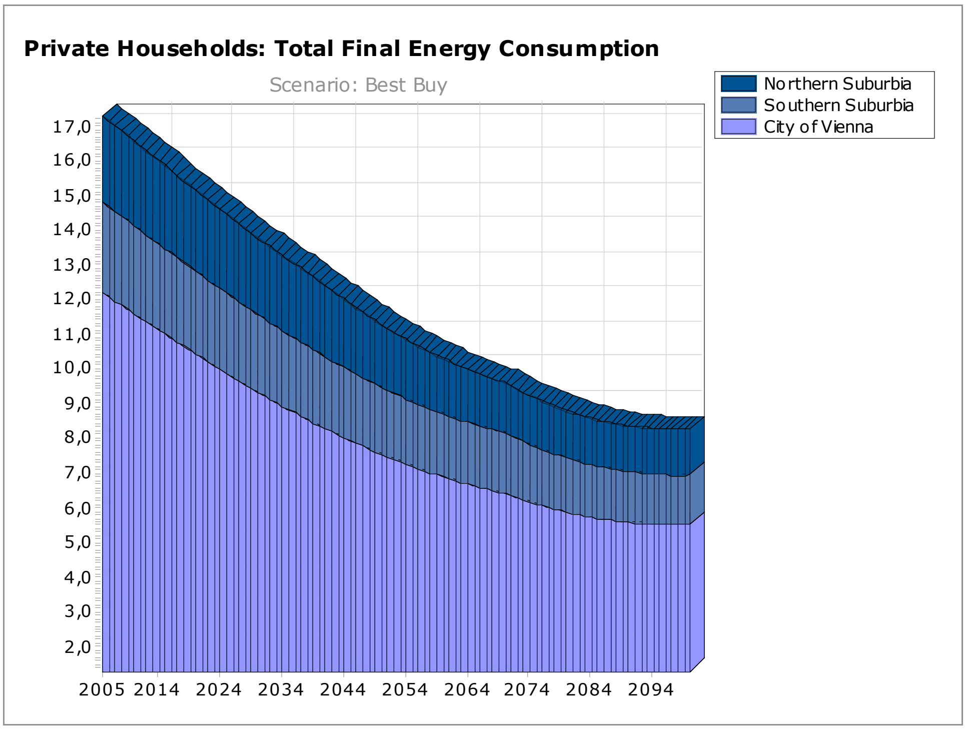


Fig. IV-28: Private Households: Total Final Energy Consumption (Best Buy)

During the first years there is still a high dependence of transport on conventional and inefficient technologies; the energy intensity per hectare increases a little. Surface areas needed for transportation will be just slightly extended. There is a low increase of the percentage in the suburban areas mainly due to the fact that the suburbanization trend turns down.

However, a strong transformation of the whole transport sector will take place: the share of public transport within the city's boundaries rises from now 35 to 60%. In the suburban areas a portion of about 25% can be reached until 2100. Over and above the fuel share experiences a big shift. The usage of electricity instead of gasoline or diesel strongly increases, especially in the private transport sector. Huge efforts are undertaken and by the end of the century more than 80% of the fuel will derive from electric based technologies, with much higher efficiencies than today.[47]

Hence, despite the high population growth and the associated mobility needs, the energy intensities can be lowered from 2040 onward (*Figure IV-29*).

---

[47] The efficiency enhancements for electricity are assumed to rise by finally 40% for all branches.

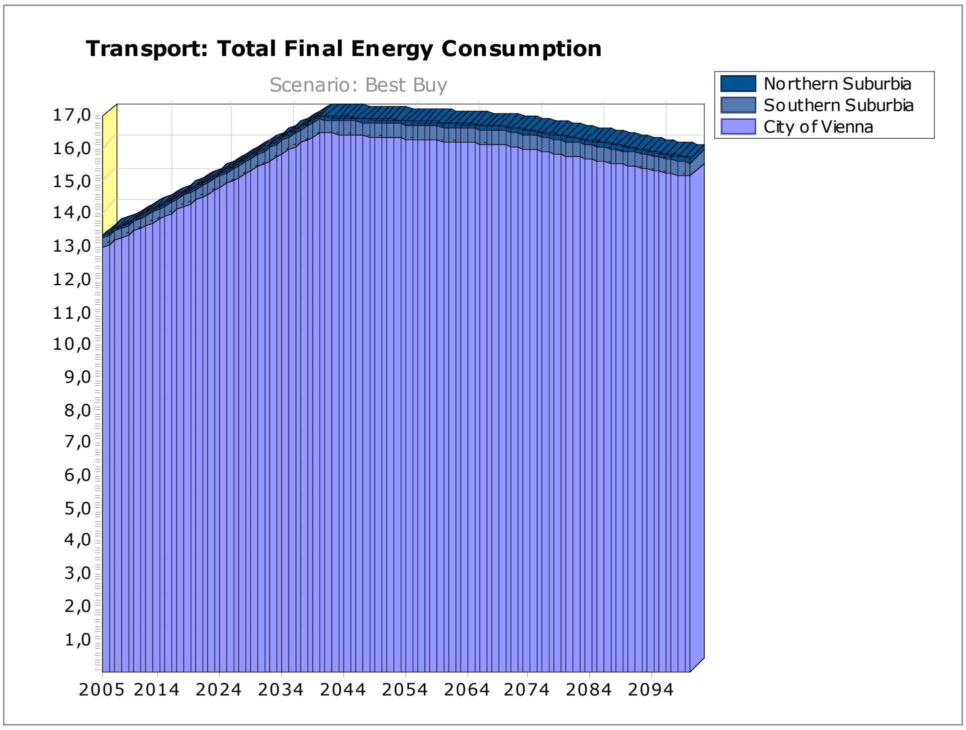


Fig. IV-29: Transport: Total Final Energy Consumption (Best Buy)

As the efforts in the Best Buy Scenario towards energy independence are strong, the agricultural sector for the first time also experiences significant investments as well as efficiency improvements. Further, a slight decrease in energy intensity per hectare will be achieved through new technologies. The area used for agriculture could be enlarged by up to 5% at the end of the third period. A controlled and almost halted urban sprawl allows this development. The main goal is the extension of biofuel production[48] for the local energy generation (while not neglecting the local crop production for nutrition purposes).

In the *best buy* case the energy demand for the primary sector also sinks, but agricultural harvests increase.

[48] High potentials are considered according to studies by PGO (2008) and ÖROK (2008).

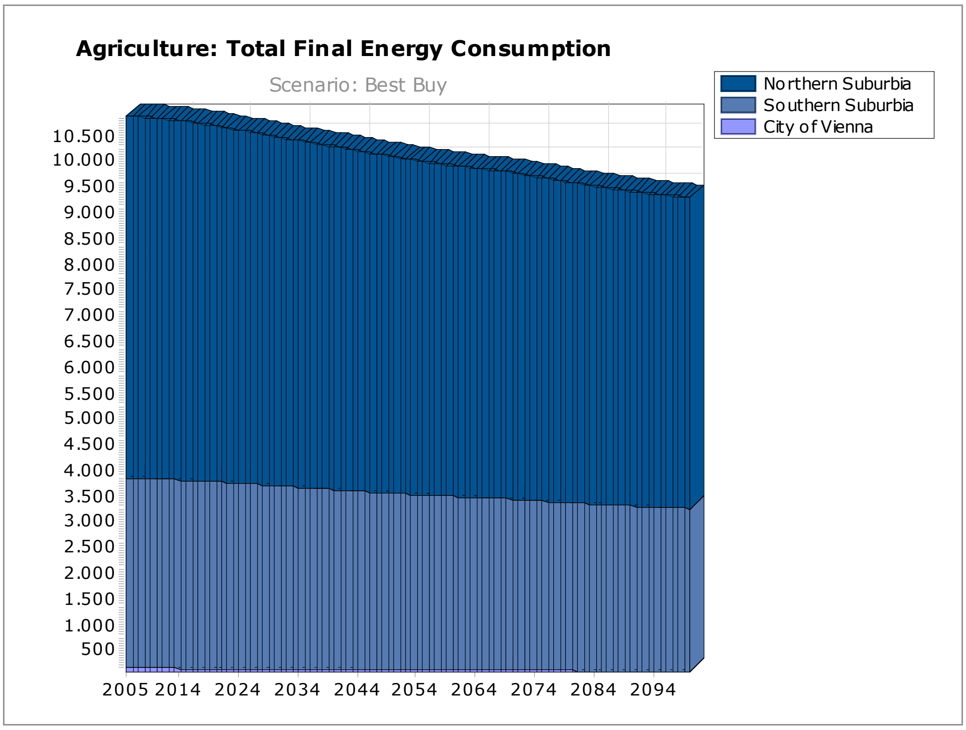
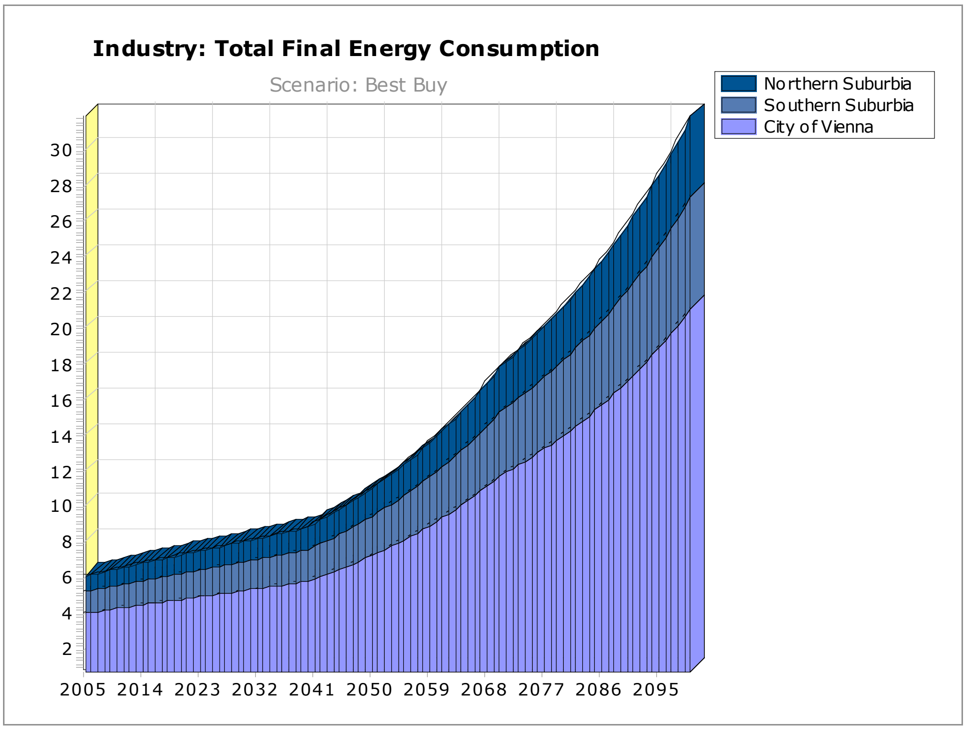


Fig. IV-30: Primary Sector: Total Final Energy Consumption (Best Buy)

Due to the overwhelming economic performance, especially from the mid-century, a higher energy demand for the service sector, particularly electricity, is to be expected. But in the Best Buy Scenario noticeable efforts towards decoupling of economy and energy demand are made right from the beginning. Of course, energy demand keeps growing, but compared to the GRP development this rise seems moderate. Highly improved efficiency rates are main supporters.

As before, the major driver of the economy remains the service sector, which grows by 2.2% p.a. at the beginning and then even rises to 3.2% p.a. In the third period it is still at 2.6% per year on average. The industrial sector follows with an original 1.3%, 2.3% from the middle of the century and 1.9% p.a. at the end. This is not accompanied by a shift in the intra-regional share in business locations. The main part, about 85% (commercial) or 65% (industry) of the GRP is generated within the city's area.

The economic development is based on (inter)national achievements in research and technology as well associated services concerning consulting, implementation and adaptation of the theoretical knowledge gains. Vienna is seen as one of several globally recognized prototypes that constitute a converging sustainable and successful development according to the SRES B1-path.



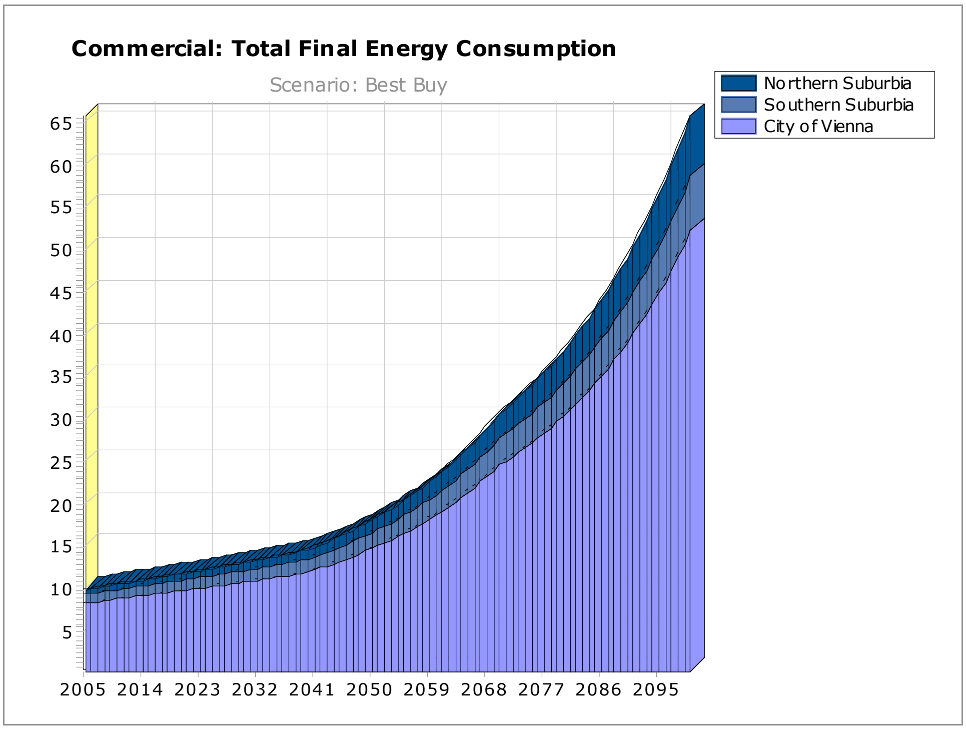


Fig. IV-31 + IV-32: Secondary and Tertiary Sector: Total Final Energy Consumption (Best Buy)

Looking at the overall results, there is still an enormous growth of the energy demand, even higher than in the Convenience Scenario, but there are large differences in detail. All branches show a decreasing demand except for commerce and industry. It is notable that population numbers show the highest increase compared with the other scenarios and that agricultural areas as well as harvests are expected to increase significantly. Further, the economic performance is good for an "old European" region with mean growth rates assumed relatively high. In view of this, the increase in energy demand seems moderate.

Another difference is the origin of the energy resources. A large part oft the locally generated energy will derive from renewable resources. Of course, also in future energy imports will be necessary for the Viennese energy supply (see IV.3.2), but the B1- scenario implies nationwide strong transformations in order to achieve sustainable development, so these imports might be provided by (national) renewables. The advantage for the individuals will be increased quality of life and health.

Even if in the Best Buy Scenario's annual efficiency improvement rates will not reach the EU target of 2% (the highest rate assumed during the second period is 1.1% p.a. on average), the decoupling of economic growth and energy demand turns out to be significant. Right from the beginning the useful energy demand (0.2% p.a.) almost catches up with the FED (0.3% p.a.). As consequence of the strong efficiency efforts, final energy demand even passes PED during the second period: 1% annual growth of PED vs. 1.5% for useful energy demand, later 1.5% vs. 2% p.a.

The increase in the final energy demand is enormous in this scenario, but strong technological improvements allow a less resource-intensive generation (compared to the other scenarios).

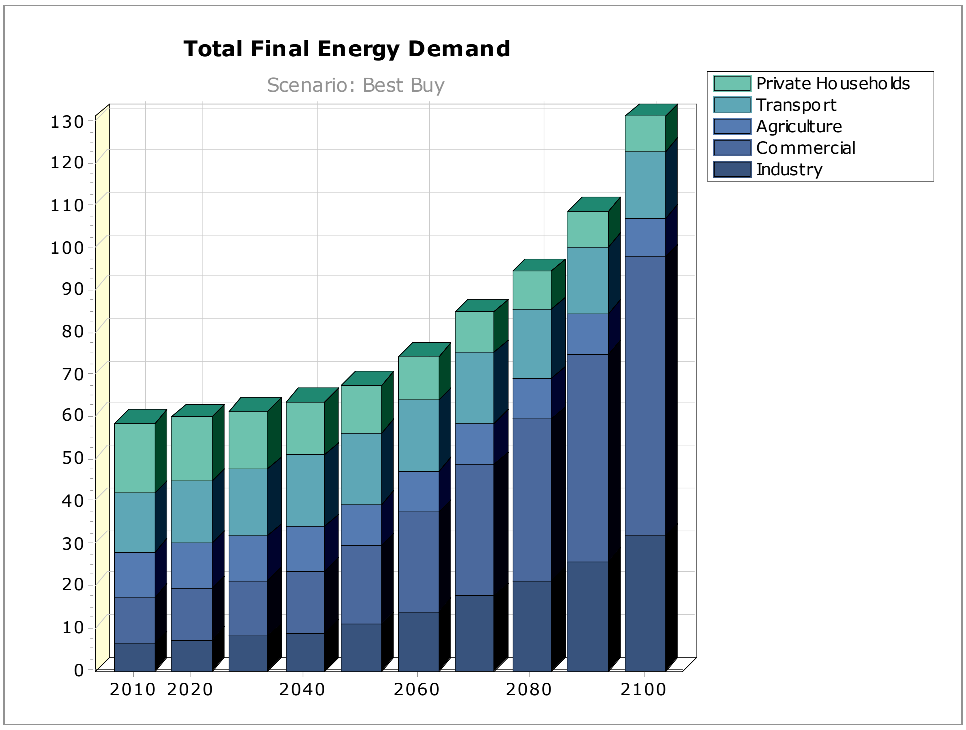


Fig. IV-33: Best Buy Total Final Energy Demand

IV.3.2 Transformation Sub-Scenario

The overview presents again the energy supply needed according to the three scenario periods with a high increase for industrial and commercial purposes. The improvement in the energy transformation process is outstanding. From 12% in 2005 the absolute transformation losses level out and make up just about 7% in 2100.

1000 GWh	2005	2040	2070	2100
Total Primary Supply	66	75	95	141
Electricity Generation	-3	-3	-2	-1
Heat Generation	-4	-7	-6	-6
Transmission and Distribution	-2	-2	-2	-3
Total Transformation	-8	-11	-10	-10
Private Households	17	13	10	8
Transport	13	17	17	16
Agriculture	11	10	10	9
Commerce	10	15	31	66
Industry	6	9	18	32
Total Demand	58	64	85	131

Fig. IV-34: Energy Balance for Best Buy Scenario

Electricity as well as heat generation by *Wien Energie* will be fundamentally restructured (as will the whole national and European energy sector itself). At the beginning high investments are necessary to build and improve renewable capacities[49], but driven by the idea of an independent energy production, and pushed by rising prices for fossil fuels, the investments are regarded as reasonable. New, decentralized and small cogeneration and renewable power plants are seen as an appropriate step towards a sustainable energy supply (European Commission, IRP, 2007).
Current climate change studies, environmental problems and peak oil (and the other resource peaks) influence attitude and behavior very strongly right from the beginning. Therefore, an innovative development path is followed.

The losses in the energy grids of *Wien Energie* are reduced further and level at 3% during the third period. Power plants using renewables like hydro, solar, biomass or wind are re-powered or newly built. The potential for hydropower will not be expanded very much – new plants within the city are not considered as feasible, but along the Danube capacities could be expanded. Also the wind potential is limited strongly within the city's boundaries, mainly due to high population densities. So 350 MW set the maximum capacity reached through wind power in

[49] This conflicts with still existing lack of interest to invest in energy efficiency, because it lowers the sales volume of the energy company and thus their own profits (European Commission, IRP, 2006). A complete re-organisation of the whole system is needed. See also section V.1.

this scenario.[50] The main energy source will be biomass with annual growth rates ranging between 3 and 6% (for electricity generation) and solar, because large capacities can be built in the city's surroundings. The total biomass potential in the near future was estimated at about 32 PJ for both the city of Vienna and the whole province of Lower Austria.[51]

Although there is a strong decrease of the usage of fossil fuels and thus of a main part of the conventional cogeneration plants, the electricity generation gains an overall plus of almost 50% until 2100.

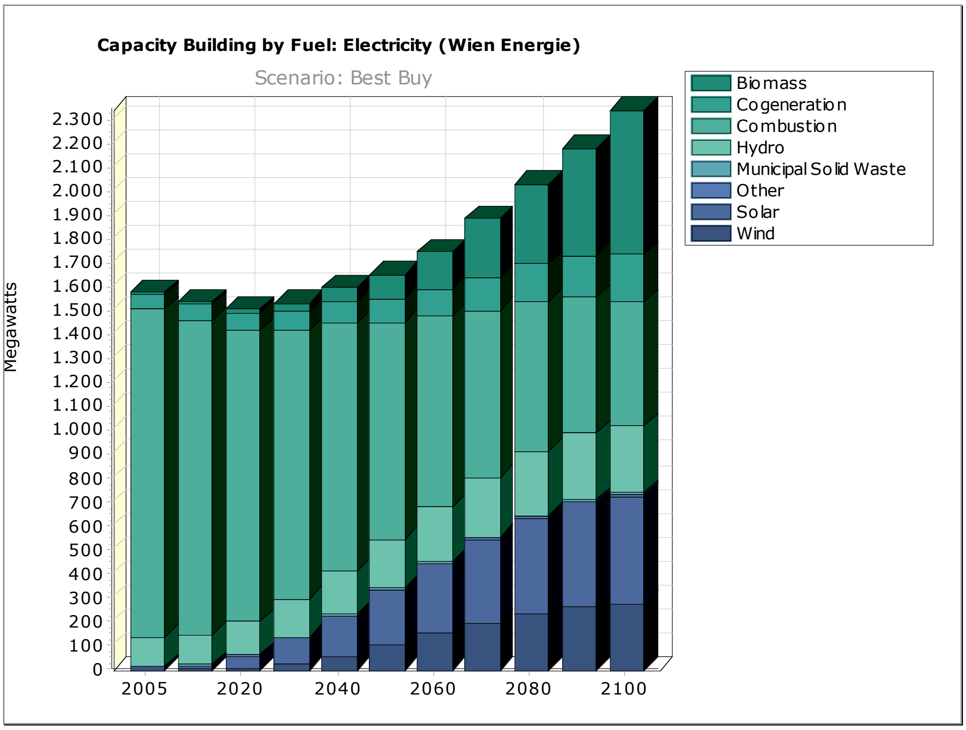


Fig. IV-35: Capacity Building by Fuel: Electricity (Best Buy)

[50] The current maximum potential was estimated by the PGO with 30 MW for the City of Vienna and 780 MW for Lower Austria. Significant accelerations in mean wind speed are not to be expected according to B1 (see also IV.3.3).
But re-powering led to an enormous capacity building in wind parks already during the last years. Between 1995 and 2007 technology efforts led to ten times higher energy outputs. Potentials were estimated for turbines in 70m height and a mean annual wind speed of 4.5 m/s. In future, economic efficiencies may be reached also with less wind intensity. While now average capacities of one plant constitute 2 MW, in future 5-6 MW are within reach. A more general approach is presented in the ORÖK study (2008).

[51] This includes the usage of forestry as another promising branch. This, however, was not included in the figures used here. The province of Lower Austria is covered by large forest areas in several regions, but in part that makes up the greater Vienna region the percentage remains low, and these wooded parts are primarily protected areas (like the Viennese Woods).

Concerning heat generation, the Best Buy Scenario shows a long-term plus, but conventional cogeneration loses its position as main deliverer.[52] Geothermal and again biomass become the preferred resources, this time with growth rates from 1.5 to 5% p.a. (after a strong increase the usage of biofuels for heating purposes will decline towards the end of the century due to a weakening demand). Municipal waste also remains an important 'heating (or cooling) resource', especially because the number of 'deliverers' rises strongly in the Best Buy Scenario. But although environmental loadings of this technology can be reduced, the capacity improvements slow down in the second period. Altogether *Wien Energie* can expand its heat capacities by a maximum of 25%, while outputs will not decrease as strongly as in the two previous scenarios.

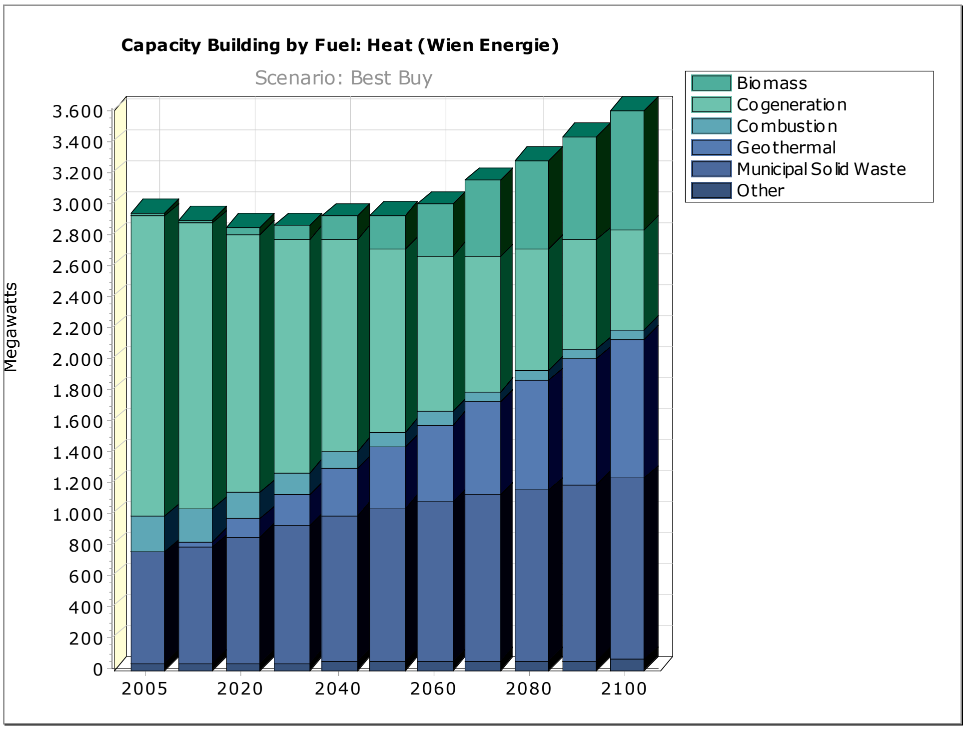


Fig. IV-36: Capacity Building by Fuel: Heat (Best Buy)

Not specified alternative technologies are again summed up in the category other. Their importance is considered to increase, especially for electricity generation (e.g. geothermal electricity). The numbers of the total energy generation of *Wien Energie* are as follows:

[52] Cogeneration is already a highly efficient generation technology for both, heat and power (at present efficiencies of cogeneration plants of *Wien Energie* have already reached 86%). Alternative resources, like biomass (whose share in the energy mix will rise most steeply in this scenario) can provide the primary energy in future and meet the heating and cooling requirements of thousands of households. As technological changes occur and emissions, waste heat as well as transmission losses will be reduced, the viability of these systems will increase (Grimmond, 2007). Cooling is a relatively new service, which is also provided by *Wien Energie* (see Wien Energie, 2006b) since a while and is based on advanced absorption cooling technologies as part of tri-generation plants.

Electricity Ouput (1000 GWh)	9,8	10,6	11,1	13,5
Heat Output (1000 GWh)	7,6	6,3	6,7	6,8
Total Energy Output by *Wien Energie*	17	17	18	20

Fig. IV-37: Energy Generation by *Wien Energie*

Despite the restructuring of the energy generation, there will be a moderate increase of the local energy supply. In the Best Buy Scenario the gap between the energy provided by *Wien Energie* and the local demand widens beginning in the second period and even more so from 2070 (see *Figure IV-38*). So to meet this demand sustainably (Best Buy philosophy), high renewable capacity building of other (inter)national energy companies (e.g. EVN) is necessary.

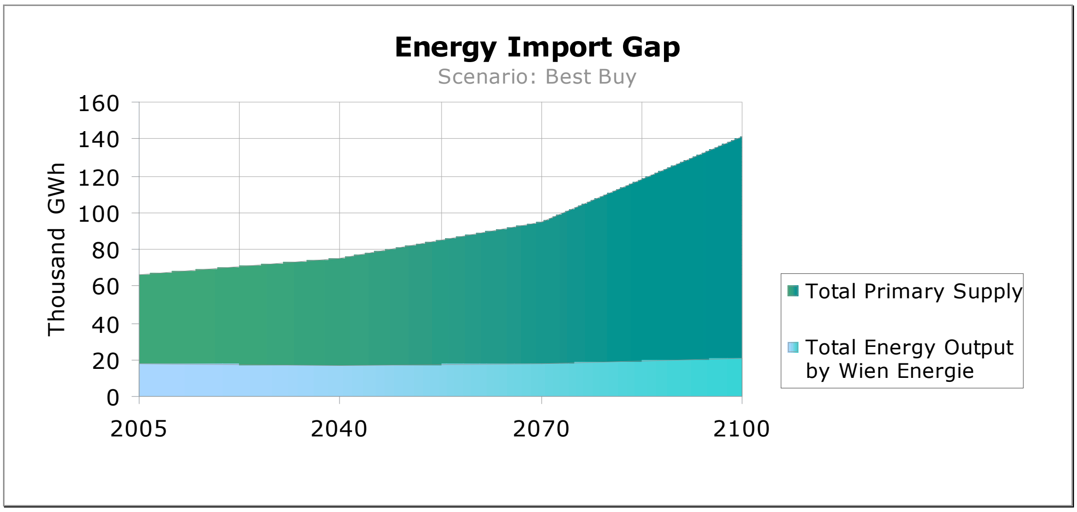


Fig. IV-38: Best Buy Energy Import Gap

IV.3.3 Where to Buy Resources Best

As in the Discount Scenario the prices for fossil energy resources will spiral due to consecutive resource peaks - peak oil having occurred at the beginning of this scenario. Driven by the will to reach resource independence while protecting the environment and human health more effort is put into the development of renewable energy resources than in any of the other scenarios. The effort will not be limited to identifying the renewable alternatives, which has already been done by many experts: High (efficiency) improvements and implementation rates lead to fundamental change of the energy generation processes. Mostly renewable energies are not yet competitive compared to conventional fuels at present prices, but well-directed investments can lead to an elimination of many current technical problems.[53] As renewable resources themselves are for free, prices for energy supply will sink constantly in the long-run.

[53] I.e. recycling problems concerning photovoltaics, noisy wind turbines etc.

Austria has an abundance of renewable energy resources. Hydropower already plays an important role for electricity generation. Big potentials are also seen for biomass, geothermal and to some degree wind and solar power. So an independence of oil and gas can be considered as a realistic option. Efforts for a higher share of renewables are found in all scenarios, but this one shows the highest implementation rate.

Besides a well developed usage of the geothermal potential found in the greater Vienna region, new wind parks and photovoltaics will be installed already during the next years. Looking at the climatic changes in line with B1, higher mean wind speeds can be expected in springtime; the overall development is similar to the climate scenarios before, but it is not as pronounced as in the others. Similar changes as for the other scenarios are expected for solar radiation. Again, any changes during the summer months remain highly uncertain. The spring decrease is less evident than in the other scenarios. The calculated changes for the hydrological patterns are much less dramatic. All of the seasons show a small increase in precipitation, even if they drop again during the third period. The highest increase is expected for autumn and winter. In conclusion, climatic conditions, especially regarding the associated potential for renewable energy resources, will not change as strongly in this scenario as in the others.

Because the potentials are already considered economically viable in many cases, the empowerment of existing as well as the additional installations of new renewable power plants will not be hindered by climatic changes; seasonally determined higher precipitation or wind speeds, and possibly higher solar radiation in summer could even support a radical re-arrangement of the energy generation processes.

IV.4 Comparing the Offers (Review of the Scenario Results)

Starting in 2005 with one and the same composite of conditions in the greater Vienna region, the Convenience, the Discount and the Best Buy Scenario describe different ways to answer the challenges and uncertainties of the 21st century. Slight differences at the beginning lead to partly enormously diverging development paths, offering limited possibilities for correction at a later stage.[54] The decisions made at the start and their consistent follow-ups, framed by the global developments pathways of the SRES scenarios, are subject to positive and negative feedbacks. So having a look in the three diverse "shopping bags" in 2100, the content will not pop out as a surprise. Of course, these scenarios present 'just' a fiction of the future of the whole metropolitan area, three plausible developments

---

[54] Cf.: in nonlinear systems "future outcomes are arbitrarily sensitive to tiny changes in present conditions." (Gell-Mann, 1995).

created with regard to the permanent interaction of local and global conditions.[55] The models the scenarios are based on can only produce outcomes that result from the model design and the input, in other words the results are predetermined. But these models can help us to understand our complex environment, the complex system(s) we live in, in a more comprehensive and integrative way. That is why they are an important tool for any integrated research.

LEAP allows to build scenarios under a wide set of social, economic and technological conditions. For this study a relatively broad approach with few details was chosen. But never having tried to look so far into the Viennese (energy) future before, this treatment appears as a useful approach and may be the beginning for more explicit studies. LEAP is a common energy model tool, but was applied to Vienna here for the first time.[56] The energy projections published so far that reach until 2015 were developed by a self-designed model of the Vienna University of Technology and cover a more profound range of input data. Some of them were adopted for the LEAP approach and thus make the first scenario years comparable, even if the predetermined philosophies of the scenarios are different.

This study aims to present a range of possible future images, plausible images. There is no black and white as sometimes presented in other scenarios; obviously the real development has to lie somewhere in-between. No 'business-as-usual' scenario (or even 'frozen efficiency scenario') is included. Following the concept of complex (adapting) systems, every system has to change steadily to be able to survive, and BAU does not integrate real change. For a short-term reflection this kind of approach may work out, but it does not seem suitable for almost a whole century. As the three scenarios presented in this study intend to come close to reality, they offer a range of possible development paths. The more realistic model outputs seem to be the better the understanding of the system's behavior and of what even small initial changes could cause also in the real world. Acting on scenarios with a horizon limited to 2015/20 could lead to unsuitable decisions and unwelcome irreversibilities.

LEAP offers the possibility for more long-term planning in the Vienna region. Simple as the results may seem here, they are able to outline thinkable developments. And

---

[55] Critics may argue that one century makes up a time horizon too long to make such assumptions as has been done here. For a major part they are right, which is also the reason why specific branch and technological developments were not described in too much detail here. Certainly, looking back at the last century, enormous changes took place, an indefinite number of new technologies was launched. But looking even farther in the past, there is the fact that the whole industrialization and now the era of post-industrialization relied on fossil fuels, or, that despite all new inventions in the last 128 years, we are still using Edison's light bulbs as primary appliance for lighting purposes with an efficiency of outstanding 5%. Though many previously unimaginable innovations appeared and have changed our lives basically, some patterns remained untouched. Hence, assuming persistent structures or behaviors in long-ranging scenarios may be an acceptable approach.

[56] Other Models are for instance MACRO (a top-down macroeconomic model), MESSAGE (Model for Energy Supply Strategy Alternatives and their General Environmental Impact) or MEDEE (Model for long-term Energy Demand evaluation), used for example by IIASA.

as it is still impossible to predict the future, a more detailed approach will not necessarily make the results more relevant.
The approach is seen as a useful tool to demonstrate the relative sensitivity of different developments to technological change. This can be considered as an "exogenous factor to the economic system or be endogenously driven through economic and political incentives", and it appears also as a main driver of GHG emissions. As long as the role of technology remains a key uncertainty when trying to model the future, maybe only simple models should be used in creating scenarios. (Casman et al., 1999, IPCC, 2007).

Comparing the results of the three scenarios, they show a clear picture: highly diverging developments, even though comprehension, behavior and social goals converge towards the end of the century.[57] The later the decision for sustainable (regional) development is seriously implemented in the system, the harder restructuring becomes. Efforts are possibly constrained by earlier decisions, and more time will be needed to eliminate the consequences of previous mistakes. The "lack of early investments in new and advanced technologies might result in long-term development paths that might be very difficult to avert, should they prove to be unsustainable and unviable." Path-dependency can cause a lock-in of the future evolution of the energy system due to the results of cumulative choices (Nakicenovic, 2003a), as it has been illustrated in the Discount Scenario. The opposite effects of cumulative choices are presented in the Best Buy scenario.

The percentage changes assumed in the Convenience, Discount and Best Buy Scenario do not differ much in each branch, usually less than 1% p.a. for each category, but the consequences for energy demand turn out to be remarkable. The next four figures present a comparison of the estimated energy demands in total as well as for private households, the transport sector and the economy, according to the three scenarios.

[57] As many of the global energy scenarios envisage a transition towards a higher importance of renewable sources as well as carbon capture and storage in the long run, by 2050 and beyond (Nakicenovic, 2003a).

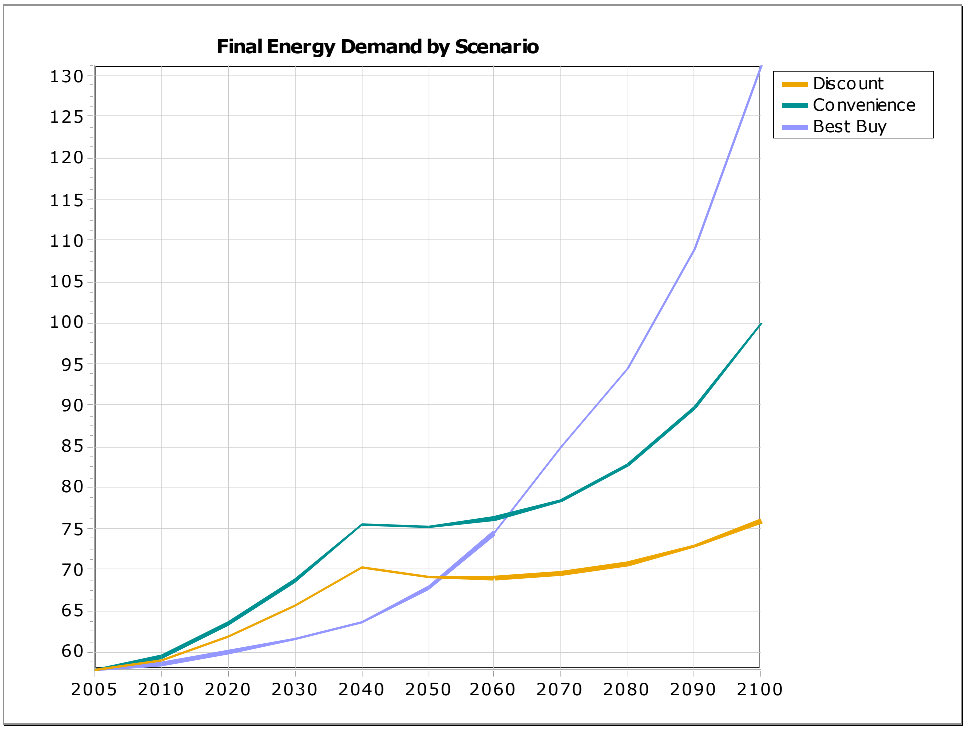


Fig. IV-39: Total Final Energy Demand by Scenario

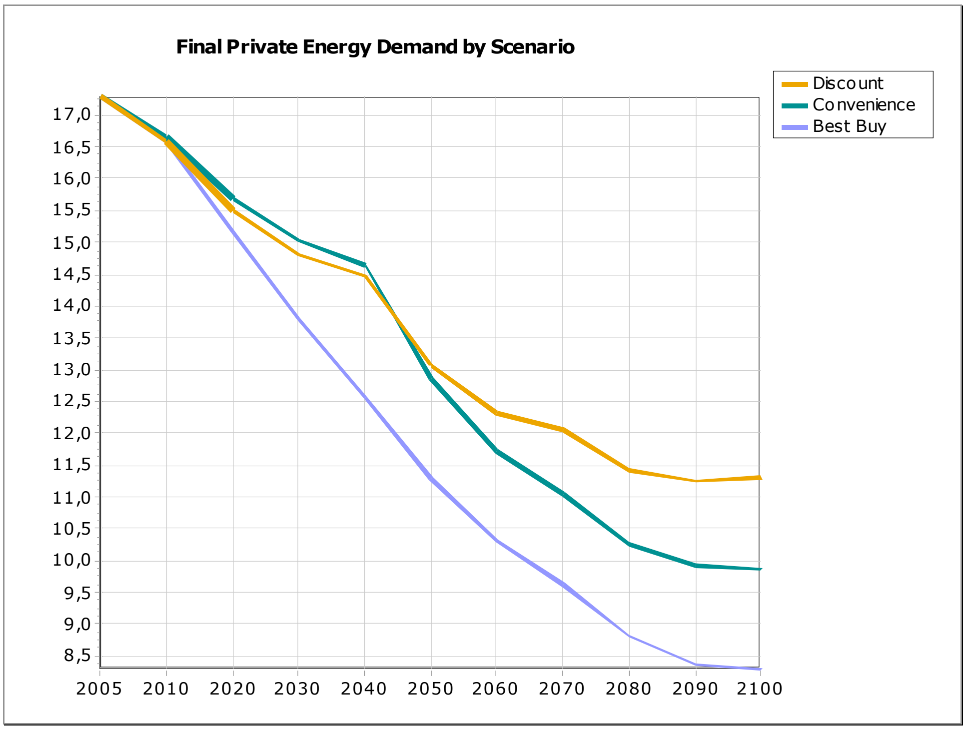


Fig. IV-40: Final Private Energy Demand by Scenario

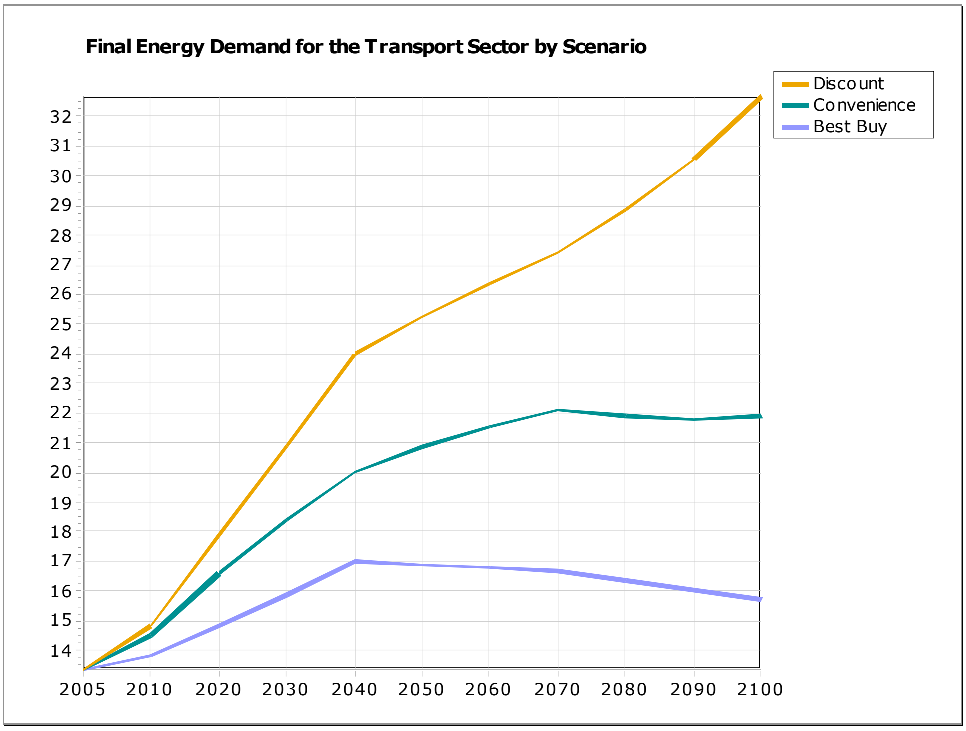


Fig. IV-41: Final Energy Demand for the Transport Sector by Scenario

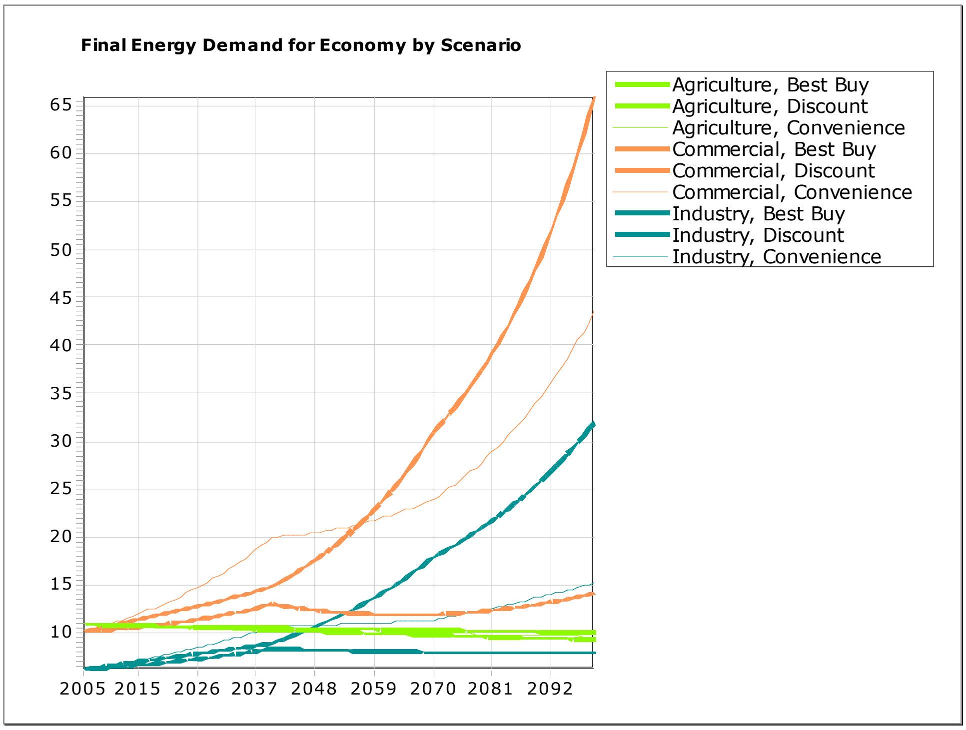


Fig. IV-42: Final Energy Demand for Economy by Scenario

Also the fostering of renewable energy resources in the energy supply by *Wien Energie* shows a diverging picture (*Figures IV-43* and *44*). Dependent on initial investments and possible future constraints, capacities can be enlarged noticeably – or not. Sustainable development relies on the implementation of an alternative energy system; it acts as the key driver for society, economy and environment: „Economic development and sound environmental management are complementary aspects of the same agenda. Without adequate environmental protection, development will be undermined; without development, environmental protection will fail.” [58]

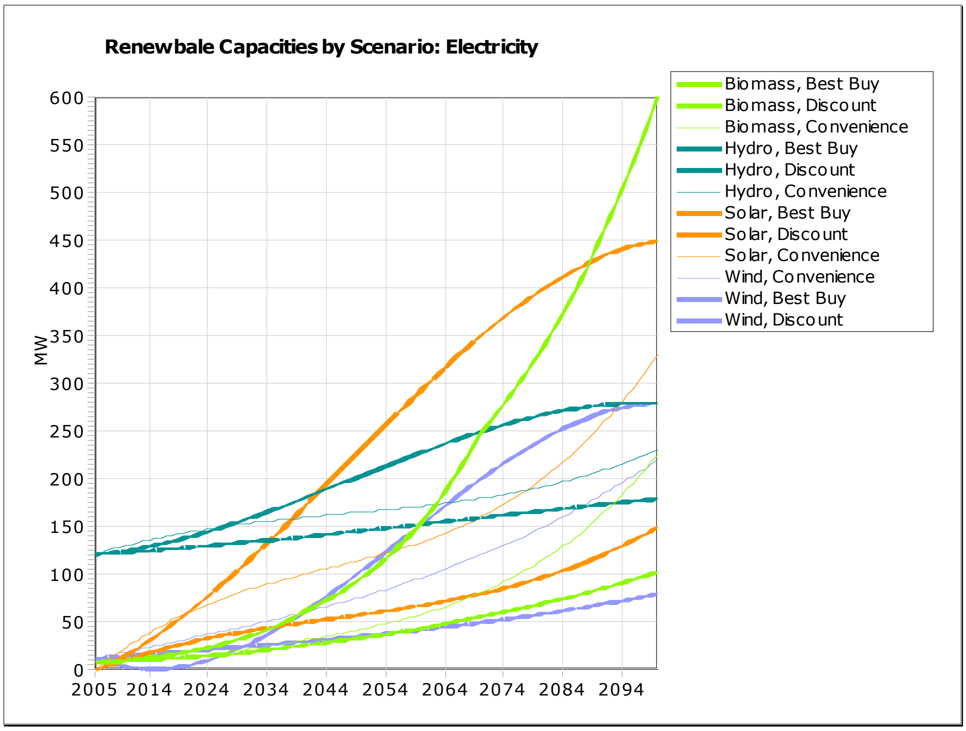


Fig. IV-43: Renewable Capacities by Scenario: Electricity

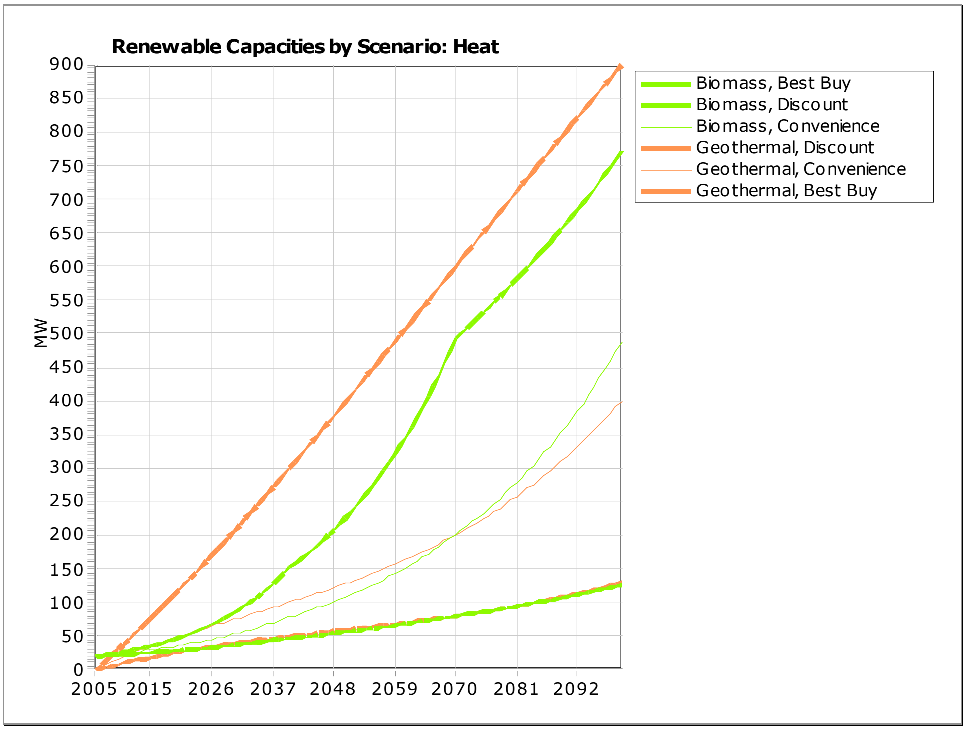


Fig. IV-44: Renewable Capacities by Scenario: Heat

[58] World Bank (1992): World Development Report. Development and the Environment, Oxford, p. 25.

As all the supply-demand gaps of the three scenarios have shown, energy imports to Vienna will be elementary also in future.[59] Today mainly the energy supplies of EVN fill this gap – first and foremost due to the fact that the suburban areas of Vienna are located in the province of Lower Austria, which is primarily served by EVN. But the liberalization of the European energy markets will increasingly change the conditions for the energy supply. The local/ national energy companies today find themselves in a competitive environment with international companies, facing new challenges and opportunities by the opening of the European energy markets. An overall, reliable planning with the target of meeting the full demand of a certain region or country has become impossible.

The Republic of Austria aims for a higher share of renewables in the national energy market, but lower prices of imported fossil energy hamper its full realization as could be observed during the last years.[60] Nonetheless, Austria prides itself of a high proportion of renewables, especially hydropower, compared to many other countries. The generation rates until the year 2000 can be found in Appendix III as citied in the energy report of the BMWA (Federal Ministry of Economics and Labor) in 2003. In fact, energy imports to Austria have been growing for years, while at the same time the national production of primary energy levels or even decreases slightly (PGO, 2008); Nakicencovic points out that the rate of hydropower has been decreasing since 1996[61]. So it remains highly uncertain how the growing gap between local energy supply and demand can be closed. Efforts regarding renewables are and will be made all over Austria and the European Union. But how serious will they be? And for how long will fossil fuels still come with a remarkable financial advantage? No exact data for future potentials can be provided as their feasible capacities depend on economic performance and the specific period of time. It is expected that the energy demand of a prosperous country such as Austria will also be met in future. But the economic and environmental costs as well as the ensuing possible constraints for society could develop very differently as outlined in the scenarios before. Thus, emphasis should be placed on flexible short-term planning and the diversification of energy sources.

TED, the Technology and Environmental Database included in LEAP, provides quantitative as well as qualitative information from numerous institutions, i.e. the IPCC, DOE or IEA on the GHG emissions ensuing from energy options. So linking the IPCC Tier 1 and 2 Default Emission Factors on demand as well as on supply side of the Viennese energy system made it also possible to build rough emission scenarios.

---

[59] They are called "imports" even when they derive from Austrian energy companies.

[60] Cf. SEP, 2006.

[61] The percentage share of hydro power for electricity generation fell from 1999 until 2004 from about 70 to 60% (Nakicenovic & Haas, 2005).

Figure IV-45 shows the possible development of GHG emissions on the demand side. Significantly diverging curves reflect the three socio-economic pathways as described before. At the end of the century the *Convenience* emission rate even lies under that of the Best Buy Scenario. The increase in the latter scenario at the end of the century is a consequence of the high economic growth rates assumed during this period. But as expected the overall sum of GHG emissions remains lowest on the *Best Buy* path.

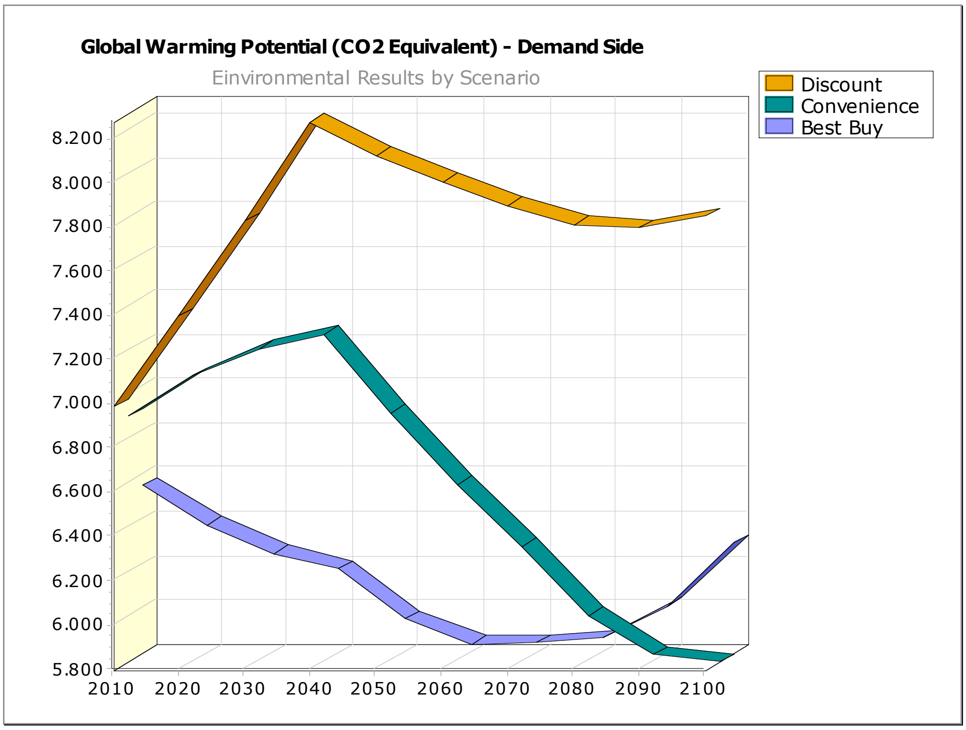


Fig. IV-45: Global Warming Potential by Scenario: Demand Side

On the supply side emission rates also differ considerably, although the *Discount* and *Convenience* paths lie fairly close together. Again, the Best Buy Scenario shows the strongest decline. When comparing the base year values with emission rates indicated by *Wien Energie* itself (about 3 million tons in 2005, Wien Energie, 2006a), the starting values assumed here appear too high. The reason might be that the average technology emission rates of the IPPC database differ from those of the concrete technologies implemented in Vienna. Though absolute values are different in the first scenario year the relative results of the three scenarios are not affected and appear clearly.

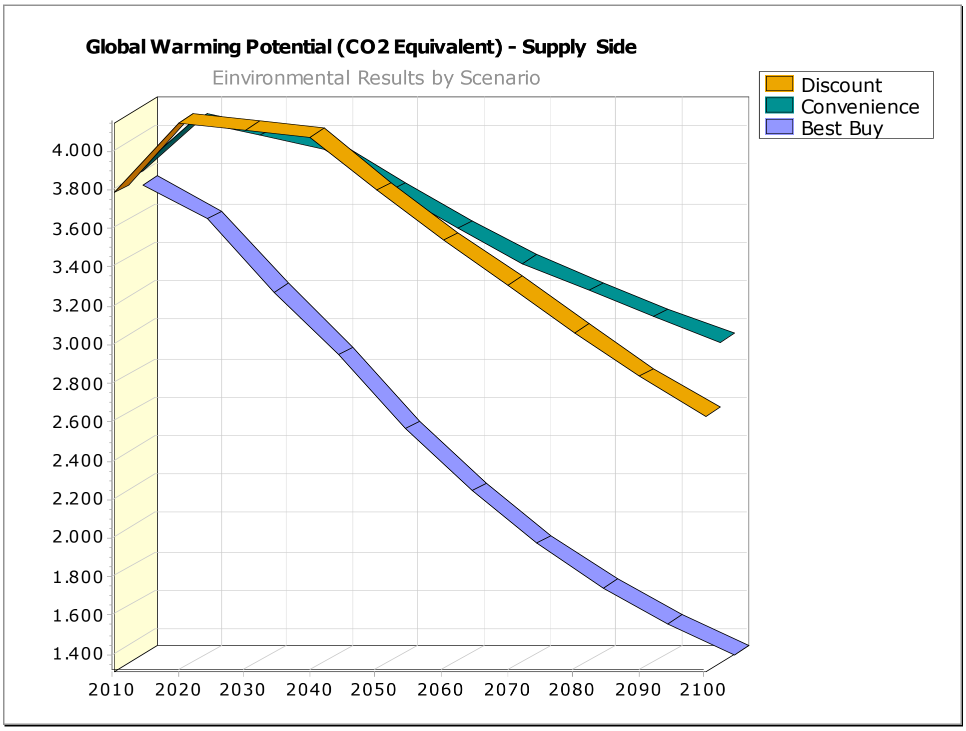


Fig. IV-46: Global Warming Potential by Scenario: Supply Side

Looking at the overall development of GHG emission rates (*Figure IV-47*) in the greater Vienna region, the three scenarios lead to very diverse emission curves. Of course, the Best Buy Scenario shows the lowest rates. As specific emission rates of present energy technologies were linked to those scenarios, real environmental loadings may be lower due to expected technological improvements.[62]

The annual per capita emission of CO_2 at the beginning of these scenarios in 2005 was calculated to be about 6 t.[63] *Wien Energie*, relying on the Federal Environmental Agency, quotes an annual rate of 5.9 t.[64] These numbers do not include the GHG emissions associated to the electricity generated outside the region and imported to meet the city's demand. Therefore per capita emissions in Vienna in fact are higher.

How do these results compare with international climate policy aims? The goal of European climate policy is to limit global warming to 2°C compared to pre-industrialized times. In order to achieve this 'high-flying' target, a cutting of the worldwide GHG emissions by 80% until 2050 would be necessary. Even the *Best Buy* path achieves only a reduction of about 20% in 2050 (27% in 2100). Vienna as

[62] Note: Though overall emission rates show lowest rates on the Best Buy path, they include a significant increase of methane and nitrous oxide loadings due to higher shares of biomass in the energy system.

[63] Total emissions were calculated with about 10.5 m t CO_2 equivalent in 2005. In the emission scenarios no plant building or substitution, viz. lifecycles were regarded.

[64] Cf. Wien Energie, 2006b.

a prosperous city in a high emission region[65] has to make much greater efforts if it intends to achieve this goal. And although in the Best Buy Scenario high investments, technology improvements as well as immediate changes of lifestyles and habits are assumed, the 2°C target seems to be far beyond reach even in this case. In fact, following a global B1 path will not achieve the aimed for 2°C temperature rise; global average temperatures may rise by 3-4°C.

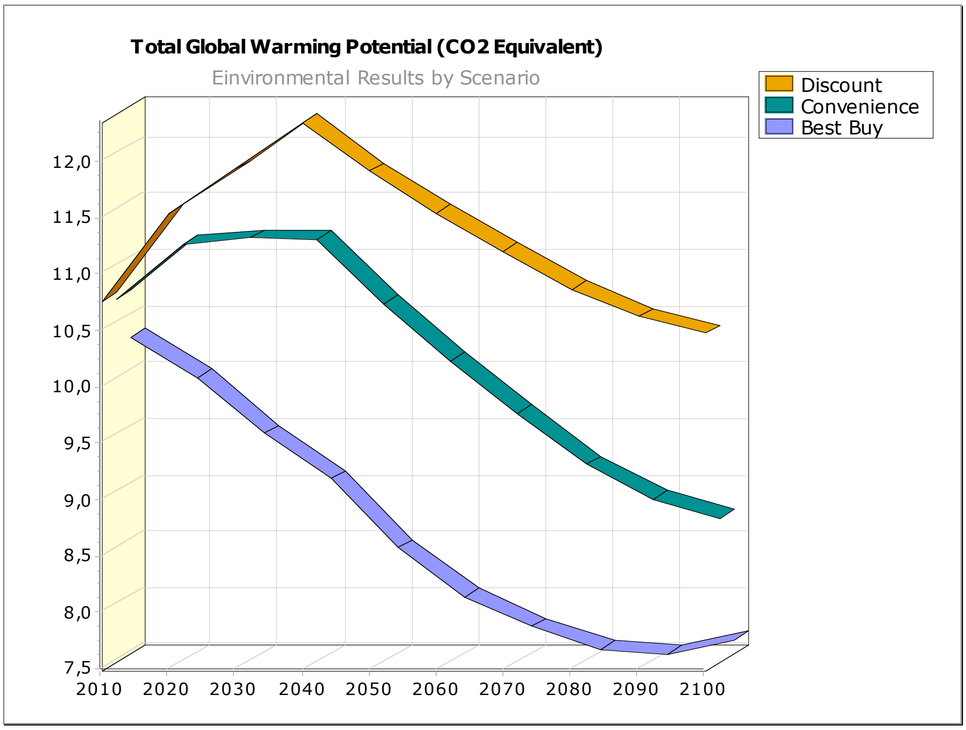


Fig. IV-47: Total Global Warming Potential by Scenario

LEAP was used to build demand and transformations scenarios, as well as emission scenarios. The model package also offers the possibility to create real resource scenarios as a third major step. But in order to do so, specific absolute cost estimates need to be made. Having in mind the current ups and sometimes even downs of prices, together with the long time horizon regarded here, it was not deemed useful to apply this module of LEAP for this study.

In summary LEAP as a tool offers a wide range of possibilities to study specific long-term questions regarding energy and its consequential effects on every spatial scale, also on the metropolitan level. Political goals can be included and compared easily. Although no policy goals and measures had influenced the assumptions here directly[66], of course, in reality they exist on the national as on the regional and citywide level. Nevertheless, the non-intervention scenarios presented here could

---

[65] IPCC world region: Western Europe.

[66] Despite of the European '20-20-20' policy set as background short-term *megatrend*.

help to re-evaluate the current political efforts. In view of the results in the long run this might help to see them in a new light (see also chapter V).

IV.5 …and Completing the Energy Package

An issue that has not yet been mentioned in detail in the scenarios are the numerous environmental effects that are caused during the energy transformation and distribution processes. Even if they do not influence the climatic conditions directly through GHG emissions, it does not mean they are not important enough to be taken into consideration at this point.

Energy transformation and distribution can lead to significant pollution of water and air: ozone smog caused by combustion engines, increased temperatures of water bodies used for cooling purposes of power plants, acid rain as another consequence of power plant emissions etc. The generation and use of energy further has severe impacts on land-use and aesthetic perception. Usually power plants are not architectural highlights in the landscape[67], sometimes safety clearances to housing developments have to be maintained, pesticides are used around power supply lines. This results again in detriments for biosphere (agriculture) and of course the well-being of the residents. The city’s environment is faced by many negative externalities caused by the energy sector. Additional heat release and altered radiation patterns, waste, noise (primarily caused by traffic), a depletion of green areas, living space and biodiversity along with changed run-off patterns are well known examples for the environmental costs of a high concentration of economic activity and population, viz. a high energy use. Special negative outcomes of the energy sector are health problems (like respiratory disease, cancer etc.), which can be worsened or even caused by exposition to the above-mentioned pollution.[68] The urban geometry plays an important role for dispersion and removal of pollution, as it further does for the (urban) climate and sustainability.[69]

The environmental and social costs, which arise as result of energy generation and use, are not included in the energy prices. When integrating the whole volume of costs caused by these processes, today’s energy prices would be much higher. Especially the conventional generation processes, the combustion of fossil fuels,

---

[67] A municipal waste incineration plant located in Vienna and designed by Hundertwasser constitutes an exception.

[68] See European Commission, IRP, 2006; Camagni, Cappello and Nijkmap, 1998.

[69] See also Button, 2002.

have serious impacts on the city, its climate (on the local scale mainly as urban heat island effect as explained in paragraph III.2), and therefore its population.

But renewable energy technologies also come along with negative side effects; hydropower e.g. provokes higher or lower temperatures in water bodies, wind parks are noisy. But summing up all of their negative effects and comparing them to the conventional technologies, pollution rates and thus environmental and social costs emerge here on a much lower level.

To sum up, urban pollution is determined by the resources and technologies used for energy generation as well as the subsequent usage patterns. A re-consideration and planning of the urban system based on minimizing the consumption of space and natural resources, a rational and efficient management of urban flows, the protection of the health of the urban population and the ensuring of equal access to resources and services seem important measures on the way to a sustainable city. The current problems of urban systems like Vienna could grow, depending on its development path, and just treating the symptoms instead of curing the affliction will not be sufficient.[70]

So instead of an "off-the-peg" approach, flexible and locally adapted policy instruments and measures are needed, as illustrated in the next chapter.

[70] Cf. Santamouris, M. (2001): On the built environment – the urban influence. In: Santamouris, M. (ed.) (2001), p. 3-18; see also for example Green Paper on the Urban Environment published by the European Commission.

V Political Spin-offs

So far, there is one issue which has not yet received much attention: the political dimensions of such a scenario. Normally, it would accompany some of the assumed developments; it can even serve as a back-drop method by applying it as a predefined final state of the system. But in this case, national and international policy goals were not included in building the scenario itself. Nonetheless, the results do have political value, as a profound understanding of the multiple interdependencies and interplays of economic development, social justice and ecological responsibility are fundamental to sustainable development (cf. Bulkeley, 2003).

V.1 Local Policy Implications

Today the greater Vienna region appears to be a prosperous and dynamic European region, which tries to attract on a national as well as an international level. But since the economic management has an impact on the environment and environmental quality impacts in return on economic performance, the scenarios presented in this paper show quite heterogeneous developmental chances. Hence, environmental considerations should be integrated into all economic decisions (cf. Pearce, 1990).

The number of policy objectives focused on sustainable urban development is huge, but they all represent important elements in a complex system, where heterogeneity is a key feature in organizing the system. Considering the urban environment as a complex adaptive (social) system, it can be characterized by equilibria, dynamics, adaptation and the power of decentralized interactions (cf. Miller & Page, 2007).

Nijkamp & Perrels listed suitable policy goals as follows:

Objectives in energy planning:

- low-cost supply
- efficiency of use
- use of renewables
- use of indigenous resources
- reduction of imported energy
- technology improvement

Objectives in regional planning:

- labor market
- technological innovation
- socio-economic welfare
- regional development
- amenities
- land-use and physical planning

Objectives in environmental management:

- effective resource management
- reduction of pollution
- restructuring of industrial processes
- ecological variability[1]

These general targets have to be adopted and specifically implemented into the context of national, regional or urban policies. To some degree, those anticipatory policies already have been determined in diverse national and local directives. Most important on the regional scale is KliP, the Viennese program for climate protection, as well as the already cited SEP, an energy efficiency program with a strong demand-side focus. KliP was first released in 1999 and from then on evaluated annually. Numerous measures and actions (together 36 comprehensive packages) were planned in order to reduce the locally produced GHG emissions. Having a look at the evaluation of 2007, big efforts are already made; sometimes targets even were exceeded (five program targets could already be reached). Meanwhile KliP II was planned and covers a time horizon until 2020. SEP was applied in 2003 and comes along with more than 100 specific measures. It relies on energy scenarios, which are based on a profound energy model developed by the Vienna University of Technology and extends to 2015. A lot of data were also adopted here from this study, as it had been considered a milestone for the Viennese energy policy.

On the national scale, the Austrian energy policy is presented by international comparison as a success with high renewable shares (energy report, BMWA, 2003) and somehow tends to relax on this issue. Very ambitious goals were formulated in the Austrian climate and sustainability strategies (released in 2002). According to a program of 2003, the share of renewables in 2010 shall reach 30% on a national scale.[2] Downscaling this to the local Viennese situation, in all three scenarios starting in 2005, this target will not be met within five years, though that does not mean it could not be achievable. An AEA (Austrian Energy Agency) paper on chances and role of municipalities in energy management claims that meeting national sustainability strategy goals can be achieved fostered mainly by the

[1] See Nijkamp & Perrels, 1994.

[2] Note: This was released even before the European 20-20-20 policy.

municipalities themselves as the major actors in energy supply and demand. In fact, another review of the AEA[3] concludes that the national goals seem very ambitious and can be reached only by making enormous efforts.[4]

But considering the tremendous restructuring an urban system like the city of Vienna needs if it wants to adapt successfully to future challenges, the previous actions may not be sufficient. Sustainable development has to be thought about on a twofold time horizon and can be considered as a dynamic, balanced and adaptive evolutionary process. On the short-term horizon, reaching more careful control of the urban environment has been tried through specific policy goals (which can be observed in Vienna as in many other cities at the moment). The long-term horizon focuses on a structural change in activities, behaviors and technology (Camagni, Capello and Nijkamp, 1997) and is still missing in the policies.

So formulating little step-by-step goals, which can be reached more or less without difficulty will not be the right policy for meeting huge upcoming challenges. Of course, the great number of approaches and adaptation efforts that were adopted during the last decade were highly valuable and show a certain awareness of environmental issues; however, the presentation of political success at the time appears almost *convenient,* as if these goals could be reached, on a national and regional level, and left doubt on the serious will to restructure the system. It still seems too easy to be convincingly the *best buy*. Short-term success still dominates political measures. But to be able to make real progress, maybe the defined goals should not be realistically achievable – to keep endeavors going.

A further objective of KliP is the generation of a municipal energy master plan (as one has existed for the transport sector since 2003). It could become a foundational part which integrates short-term measures within a necessary farsighted policy frame with the objective of a real structural change.

As these scenarios, as many others before, confirmed the importance of long-term thinking (and thus planning), they also proved the importance of irreversibility. The costs associated with a high number of decisions are irreversible, and since the environment has to be valued in the same sense as marketed goods and services, in the same way the forgone benefit resulting from environmental loss in future years should be treated as a cost and be integrated in conventional cost-benefit analysis.[5] Further, these costs are expected to increase over time because of a growing demand for environmental services, as the supply of such facilities remains limited (Pearce, 1990).

---

[3] European Commission, Handbuch Energieeffizienz in Gemeinden, 2004.

[4] As reference energy scenario the baseline scenario by Kratena & Wüger was used. It includes an efficiency improvement of 2% p.a. which matches to the European efficiency guideline; to compare: the highest efficiency enhancement assumed in the Best Buy Scenario reaches 1.1% p.a. during the second period.

[5] Economic values reflect people's preferences. But many things cannot be valued this way, which does not mean they are priceless.

An example of an anticipated, irreversible change is the deficiency of modern urban technology as a result of energy-profligate land-use patterns just like suburban developments, which did not pay attention to the physical environment in which the urban system evolved. This generalization, made by White, is true for the energy demand for both housing and transport (cf. White, 1994). Also the IPCC (2007) stated that scenarios of land-use changes can be thought of as adaptation scenarios.

Consequently, a way to address urban energy use is through more compact cities and the planning system by minimizing urban energy use itself - directly and indirectly through a reduction of space consumption and waste, the number and length of motorized journeys as well as a design for better energy conservation and efficiency, including renewable energies.[6] These goals are also objectives of the European Union or the ICLEI (Local Governments for Sustainability)[7] and thus of Viennese policies. But the physical urban environment shows a lot of dynamics and in this case a paradox: the concentration of people and services under conventional circumstances also leads to a higher concentration of environmental loadings (which affect well-being, health etc.) (cf. Breheny 1997, Camagni, Capello & Nijkamp, 1997). Hence, there is the strong necessity of more intelligent design using the vast knowledge around urban climatic patterns as well as architectural potentials, which meanwhile have accumulated over ages.[8]
Sustainable development relies in no small part on planning policy and practice; the European Commission therefore aims to support "polycentric, balanced urban systems" and the promotion of "resource-efficient settlement patterns that minimise land-take and urban sprawl,"[9] which requires the implementation of new technologies. It seems the conventional technologies have almost led to a "lock-in," and diffusion is needed to avoid negative feedbacks.[10] High investments in well-directed R&D projects could diminish current negative developments. But the later these investments are made, the higher the costs climb – by postponing policies it is highly likely that problem solving will cost more in the future (see Pearce, 1990).

Energy and environmental issues are just two sides of the same coin. Urban/ regional energy and environmental management and planning are gaining more and more importance as an effective strategy to ensure ecologically sustainable development. The main areas for short- and long-term sustainable policy

---

[6] Note: In contrast, Breheny's paper on the feasibility and acceptance of urban compaction (in the UK) states that most people „are happier in decentralized locations", they prefer houses and would therefore not vote freely for a higher compactness of urban areas. So „should they be compelled to more sustainable lifestyles?" (Breheny, 1997).

[7] ICLEI: International Council for Local Environmental Initiatives.

[8] See also Pearlmutter, 2007.

[9] European Commission, 1998, p. 2 and 6.

[10] Nakicenovic et al., 2000.

intervention are technology, territory and lifestyles (cf. Nijkamp & Perrels, 1994; Camagni, Capello & Nijkamp, 1997).
And while the impact and relationship between global and local issues are increasing, urban energy practices can improve the competitive position of a city facing the perpetual challenge of attracting investments, business and high-skilled workers (Bulkeley, 2003). These assumptions played a part in the Best Buy Scenario especially with significant differences in long-term consequences for the attractiveness and well-being of the whole region compared to the other scenarios. Although in this study, the development paths outlined for the greater Vienna region do not intend to assess them as being more favorable or not; they just present three possible futures. Many uncertainties will remain, viz. mainly scientific and socio-behavioral uncertainties about economy, climate change and resource availability. And there are no rules for choosing which policy to undertake in the face of these uncertainties, but scenarios can serve as a valuable tool for a better understanding of the complex system interactions and may, consequently, help leaders make more sophisticated, anticipatory policy decisions.

As explained before, LEAP offers a wide range of application opportunities to plan (urban) energy management. It is software capable of supporting the creation as well evaluation of political milestones on the way to successful metropolitan climate protection, following these five steps:

1 conduct an energy and emissions inventory and forecast,
2 establish an emission target,
3 develop a local action plan to achieve that target,
4 implement policies and measures and
5 monitor and verify results[11]

Following the IRP (Integrated Resource Planning) philosophy, sustainable development is a continuous planning process, where cities are considered as efficient starting points with challenges crossing the city's boundaries. Stanislaw (2007) states that we are at the beginning of a global race to create dominant green economies. A socio-economy and environmental win-win situation can be reached by defining new efficiency technologies, establishing 'low-impact production processes,' creating 'new eco-chic products and services,' 'greening brands' as well as 'discovering supply alternatives.'[12] Thus, the energy system has to be restructured. Locally adapted energy models and demand-side management seem to be promising options for realization of this restructuring.[13] Easier

---

[11] ICLEI: CCP (cities for climate protection campaign, 1993-2008), source: http://www.iclei.org/ [09/17/2008].

[12] The efforts which have been made so far through KliP show clear results: between 1999 and 2006 8.4 bn € had been invested while 10.9 bn € were obtained within the same time span; more than 40.000 jobs/ year could be created (KliP, 2007).

[13] There is the need of reversing the drivers of the energy system. The profit of energy service should be based on their service, not on the volume of energy sold: instead of selling commodities like cubic meters of gas or kWh of electricity, a high-value company provides

consensus within the society can be obtained when the local quality of life improves rather than when global climate change is prophesised. Conversely, these local implementations are beneficial on a global level (cf. Camagni, Capello & Nijkamp, 1997)

V.2 Applicability to other Metropolitan Areas

The city of Vienna, as a modern urban system with a high density of population as well as economic activities, is one of numerous European cities which hold a nodal position in an 'interwoven geographical and functional-economic (inter)national network' (Nijkamp & Perrels, 1994). While trying to keep and even expand its influence, it faces a rising number of environmental problems. In chapters III and IV, some of the negative effects of high population numbers, a dense transport system and an incremental economic weight have already been outlined. The resultant question is how far state and development options described in this study can be transferred to other cities. Looking at Vienna's economic, political and socio-cultural conditions today, a number of other metropolitan areas show similar dynamics, e.g. Munich, Zurich or Milan. Regarding climatic conditions, the first two are comparable. In a less narrow sense, metropolitan areas like Prague, Paris or London[14] show similarities, especially concerning population pressure[15], urban sprawl and a rising energy demand primarily for the expanding service sector. Therefore, an application of the approach presented here seems also useful for other metropolitan areas (not necessarily located in Europe). The dynamic interaction of socio-economic development, technology and climate change is a common challenge for all urban centers. Certainly the specific degree to which those regions will be exposed varies, while most of the European and Northern American regions will keep their advantages due to financial power and 'moderate' climate change impacts. Also, a usually secure (while expensive) supply with energy for basic needs is not yet seen as a possible upcoming problem here. So remembering the results of the three scenarios for the greater Vienna region, the dynamics of the energy demand of different branches could also show up similarly in other comparable cities. Regarding the supply side, more differences could appear, but due to more and more liberalized energy markets, conditions will assimilate. The development of higher shares of renewable energies (and in some cases nuclear energy) in the energy supply is a target of all European and Northern

---

light, heat and mobility. Re-imagine, re-engineer and re-design are the basics for the development of new products like energy packages or energy efficiency programs (see Stanislaw, 2007; European Commission, IRP, 2006).

[14] Compare: Scientific proof is given that risks to the built environment in the UK will be driven primarily by increased temperatures, changing precipitation patterns (more rainfall in winter, less in summer) and an increase in the frequency of extreme events, with the possibility of more storms. (McEvoy, 2007).

[15] Despite Vienna's specific demographic history, from now on it probably follows a similar development path as other major European cities (Lutz, W., Scherbov, S. and Hanika, A., 2003).

American countries. Potentials for certain technologies differ from region to region, but no region lacks potential worth developing.
The greater Vienna region (as Austria in general) offers great potential, especially for hydro power and biofuels[16], but even if the capacities of the scenarios presented here cannot be achieved in other regions, sustainable development is still practicable by adequate imports. In any case, all of the metropolitan areas also remain highly dependent on energy imports in the future – due to growing population numbers and limited space. The challenge is just which kind of resource or energy "import" will be preferred.

An ecologically sustainable urban development is the target of most European cities today. "Sustainable cities are cities where socio-economic interests are brought together in harmony (co-evolution) with environmental and energy concerns in order to ensure continuity in change."[17] In order to achieve this objective, Nijkamp and Perrels call for more integrated, strategic and visionary urban policies. In this context, this study could support a re-evaluation and amelioration of the current policies. Sustainable development is not a sprint[18] - it is a marathon, which requires planning, preparation and patience on a longer time horizon than has previously been done.
Integrated long-term scenarios, like the three presented here, can help to recognize irreversibilities and let us re-think the present targets by enhancing the understanding of interactions and make a re-orientation easier. Cities find themselves in a hard competition, and sustainability may be regarded as the "(implicit) ultimate goal of a dynamic multi-actor system." (Nijkamp & Perrels, 1994) Further, regional sustainable developmental (RSD) can be compared to global development: if all regions succeed to realize RSD, the whole system will be sustainable. Paths to reach this goal vary from region to region due to the site-specific local circumstances, e.g. availability and use of natural resources as mentioned before, environmental vulnerability, resilience and so on. Key factors which are relevant for RSD are intergenerational and interregional trade-offs as well as the multiple and sustainable use of environmental resources.[19]

Different scenarios afford an opportunity to explore future energy perspectives - and so to compare different regional (and global) development paths, be they more conventional or alternative. Risks and lasting uncertainties become clearer. More insight about the nature of interactions can help both improve public policy responses and stimulate automatic feedback mechanisms (cf. Button, 2002). Subsequent cost-benefit analysis can evaluate possible trade-offs.

---

[16] Current studies on renewable energy potentials in Austria are released by PGO in 2008 and ÖROK (to be released in 2009), representing the most profound and up-to-date proof.

[17] Nijkamp & Perrels, 1994, p.4; change means changing situations for cities.

[18] Or as one currently may assume relay, while counting on the next runner.

[19] See Nijkamp, Laschuit & Soeteman 1991.

A general model to assess the environmental improvement of a region was created by Nijkamp and Perrels (1994). It presents the interactions of economy, policy and environment with (energy) scenarios playing a key role. It has been adjusted in this study (see *Figure V-1*) and appears applicable to every regional case study with the scope of RSD research.

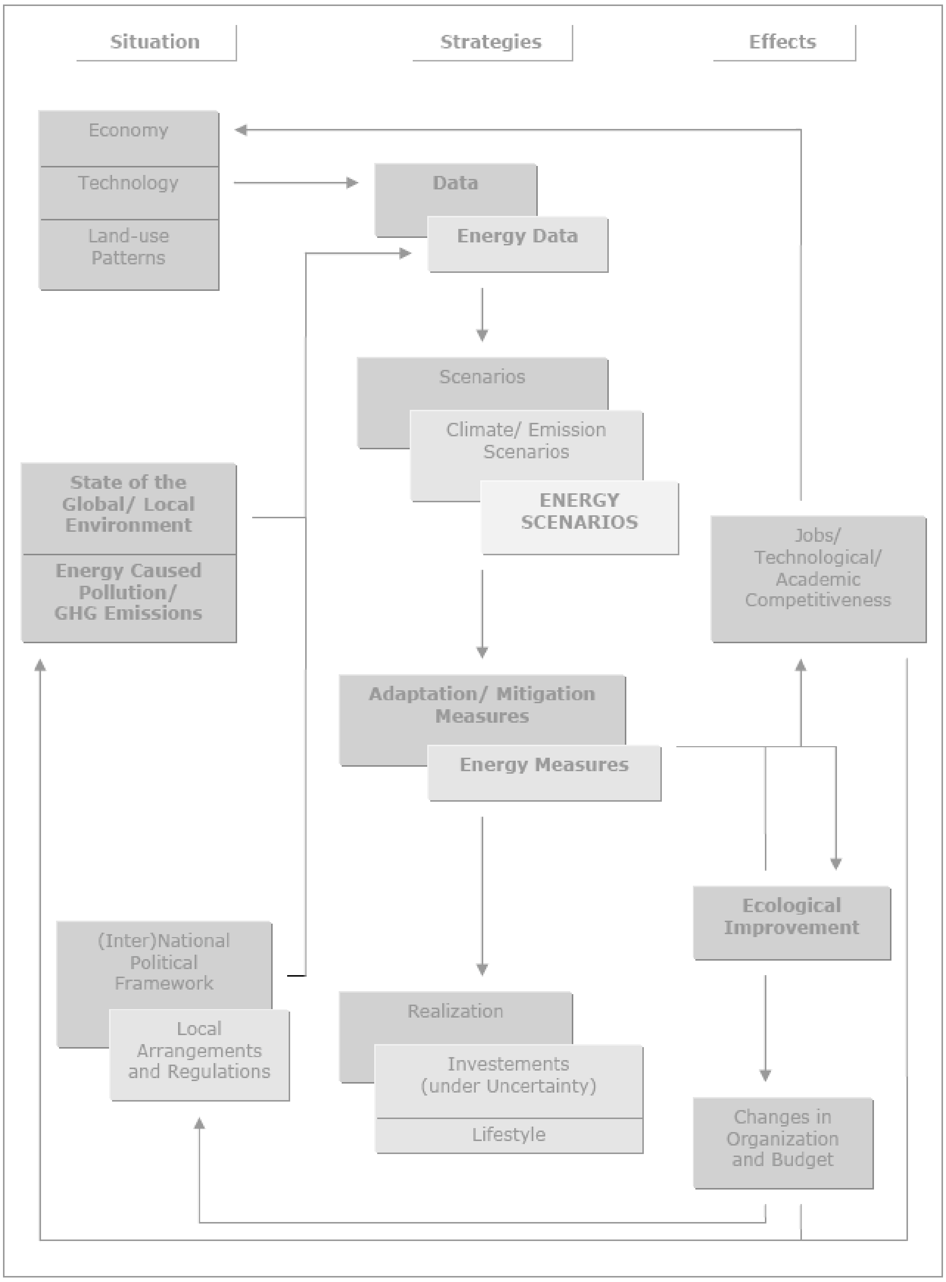


Fig. V-1: Adaptation of Nijkamp's & Perrels' Environmental Improvement Model

VI Conclusion

"We are made wise not by the recollection of our past,
but by the responsibility for our future."
G. B. Shaw

Our world is made up of complex interdependencies and interactions of socio-economic and natural systems as well as deep uncertainties. Scenario approaches aim to provide an analytical framework for a better understanding of these complexities. They are a robust tool to assess possible future developments, as, for instance, the SRES scenarios have verified. But down-scaling global phenomena to the local scale comes with big difficulties (cf. Nakicenovic, 2003 c). In order to gain insight into the different paths a city like Vienna could follow and what its local energy perspectives could be, the proven energy model tool LEAP was applied in this paper. Certainly, the specific assumptions that have been made to break down global circumstances to local development options remain subject to analysis. But this should not distract from the general results. Effective data and already existing research efforts on the local and short-term scale of the Vienna region were brought into a global context and extended for the whole 21st century based on the conditions of the global SRES development paths released in 2000. The findings of the three local scenarios - *Convenience, Discount* and *Best Buy* (based on SRES A1B, A2 and B1) - diverge strikingly for some branches and periods and point out the importance of the integration of social and physical scientific perspectives of research addressing the (peri-)urban global environmental change in a long time horizon (Cf. Simon, 2007).

Depending on near-term investments and efforts in technology research, the respective development paths will unfold, each bringing along positive or negative irreversibilities. Cities such as Vienna are not isolated entities; they fit into the larger dynamics and interactions of the global economic and ecological system. Thus, to implement (urban) sustainable development entirely, adverse impacts of the economic and energy systems on all levels, from local air pollution all the way to global climate change, need to be combated. To become capable of providing a "liveable and healthy environment for [the urban] habitants and meet their needs without impairing the capacity of the local, regional and global environmental systems to satisfy the needs of future generations" (Stanners and Bourdeau[1]), fundamental policy and behavioural changes will be needed during the next few decades. However, the complexity and the uncertainties (i.e. of climate change scenarios) of the challenges should not be taken as an excuse to delay the required technology improvements. Without investments, however uncertain, surely no improvements will be made (Cf. Nakicenovic, 2003; White, 1994).

[1] Cited in Santamouris, 2001, p. 14.

The scenarios created here intend to present plausible images of the future of a dynamic metropolitan area like Vienna and underline (again) the importance of energy conservation and efficiency as well as the use of renewables. The scenarios have not been judged nor given any preferences. No probabilities of occurrence can be stated regarding the endless number of development variations and the long time horizon. They do not include any specific policy interventions as they do not have to be interpreted as policy recommendations – but, of course, they can be seen as a valuable approach for necessary long-term considerations and more ambitious local sustainable development.

REFERENCES

Auer, I., *Böhm,* R. & *Mohnl*, H. (1989): Klima von Wien. Magistrat Stadt Wien (ed.), Wien.

Austrian Biomass Association (2006): Biomasse-Boom. Ausweitung der Biomasseproduktion ein Gebot der Stunde. Press release 07/20/2008, Wien.

Birol, F. (Interview, April 2008): Die Sirenen schrillen- Die internationale Energieagentur (IEA) schlägt Alarm: Schneller als erwartet könnte der Welt das Öl ausgehen - die Gefahr einer Versorgungskrise wächst, In: Internationale Politik, p. 34-43.

Breheny, M. (1997): Urban compaction. Feasible and acceptable?. In: Cities Vol. 14, No. 4, p. 209-217.

Bulkeley, H. & *Betsill*, M. M. (ed.) (2003): Cities and climate change: urban sustainability and global environmental governance. London.

Button, K. (2002): City management and urban environmental indicators. In: Ecological Economics, Vol. 40, p. 217-233.

Camagni, R., *Capello*. R. & *Nijkamp*, P. (1998): Towards sustainable city policy: an economy-environment technology nexus. In: Ecological Economics, Vol. 24, p. 103-118.

Canziani, O. et. al. (ed.) (2007): Climate Change 2007 – Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC, Cambridge.

Cartalis, C. et al. (2001): Modifications in energy demand in urban areas as a result of climate changes: an assessment for the southeast Mediterranean region. In: Energy Conversion and Management, Vol. 42, p. 1647-1656.

Casti, J. (1999): Would-be worlds: the science and surprise of artificial worlds. In: Computers, Environment and Urban Systems, Vol. 23, p. 193-203.

Christian, R. et. al. (1984): Energie 2030, der sanfte Weg. Eine umweltfreundliche Variante der künftigen Energieversorgung Österreichs. Österreichische Gesellschaft für Ökologie, Wien.

Dixit, A. & *Pindyck*, R. (1994): Investment under Uncertainty. Princeton.

Dooley, K. J. (1997): A Complex Adaptive Systems Model of Organization Change. In: Nonlinear Dynamics, Psychology and Life Sciences, Vol. 1, No. 1, p. 69-97.

Energy Watch Group (ed.) (2007): Crude Oil. The Supply Outlook. Final Draft.

European Commission (1998): Sustainable Urban Development in the European Union: A Framework for Action. Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions, Brussels.

European Commission, DG Energy and Transport (ed.) (2004): Handbuch Energieeffizienz in Gemeinden Handbuch Energieeffizienz in Gemeinden, Brussels.

European Commission, DG Energy and Transport (ed.) (2006): Integrierte Ressourcenplanung, Brussels.

EVN (ed.) (2006): Geschäftsbericht 2005/06. Maria-Enzersdorf.

Fezer, F. (1995): Das Klima der Städte. Gotha.

Formayer, H. et al. (2007): Räumlich und zeitlich hochaufgelöste Temperaturszenarien für Wien und ausgewählte Analyse bezüglich Adaptionsstrategien. Wien.

Gell-Mann, M. (1994): The Quark and the Jaguar. Adventures in the Simple and the Complex, New York.

Gell-Mann, M. (1995): What is complexity? In: Complexity, Vol. 1, Issue 1.

Grimmond, S. (2007): Urbanization and global environmental change: 21st century challenges. Urbanization and global environmental change: local effects of urban warming. In: The Geographical Journal, Vol. 173, Issue 1, p. 83-88.

Hanika, A., Lebhart. G. & *Marik*, S. (2003): Bevölkerung Österreichs im 21. Jahrhundert. Statistik Austria (ed.), Wien.

Hanika, A. et al. (2004): ÖROK-Prognosen 2001-2031. Teil 1. Bevölkerung und Arbeitskräfte nach Regionen und Bezirken, ÖROK, Schriftenreihe Nr. 166/I, Wien.

Hanika, A. et al. (2005): ÖROK-Prognosen 2001-2031. Teil 2. Haushalte und Wohnungsbedarf nach Regionen und Bezirken Österreichs, ÖROK, Schriftenreihe Nr. 166/II, Wien.

Hanika, A. (2007): Bevölkerungsvorausschätzung 2007-2050 sowie Modellrechnung bis 2075 für Wien (Mittlere Variante). Statistik Austria (ed.), Wien.

ICLEI: CCP (cities for climate protection campaign, 1993-2008), source: http://www.iclei.org/ [09/17/2008].

Kratena, K. & *Wüger*, M. (2005): Energieszenarien für Österreich bis 2020. WIFO (ed.), Wien.

Kromp-Kolb, H. & *Formayer*, H. (2005): Schwarzbuch Klimawandel. Wieviel Zeit bleibt uns noch? Salzburg.

Lam, J. (1998): Climatic and Economic Influence on Residential Electricity Consumption. In: Energy Conversion and Management, Vol. 39, No.7, p. 623-629.

Langer, B. (2000): Untersuchung der städtischen Wärmeinsel Linz. Linz.

Lebhart, G., *Marik-Lebeck*. S. & *Klotz*, J. (2007): Kleinräumige Bevölkerungsprognose für Wien 2005 bis 2035. Stadtentwicklung Wien, MA 18 (ed.), Stadtentwicklung und Stadtplanung (Werkstattberichte / Stadtentwicklung, 86), Wien.

Levin, S. (2002): Complex Adaptive Systems: Exploring the Known, the Unknown and the Unknowable. In: Bulletin of the American Mathematical Society, Vol. 40, No. 1, p. 3-19.

Loibl, W. (2004): Simulation of suburban migration: driving forces, socio-economic characteristics, migration behaviour and resulting land-use patterns. Vienna Yearbook of Population Research, p. 203-226, Vienna.

Luhmann, N. (1989): Soziale Systeme: Grundriß einer allgemeinen Theorie. Frankfurt a.M.

Lutz, W., *Scherbov*. S. & *Hanika*, A. (2003): Vienna: a city beyond aging - revisited and revised. Vienna Yearbook of Population Research, Vol. 1, p. 181-195, Vienna.

Matzarakis, A. (2001): Die thermische Komponente des Stadtklimas. Berichte des Meteorologischen Instituts der Universität Freiburg, Nr. 6, Freiburg.

Mayer, V. (2004): Wohnbauentwicklung und Wohnqualität im Umland von Wien: Ergebnisse einer Bürgermeisterbefragung. Schriftenreihe Wohnwesen Umland Wien, Bd. 1, Wien.

McEvoy, D. (2007): Climate Change and Cities. In: Built Environment, Vol. 33 No. 1.

Miller, J. & *Page*, S. (2007): Complex Adaptive Systems. An Introduction to Computional Models of Social Life. Princeton.

Nakicenovic, N. (2003a): Global Energy Perspectives and the Role of Technology. Vienna University of Technology, Vienna.

Nakicenovic, N. (2003b): Global Energy Scenarios, Climate Change and Sustainable Development. Riso/ International Energy Conference, Copenhagen.

Nakicenovic, N. (2003c): IPCC SRES revisited: a response. Vienna.

Nakicenovic, N. (2007): The Changing World: Energy and Social Futures. IIASA Conference (11/13-15/2007), Laxenburg.

Nakicenovic, N. et al. (2000): Special Report on Emissions Scenarios. Cambridge.

Nakicenovic, N. & *Haas*, R. (2005): Wohin führen Energieszenarien?. Internationaler Workshop Energievisionen für die Zukunft. 24/11/2005, Wien.

Nijkamp, P., *Laschuit*. P. & *Soeteman*, F. (1991): Sustainable Development in a Regional System. Research Memorandum, Vrije Universiteit Amsterdam, p. 1-31, Amsterdam.

Nijkamp, P. & *Perrels*, A. (1994): Sustainable Cities in Europe. A Comparative Analysis of Urban Energy-Environmental Policies. London.

ÖGUT (2008): Wege zur Strom- und Wärmeaufbringung ohne fossile Energieträger bis 2020/2030. Ein Diskussionsbeitrag. Wien.

Oke, T. (2001): Boundary Layer Climates. 2nd edition, London/ New York.

ÖROK (ed.) (2008): Szenarien der Raumentwicklung Österreichs 2030. Matrialienband, Wien.

ÖROK (ed.) (2008): Zwischenbericht zum Projekt: Energie und Raumentwicklung - Darstellung der Potenziale erneuerbarer Energieträger. Draft (to be released in 2009), elaborated by iSpace, IIASA, Wien.

Österreichische Bundesregierung/ BMWA (2003): Energiebericht 2003. Wien.

Österreichisches Institut für Erwachsenenbildung (2004): Motivation und Zufriedenheit von Zuzüglern ins Wiener Umland. Wien.

Ottinger, R. L. (2006): Energy efficiency: The best immediate option for a secure, clean, healthy future. Commentary, Natural Resources Forum 30, p. 318–327.

Pearlmutter, D. (2007): Architecture and Climate: The Environmental Continuum. In: Geography Compass, ¼, p. 752–778.

Pearce, D. W. (1990): Blueprint for a green economy. London.

PGO (ed.) (2008): Raum und Energiepotentiale in der Ostregion. Elaborated by mecca, Wien.

Plach, W. (1998): Prognose des thermischen Komforts in der Stadt. Wien.

Renewable Energy Enquiries Bureau (ed.) (2001): Efficiency and performance. Wind Energy Fact Sheet 14. Harwell.

Santamouris, M. (ed.) (2001): Energy and climate in the urban built environment. London.

Simon, D. (2007): Urbanization and global environmental change: 21st century challenges. Cities and global environmental change: exploring the links. In: The Geographical Journal, Vol. 173 , Issue 1, pp. 75–92.

Sivertsson, A. (2004): Study of World Oil Resources with a Comparison to IPCC Emissions Scenarios. Master thesis, Department of Radiation Sciences, Uppsala University, Uppsala.

Spirn, A. W. (1984): The Granite Garden. Urban Nature and Human Design. New York.

Stadt Wien, MA 22 (1996-2007), Klimaschutzprogramm Wien (KliP). Wien.

Stadt Wien, MA 22 (2003): Stadtklimauntersuchung Wien. Wien.

Stadt Wien, MA 27 (2006): Städtisches Energieeffizienzprogramm (SEP). Konzept 2006, Wien.

Stadt Wien, MA18, MA 41 (2008): Flächennutzung Wen 2005. Wien.

Stanislaw, J. A. (2007): Climate Change and Energy Security: The Future is Now. White Paper.

Statistik Austria: Bevölkerungsregister. Wien.

Statistik Austria (2007): Bevölkerungsstand 2007. Wien.

Statistik Austria (2007): Energieflussbild Wien 2005. Stand 2007, Wien.

Statistik Austria (2007): Regionale Gesamtrechnungen. Erstellt am 18.12.2007, Wien.

Statistik Austria (ed.) (2007): Statistisches Jahrbuch Österreichs. Wien.

Statistik Austria (2007): Volkszählungen. Erstellt am 15.05.2007, Wien.

Statistik Austria/ Österreichischer Städtebund (ed.) (2006): Statistisches Jahrbuch Österreichischer Städte 2005. Wien.

Statistik Austria/ Stadt Wien (MA 62, MA 14, MA 5): Lokales Melderegister, Wien.

Vester, F. (2002): Die Kunst vernetzt zu denken. Ideen und Werkzeuge für einen neuen Umgang mit Komplexität. Ein Bericht an den Club of Rome, München.

White, R. R. (1994): Urban environmental management. Environmental change and urban design. Chichester inter alia.

Wien Energie (ed.) (2006): Geschäftsbericht 2005/06 (01/10/2005–30/09/2006). Wien.

Wien Energie (ed.) (2006): Nachhaltigkeitsbericht 2005/06. Wien.

Wood, J.H., *Long*, G. R. & *Morehouse*, F. E. (2003): Long-Term World Oil Supply Scenarios. The Future Is Neither as Bleak or as Rosy as Some Assert. Washington D.C.

ZAMG (2008): Klimadaten Österreich 1961-90. Wien.

APPENDIX

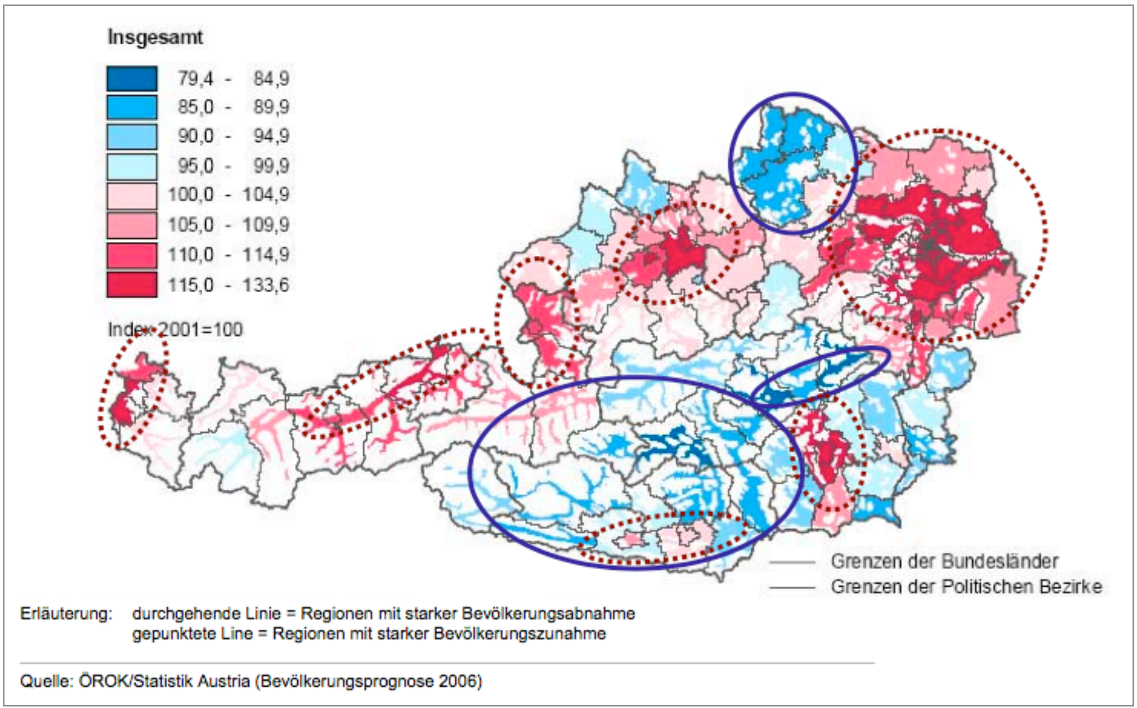
Regional Overview Data

Key Data Greater Vienna Region 2005

	Area (km²)	Population	Number of Households	Population Density (cap/km²)	GRP (m €)	GRP Growth (2000-2005)
City of Vienna	414.65	1,651,437	817,198	3,982.725	60,351	2.5%
Northern Suburbia	2,722.4	290,631	120,095	106.76	5,273	1.9%
Southern Suburbia	1,474.71	306,829	126,789	208.06	9,160	3.6%

Source: Statistical Office of Austria, 2008

Regional Population Forecast 2001-2031



Source: Statistical Yearbook of Austrian Cities, 2006, p.40

Note: This map outlines the national importance of the greater Vienna region for Austria. Hence, population growth as in the scenarios is just assumed for the specific region, not for the whole country.

List of Municipalities in the Greater Vienna Region

(Wiener Umland Nord + Süd)

Municipalities Northern Suburbia (Province of Lower Austria)	Municipalities Southern Suburbia (Province of Lower Austria)
Aderklaa	Alland
Andlersdorf	Bad Vöslau
Angern an der March	Baden
Auersthal	Ebreichsdorf
Bad Pirawarth	Günselsdorf
Deutsch-Wagram	Heiligenkreuz
Ebenthal	Klausen-Leopoldsdorf
Eckartsau	Kottingbrunn
Engelhartstetten	Leobersdorf
Gänserndorf	Mitterndorf an der Fischa
Glinzendorf	Oberwaltersdorf
Groß-Enzersdorf	Pfaffstätten
Großhofen	Pottendorf
Groß-Schweinbarth	Reisenberg
Haringsee	Schönau an der Triesting
Hohenruppersdorf	Seibersdorf
Lassee	Sooß
Leopoldsdorf im Marchfelde	Tattendorf
Mannsdorf an der Donau	Teesdorf
Marchegg	Traiskirchen
Markgrafneusiedl	Trumau
Matzen-Raggendorf	Blumau-Neurißhof
Obersiebenbrunn	Au am Leithaberge
Orth an der Donau	Bad Deutsch-Altenburg
Parbasdorf	Berg
Prottes	Bruck an der Leitha
Raasdorf	Enzersdorf an der Fischa
Schönkirchen-Reyersdorf	Göttlesbrunn-Arbesthal
Spannberg	Götzendorf an der Leitha
Strasshof an der Nordbahn	Hainburg a.d.Donau
Untersiebenbrunn	Haslau-Maria Ellend
Velm-Götzendorf	Höflein
Weikendorf	Hof am Leithaberge
Weiden an der March	Hundsheim
Bisamberg	Mannersdorf am Leithagebirge
Enzersfeld	Petronell-Carnuntum
Ernstbrunn	Prellenkirchen
Großmugl	Rohrau
Großrußbach	Scharndorf
Hagenbrunn	Sommerein
Harmannsdorf	Trautmannsdorf an der Leitha
Hausleiten	Wolfsthal
Korneuburg	Achau
Langenzersdorf	Biedermannsdorf
Leitzersdorf	Breitenfurt bei Wien
Leobendorf	Brunn am Gebirge
Rußbach	Gaaden

Municipalities Northern Suburbia (Province of Lower Austria)	Municipalities Southern Suburbia (Province of Lower Austria)
Sierndorf	Gießhübl
Spillern	Gumpoldskirchen
Stetteldorf am Wagram	Guntramsdorf
Stetten	Hennersdorf
Stockerau	Hinterbrühl
Niederhollabrunn	Kaltenleutgeben
Bockfließ	Laab im Walde
Großebersdorf	Laxenburg
Groß-Engersdorf	Maria Enzersdorf
Hochleithen	Mödling
Kreuttal	Münchendorf
Kreuzstetten	Perchtoldsdorf
Pillichsdorf	Vösendorf
Ulrichskirchen-Schleinbach	Wiener Neudorf
Wolkersdorf im Weinviertel	Wienerwald
Absdorf	Ebergassing
Atzenbrugg	Fischamend
Fels am Wagram	Gramatneusiedl
Grafenwörth	Himberg
Großriedenthal	Klein-Neusiedl
Großweikersdorf	Lanzendorf
Judenau-Baumgarten	Leopoldsdorf
Kirchberg am Wagram	Maria-Lanzendorf
Königsbrunn am Wagram	Moosbrunn
Königstetten	Rauchenwarth
Langenrohr	Schwadorf
Michelhausen	Schwechat
Sieghartskirchen	Zwölfaxing
Sitzenberg-Reidling	
Tulbing	
Tulln an der Donau	
Würmla	
Zeiselmauer-Wolfpassing	
Zwentendorf an der Donau	
Sankt Andrä-Wördern	
Muckendorf-Wipfing	
Gablitz	
Gerasdorf bei Wien	
Klosterneuburg	
Mauerbach	
Pressbaum	
Purkersdorf	
Tullnerbach	
Wolfsgraben	

Source: Statistical Office Austria, 2008

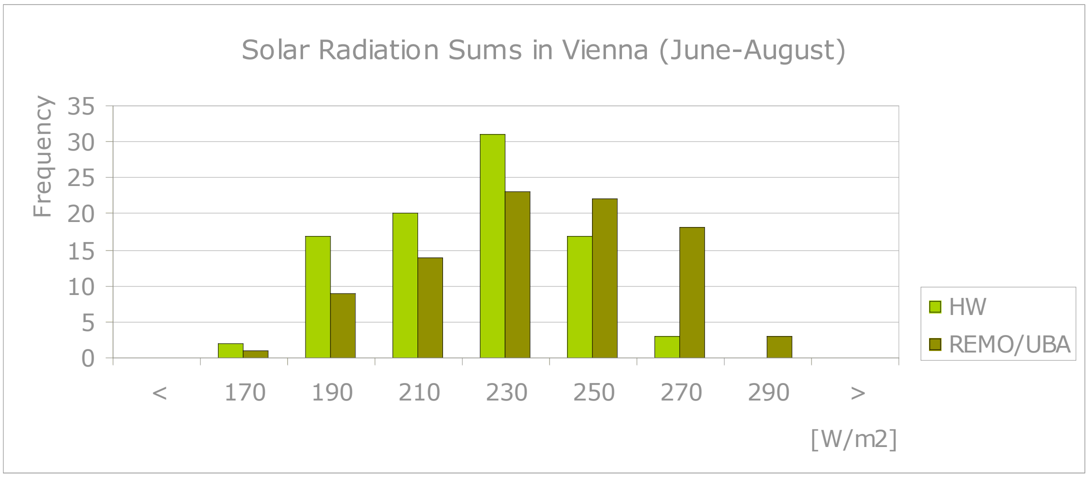
Addition to Regional Climate Change Results

Meteorological Stations (ZAMG)

Name	Height	Characteristics
Groß-Enzersdorf	153 m	characterized by agricultural land-use, typical patterns of the outskirts eats of the Danube river
Wien – Hohe Warte	203 m	close to the Danube river, typical for high density developments at the watersides
Wien – Innere Stadt	171 m	typical for high density developments within the city center
Wien - Mariabrunn	227 m	characterized by agricultural land-use, slight basin exposure, typical for western outskirts

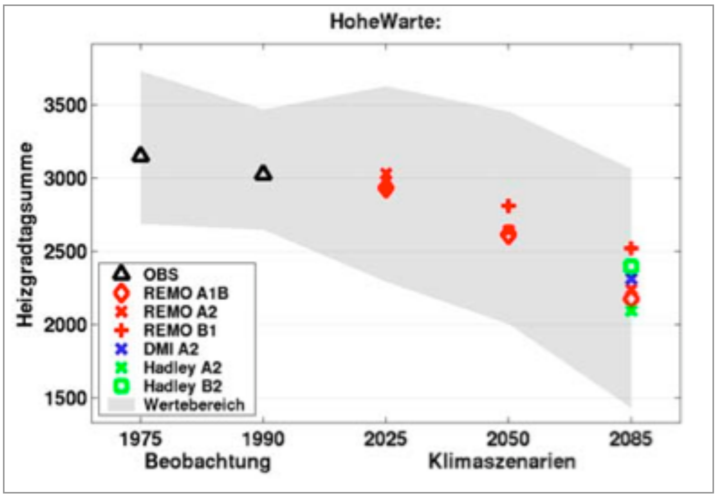
Source: Formayer, H. et al, 2007, p. 18

Deviation of Solar Radiation Sums: *Hohe Warte* vs. REMO/UBA 1961-90



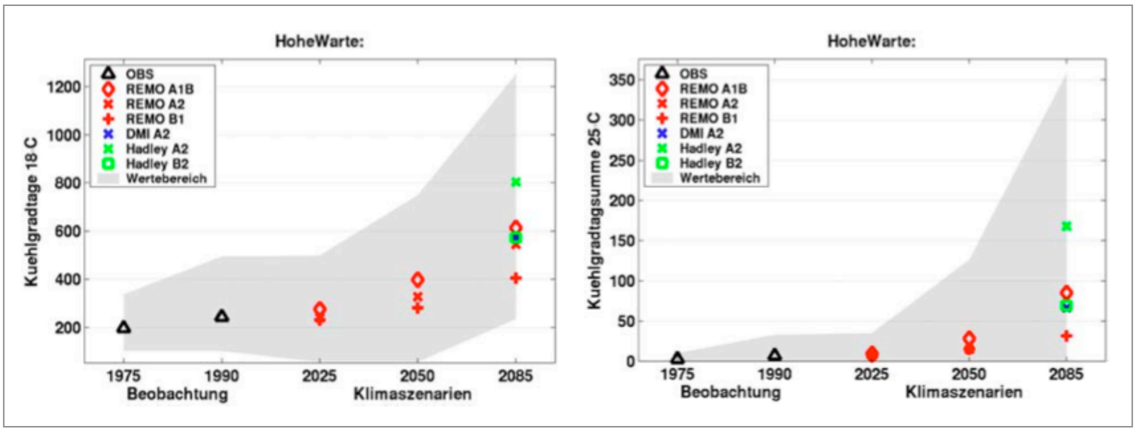
Source: own design based upon REMO/UBA results

Observed Heating Degree Days 1976-2005 plus Scenarios for *Hohe Warte*



Observed Cooling Degree Days 1976-2005 plus Scenarios for *Hohe Warte*

(tresholds: 18.3°C left, 25°C right)



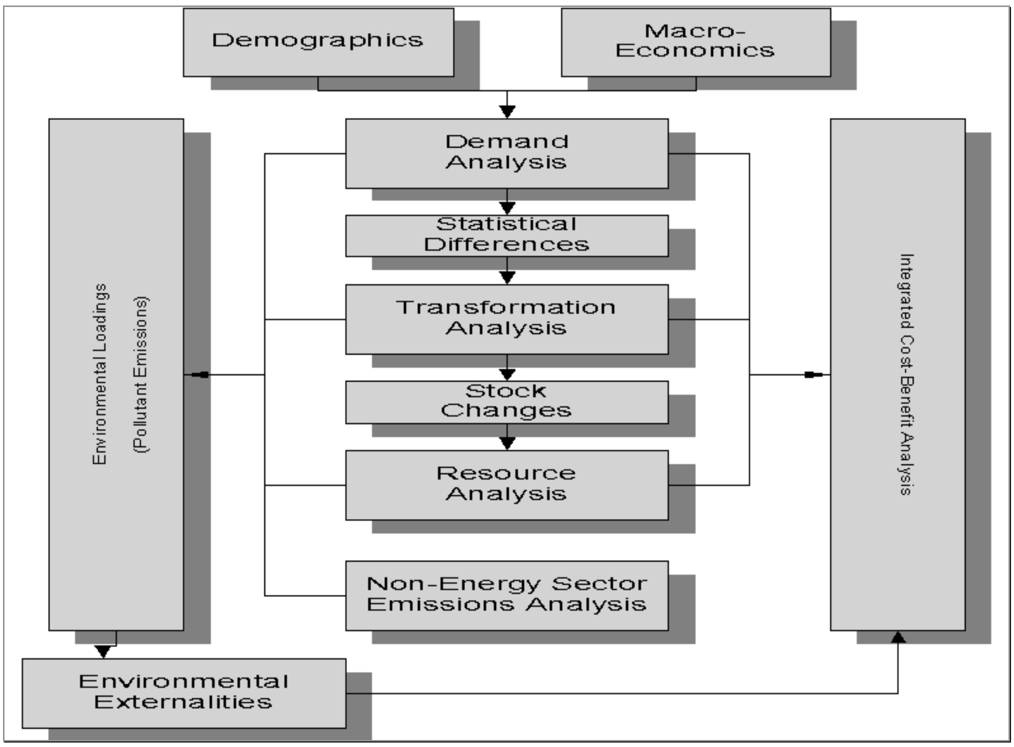
Source: Formayer, H. et al., 2007, p. 30-32

General Scenario Methodology and Energy Data

LEAP Key Characteristics

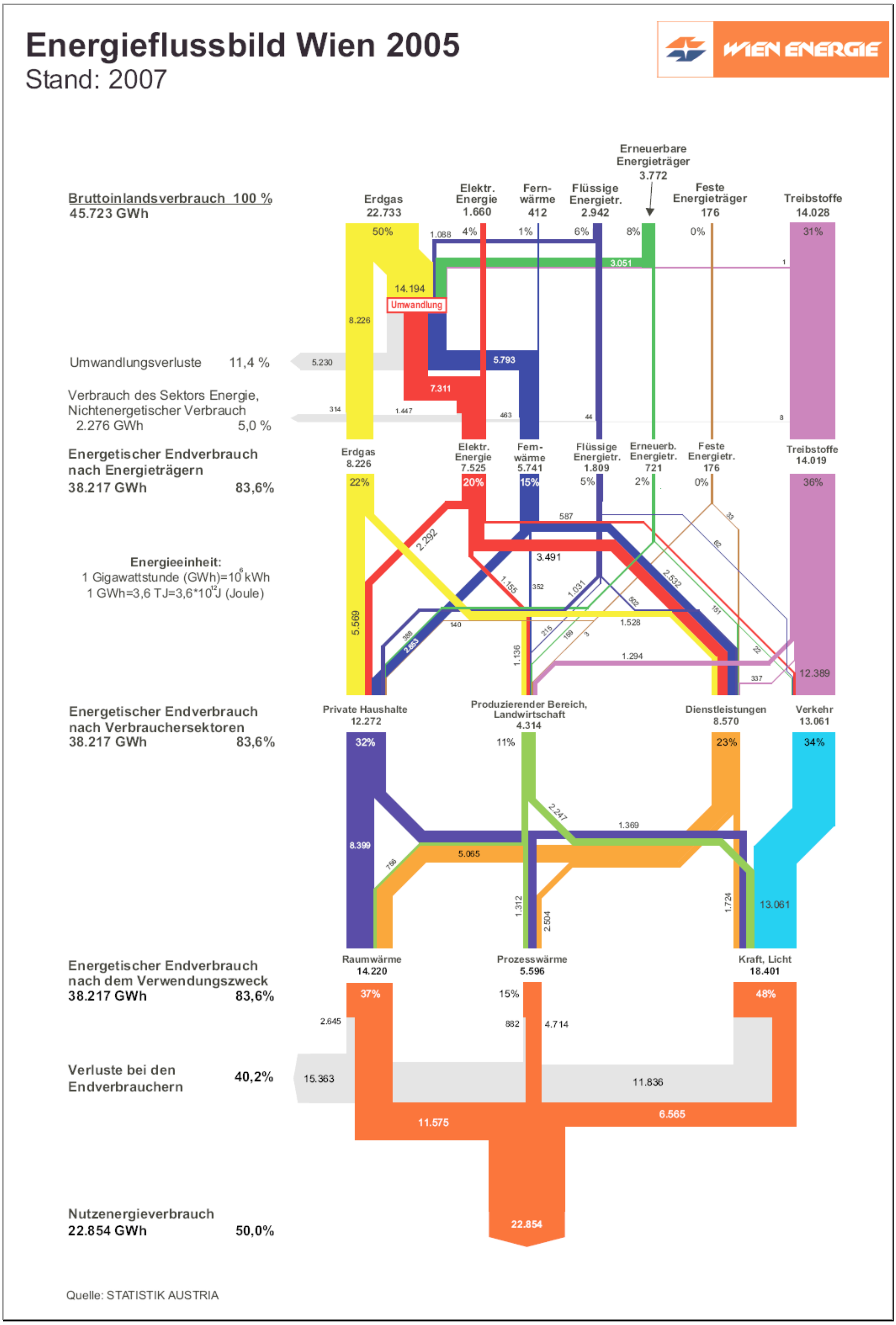
- An integrated energy-environment, scenario-based modeling system.
- Based on simple and transparent accounting and simulation modeling approaches.
- Broad scope: demand, transformation, resource extraction, GHG & local air pollutant emissions, social cost-benefit analysis, non-energy sector sources and sinks.
- Used for Forecasting, energy planning, GHG mitigation assessment, emissions inventories, transport modeling.
- Not a model of a particular system, but a tool for modeling different energy systems.
- Support for multiple methodologies such as transport stock-turnover modeling, electric sector load forecasting and capacity expansion and econometric and simulation models.
- Standard energy and emissions accounting built-in. User can also create their own econometric and simulation models using spreadsheet-like math expressions.
- Low initial data requirements: most aspects optional.
- Includes a Technology and Environmental Database (TED) containing costs, performance and emissions factors of energy technologies, plus IPCC default emission factors.
- Links to MS-Office (Excel, Word and PowerPoint).
- Local, national, regional and global applicability.
- Medium to long-term time frame, annual time-step, unlimited number of years.
- Downloadable data sets under development for most countries.

LEAP Calculation Flows



See also www.energycommunity.org/

Energy Flows Vienna 2005



Source: Statistical Office Austria, 2007

References from the SEP (2006)

Final Viennese Energy Demand by Branches in the SEP BAU scenario

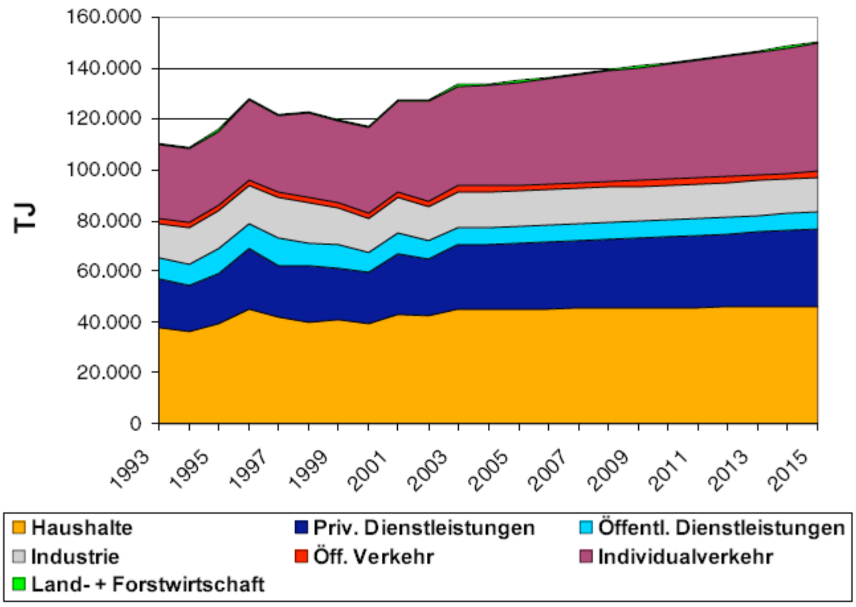


Abb. 1-2 Endenergieverbrauch nach Sektoren im BAU-Szenario 1993-2015
Quelle: Statistik Austria, eigene Berechnungen

Source: SEP, 2006, p. 14

Percentage Equipment of Air Condition in Viennese Private Households and Services

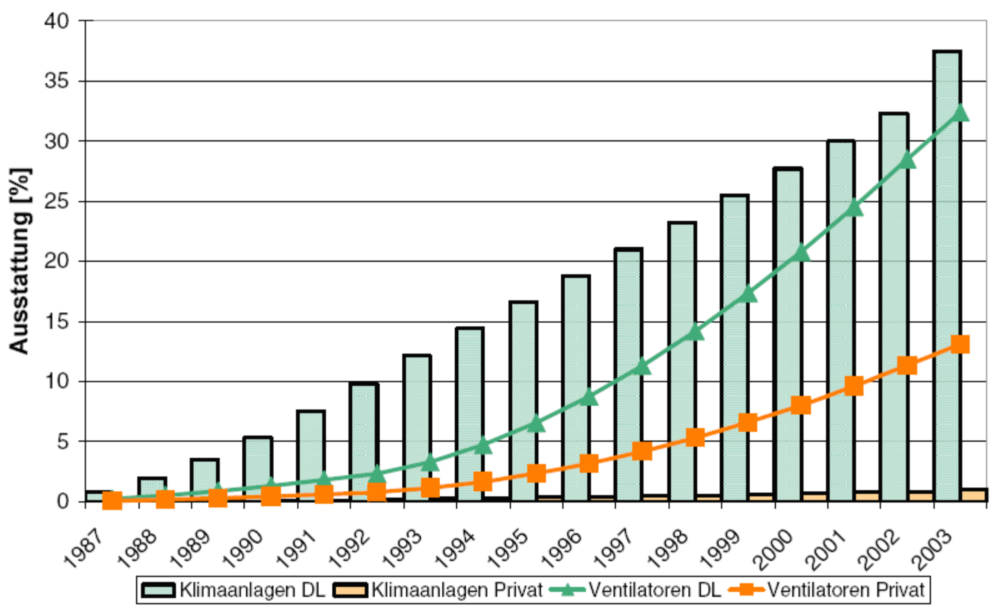


Abb. 4.37 Ausstattung von Klimaanlagen und Ventilatoren
im Privat- und Dienstleistungsbereich, 1987–2003
Quelle: Kältetechnikfirmen, Baumarktges., Statistik Austria, Hauer, eigene Berechnungen

Source: SEP, 2006, 2nd data volume, p. 65

Key Data *Wien Energie* 2005/06

KENNZAHLENÜBERSICHT WIRTSCHAFT

Entstehung der Wertschöpfung

GRI-Code	Wertschöpfung Teilkonzern in 1.000 €	2005/2006	2004/2005	2003/2004
EC 1	Gesamtleistung	2.120.234	1.957.495	1.898.330
	– Erträge aus dem Abgang von Anlagevermögen	5.101	16.575	1.463
	– Erträge aus der Zuschreibung von Anlagevermögen	0	0	0
	+ Beteiligungserträge	17.503	1.138	6.324
	+ Erträge aus WP und Ausleihungen des FAV	33.573	13.298	6.500
	+ Zinserträge	6.251	8.094	7.589
	– Erträge aus dem Abgang von Finanzanlagen	4.309	226	60
	– Erträge aus der Zuschreibung zu Finanzanlagen	0	120	0
EC 1	= Unternehmensleistung	2.168.151	1.963.104	1.917.220
	– Materialaufwand	1.140.624	889.209	819.837
	– Abschreibungen	231.351	241.879	253.004
	– Sonstige betriebliche Aufwendungen korrigiert	219.900	207.056	214.671
	– Abschreibungen auf Finanzanlagen	1.410	332	1.189
	– übrige Finanzaufwendungen	0	165	0
EC 1	= Wertschöpfung	574.886	624.464	628.519
EC 1	Wertschöpfungsquote	26,51 %	31,81 %	32,78 %

Verteilung der Wertschöpfung

GRI-Code	Wertschöpfung Teilkonzern in 1.000 €	2005/2006	2004/2005	2003/2004
EC 1	Mitarbeiter	435.289	458.460	428.065
EC 1	Steuern und Abgaben	33.376	55.862	58.046
EC 1	Gesellschafter	18.975	19.041	21.355
EC 1	Zinsaufwand	13.285	14.802	30.390
EC 1	Unternehmen	73.941	76.299	90.663

Erzeugung

GRI-Code	Energieerzeugung	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Stromerzeugung gesamt	MWh	5.605.084	−12,40 %	6.396.217	9,00 %	5.867.277
EN3	Nahwärmeerzeugung	MWh	240.422	4,50 %	230.062	−0,30 %	230.725
EN3	Fernwärmeerzeugung	MWh	5.428.850	5,03 %	5.168.452	−0,57 %	5.198.108

GRI-Code	Stromerzeugung	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Stromerzeugung kalorische Kraftwerke	MWh	5.085.706	−13,90 %	5.903.463	9,40 %	5.395.360
EN3	Stromerzeugung Wasserkraftwerke	MWh	430.506	−4,90 %	452.635	5,00 %	431.268
EN3	Stromerzeugung Windkraftanlagen	MWh	46.678	−86,40 %	25.046	29,30 %	19.364
EN3	Stromerzeugung Biomasse	MWh	28.371	ab 2006	0	ab 2006	0
EN3	Stromerzeugung Abfallverwertung	MWh	11.616	−3,60 %	12.045	−19,40 %	10.085
EN3	Stromerzeugung sonstige Kraftwerke	MWh	2.207	−27,10 %	3.027	−73,00 %	11.200
EN3	Stromerzeugung gesamt	MWh	5.605.084	−12,40 %	6.396.217	9,00 %	5.867.277

GRI-Code	Fernwärmeerzeugung	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Wärmeerzeugung aus KWK	MWh	3.715.299	3,20 %	3.598.645	−3,40 %	3.725.660
EN3	Wärmeerzeugung aus Abfallverbrennung	MWh	1.378.149	5,20 %	1.309.831	7,20 %	1.221.681
EN3	Wärmeerzeugung aus Spitzenkessel	MWh	238.600	49,30 %	159.824	11,90 %	142.807
EN3	Wärmeerzeugung aus Biomasse	MWh	702	ab 2006	ab 2006	ab 2006	ab 2006
EN3	Wärmeerzeugung sonstige	MWh	96.100	−4,05 %	100.152	−7,23 %	107.960
EN3	Fernwärmeerzeugung gesamt	MWh	5.428.850	5,03 %	5.168.452	−0,57 %	5.198.108

GRI-Code	Nahwärmeerzeugung	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Wärmeerzeugung aus Kesselanlagen	MWh	202.816	4,70 %	193.652	−2,20 %	197.951
EN3	Wärmeerzeugung aus Biomasse EC	MWh	37.606	3,30 %	36.411	11,10 %	32.773
EN3	Nahwärmeerzeugung gesamt	MWh	240.422	4,50 %	230.062	−0,30 %	230.725

GRI-Code	Fern- und Nahwärmeerzeugung gesamt	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
	Wärmeerzeugung gesamt	MWh	5.656.067		5.384.986		5.417.357
EN5	Wärme aus KWK	%	65,69 %		66,83 %		68,77 %
EN5	Wärme aus Müllverbrennung gesamt	%	24,37 %		24,32 %		22,55 %

GRI-Code	Fern- und Nahwärmeerzeugung gesamt	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN5	Wärme aus Spitzenkessel	%	4,22 %		2,97 %		2,64 %
EN5	Wärme aus Biomasse Fernwärme	%	0,01 %		0,00 %		0,00 %
EN5	Wärme sonstige	%	1,47 %		1,61 %		1,78 %
EN5	Wärme aus Kesselanlagen	%	3,59 %		3,60 %		3,65 %
EN5	Wärme aus Biomasse EC	%	0,66 %		0,68 %		0,60 %
EN5	Wärmeerzeugung gesamt	%	100,00 %		100,00 %		100,00 %

GRI-Code	Energiezukauf	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Zukauf Strom	MWh	5.947.346	26,20 %	4.714.453	−7,80 %	5.112.936
EN3	Zukauf Nahwärme	MWh	63.291	19,20 %	53.082	−1,10 %	53.667
EN3	Zukauf Fernwärme	MWh	523.155	30,3 %	401.562	−10,1 %	446.810

Netze

GRI-Code	Netztransport	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
	transportierte Strommenge im Netz	MWh	11.552.430	4,00 %	11.110.670	1,20 %	10.980.213
	Anteil Netzverluste Strom	%	5,22 %		5,22 %		5,20 %
	transportierte Gasmenge im Netz	1.000 Nm³	2.159.766	−6,10 %	2.300.484	5,90 %	2.172.116
	Anteil Netzverluste Gas	%	0,35 %		0,32 %		0,40 %
	Netzverluste Fernwärme	MWh	458.566	16,60 %	393.197	−8,90 %	431.609
	Anteil Netzverluste Fernwärme	%	7,44 %		6,81 %		7,37 %

KENNZAHLENÜBERSICHT SOZIALES

Beschäftigung

GRI-Code	Indikator	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
LA1	Personalstand per 30.9. inkl. Karenzierte und Präsenzdiener exklusive Lehrlinge	Vollzeit äquivalent	5.542	−1,2 %	5.606	−0,6 %	5.641
LA1	Anzahl Beschäftigte inkl. Lehrlinge & Karenzierte und Präsenzdiener	Personen	5.731	−0,8 %	5.778	−0,3 %	5.794
LA1	davon Lehrlinge weiblich	Personen	32	7 %	30	−3 %	31
LA1	davon Lehrlinge männlich	Personen	157	11 %	142	16 %	122
LA1	davon Akademiker	Personen	155	4,7 %	148	0 %	148
LA1	davon Trainees	Personen	1		0		0
LA1	Durchschnittsalter der MA	Jahre	40,6	1 %	40,3	1 %	40
LA2	Neuaufnahmen	Personen	165	−15 %	195	45 %	134
LA2	davon Frauen	Personen	43	−32 %	64	35 %	41
LA2	davon Lehrlinge	Personen	60	−13 %	69	50 %	46
LA2	Anzahl Kündigungen durch das Unternehmen und Entlassungen	Personen	20	−16,6 %	24	−11,1 %	27
LA2	Fluktuationsrate gesamt	%	3,03		3,56		3,39
LA2	Dauer der Unternehmenszugehörigkeit	Jahre	17,50		16,99		16,45

Aus- und Weiterbildung

GRI-Code	Indikator	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
LA11	Weiterbildungstage/MA	d/MA	0,940	−1,5 %	0,954	8 %	0,885
LA11	direkter Bildungsaufwand/MA	€/MA	234,48	5 %	222,84	−4 %	232,57

Gleichstellung von Frau und Mann

GRI-Code	Indikator	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
LA14	Frauen im Management	Anzahl	11		11		11
LA14	Anteil Frauen im Unternehmen gesamt inkl. Karenzierte und Präsenzdiener	%	18,2		18,3		18,1

Arbeitssicherheit und Gesundheitsschutz

GRI-Code	Indikator	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
LA7	unfallbedingte Abwesenheit/MA	Summe Tage	0,539		0,618		0,555

KENNZAHLENÜBERSICHT UMWELT

GRI-Code	**Umweltkennzahlen** Brennstoffeinsatz zur Strom- und Wärmeerzeugung	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Gas	1.000 Nm^3	1.185.871	−13,40 %	1.369.421	13,00 %	1.212.188
aEN3	Abfall	t	862.994	19,80 %	720.307	5,20 %	684.941
EN3	Biomasse	MWh	145.804		ab 2006		ab 2006
EN3	Biomasse EC	t	29.968	0,50 %	29.812	45,90 %	20.434

GRI-Code	Stromverbrauch	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Licht und Kraft	MWh	197.402	5,0 %	187.913	2,4 %	183.568
EN3	Eigenbedarf Kraftwerke	MWh	127.211	−5,6 %	134.701	−1,0 %	136.079

GRI-Code	Heizenergieverbrauch	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Fernwärme	MWh	11.722	−3,90 %	12.192	1,10 %	12.064
EN3	Nachtspeicher	MWh	625	−4,50 %	654	−1,50 %	664
EN3	Erdgas	MWh	11.622	−6,40 %	12.413	−43,40 %	21.944
EN3	Summe Heizenergie-verbrauch	MWh	23.968	−5,10 %	25.260	−27,10 %	34.672

GRI-Code	Treibstoffe	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN3	Diesel	1.000 Liter	1.239	0,70 %	1.231	−0,10 %	1.231
EN3	Erdgas	1.000 m^3	79	171,60 %	29	506,10 %	5
EN3	Benzin	1.000 Liter	108	1,10 %	106	−19,70 %	132
EN3	Diesel	MWh	12.142	0,70 %	12.060	−0,10 %	12.067
EN3	Erdgas	MWh	1.064	171,60 %	392	506,10 %	65
EN3	Benzin	MWh	925	1,10 %	915	−19,70 %	1.139
EN3	Treibstoffe gesamt	MWh	14.131	5,70 %	13.367	0,70 %	13.271
EN3	Anteil Diesel	%	85,93 %		90,23 %		90,93 %
EN3	Anteil Erdgas	%	7,53 %		2,93 %		0,49 %
EN3	Anteil Benzin	%	6,54 %		6,84 %		8,58 %
EN3	Treibstoffe	%	100,00 %		100,00 %		100,00 %

GRI-Code	CO_2 Emissionen	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN17	CO_2-Emissionen Strom- und Fernwärmeerzeugung	t	2.882.448	−7,30 %	3.110.452	4,80 %	2.966.680
EN17	CO_2-Emissionen Fuhrpark	t	3.697	4,5 %	3.538	0,1 %	3.535

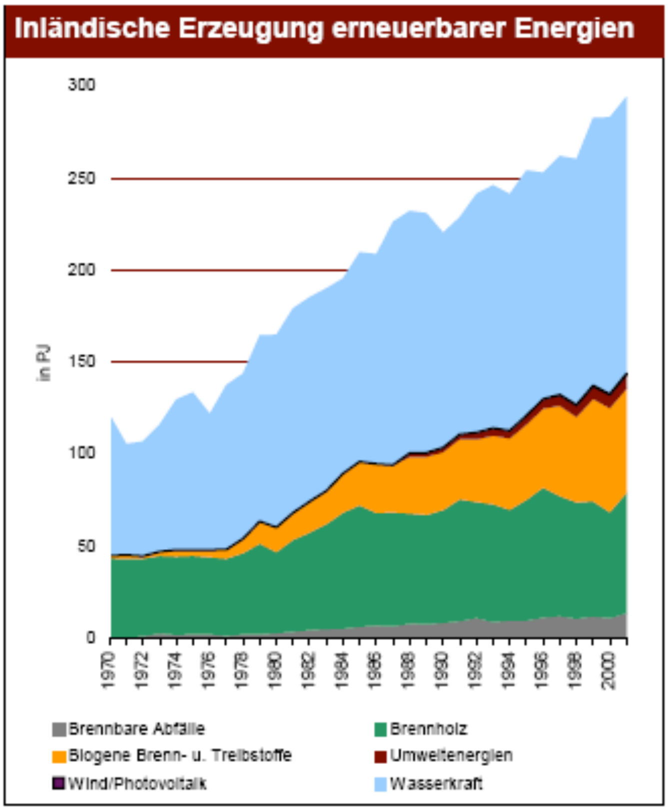
GRI-Code	Sonstige Emissionen	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004 2
EN19	SO_2	t	326	85,30 %	176	−29,70 %	250
EN19	NOx	t	1.311	−17,1 %	1.582	16,20 %	1.362

GRI-Code	Abfälle	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN20	nicht gefährliche Abfälle	t	171.104	−4,7 %	179.493	1,0 %	177.771
EN20	davon Schlacke	t	129.318	−6,1 %	137.647	−1,9 %	140.370
EN20	davon Asche	t	41.361	−0,1 %	41.417	11,0 %	37.306
EN20	gefährliche Abfälle	t	3.598	0,5 %	3.581	−12,1 %	4.076
EN20	davon Filterkuchen	t	3.171	−1,2 %	3.210	−18,7 %	3.950
EN20	Wertstoffe	t	9.878	−14,7 %	11.577	18,1 %	9.805

GRI-Code	Wasser/ Abwasser	Einheit	2005/2006	Veränderung zum Vorjahr	2004/2005	Veränderung zum Vorjahr	2003/2004
EN9	Wasserentnahme aus Brunnen	1.000 m^3	2.771	2,5 %	2.704	−7,5 %	2.925
EN9	Wasserentnahme aus Netz	1.000 m^3	390	1,1 %	386	14,4 %	337
EN9	Flusswasser (Kühlwasser)	1.000 m^3	258.631	−2,5 %	265.227	9,2 %	242.860
EN21	Abwasser in Kanalisation	1.000 m^3	375	−21,7 %	479	38,4 %	346

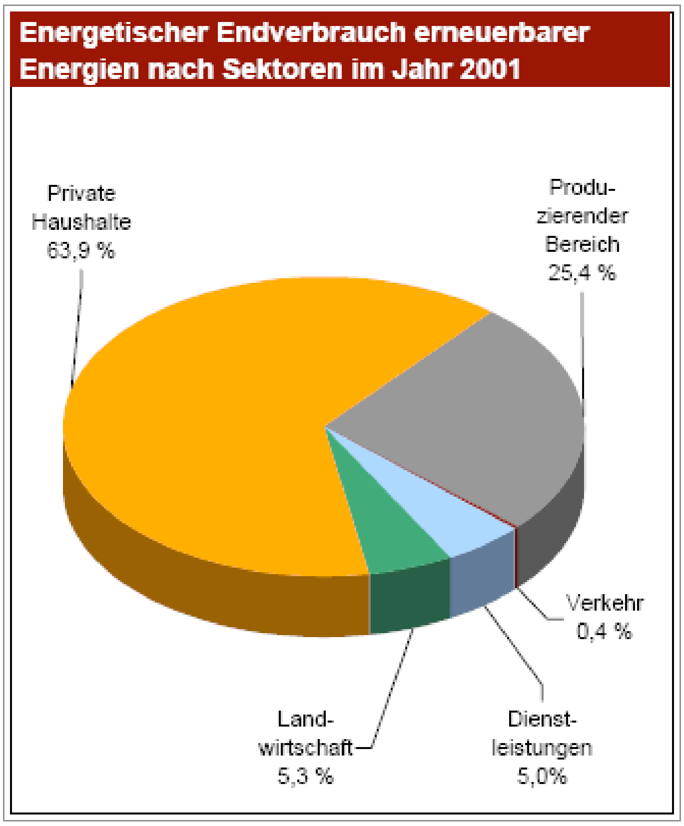
Source: Sustainability Report, *Wien Energie*, 2006.

Austrian Renewable Energy Generation



Source: BMWA, 2003, p. 62

Final Energy Use of Renewables 2001



Source: BMWA, 2003, p. 64

Energy Demand Data (LEAP, Project Vienna 2100, 2008)

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Private Households		Activity Level	Current Accounts		Person	2248961
Demand	Private Households		Activity Level	Best Buy		Person	Growth(0,6%; 2040; 0,9%; 2070; 0,7%)
Demand	Private Households		Activity Level	Discount		Person	Growth(0,5%; 2040; 0,3%; 2070; 0,2%)
Demand	Private Households		Activity Level	Convenience		Person	Growth(0,7%; 2040; 0,5%; 2070; 0,5%)
Demand	Private Households	Northern Suburbia	Activity Level	Current Accounts	%	Share	12,9
Demand	Private Households	Northern Suburbia	Activity Level	Best Buy	%	Share	Interp(2040;15; 2070;15; 2100;15)
Demand	Private Households	Northern Suburbia	Activity Level	Discount	%	Share	Interp(2040;15; 2070;20; 2100;22)
Demand	Private Households	Northern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 15; 2070; 16; 2100; 18)
Demand	Private Households	Northern Suburbia\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Northern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Northern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Northern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Northern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Northern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Northern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	Northern Suburbia\cooling	Activity Level	Current Accounts	%	Saturation	1
Demand	Private Households	Northern Suburbia\cooling	Activity Level	Best Buy	%	Saturation	1
Demand	Private Households	Northern Suburbia\cooling	Activity Level	Discount	%	Saturation	1
Demand	Private Households	Northern Suburbia\cooling	Activity Level	Convenience	%	Saturation	1
Demand	Private Households	Northern Suburbia\cooling\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\cooling\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Northern Suburbia\cooling\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Northern Suburbia\cooling\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	Northern Suburbia\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Northern Suburbia\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Northern Suburbia\lighting	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Northern Suburbia\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Northern Suburbia\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Northern Suburbia\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Northern Suburbia\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	Northern Suburbia\cooking	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Northern Suburbia\cooking	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Northern Suburbia\cooking	Activity Level	Discount	%	Saturation	100

Demand	Private Households	Northern Suburbia\cooking	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Northern Suburbia\cooking\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\cooking\Electricity	Activity Level	Best Buy	%	Share	8.866.667
Demand	Private Households	Northern Suburbia\cooking\Electricity	Activity Level	Discount	%	Share	8.866.667
Demand	Private Households	Northern Suburbia\cooking\Electricity	Activity Level	Convenience	%	Share	8.866.667
Demand	Private Households	Northern Suburbia\cooking\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\cooking\Natural Gas	Activity Level	Best Buy	%	Share	1.133.333
Demand	Private Households	Northern Suburbia\cooking\Natural Gas	Activity Level	Discount	%	Share	1.133.333
Demand	Private Households	Northern Suburbia\cooking\Natural Gas	Activity Level	Convenience	%	Share	1.133.333
Demand	Private Households	Northern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Northern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Northern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Northern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Northern Suburbia\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\heating\Electricity	Activity Level	Best Buy	%	Share	5,2
Demand	Private Households	Northern Suburbia\heating\Electricity	Activity Level	Discount	%	Share	5,2
Demand	Private Households	Northern Suburbia\heating\Electricity	Activity Level	Convenience	%	Share	5,2
Demand	Private Households	Northern Suburbia\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\heating\Natural Gas	Activity Level	Best Buy	%	Share	60,2
Demand	Private Households	Northern Suburbia\heating\Natural Gas	Activity Level	Discount	%	Share	60,2
Demand	Private Households	Northern Suburbia\heating\Natural Gas	Activity Level	Convenience	%	Share	60,2
Demand	Private Households	Northern Suburbia\heating\Others	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\heating\Others	Activity Level	Best Buy	%	Share	0,1
Demand	Private Households	Northern Suburbia\heating\Others	Activity Level	Discount	%	Share	0,1
Demand	Private Households	Northern Suburbia\heating\Others	Activity Level	Convenience	%	Share	0,1
Demand	Private Households	Northern Suburbia\heating\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\heating\Oil	Activity Level	Best Buy	%	Share	8,6
Demand	Private Households	Northern Suburbia\heating\Oil	Activity Level	Discount	%	Share	8,6
Demand	Private Households	Northern Suburbia\heating\Oil	Activity Level	Convenience	%	Share	8,6
Demand	Private Households	Northern Suburbia\heating\District Heat	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\heating\District Heat	Activity Level	Best Buy	%	Share	25,9
Demand	Private Households	Northern Suburbia\heating\District Heat	Activity Level	Discount	%	Share	25,9
Demand	Private Households	Northern Suburbia\heating\District Heat	Activity Level	Convenience	%	Share	25,9
Demand	Private Households	Northern Suburbia\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Northern Suburbia\other	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Northern Suburbia\other	Activity Level	Discount	%	Saturation	100

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Private Households	Northern Suburbia\other	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Northern Suburbia\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Northern Suburbia\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Northern Suburbia\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Northern Suburbia\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	Southern Suburbia	Activity Level	Current Accounts	%	Share	13,6
Demand	Private Households	Southern Suburbia	Activity Level	Best Buy	%	Share	Interp(2040;15; 2070;16; 2100;15)
Demand	Private Households	Southern Suburbia	Activity Level	Discount	%	Share	Interp(2040;20; 2070;20; 2100;20)
Demand	Private Households	Southern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 15; 2070; 16; 2100; 17)
Demand	Private Households	Southern Suburbia\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Southern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Southern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Southern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Southern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Southern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Southern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	Southern Suburbia\cooling	Activity Level	Current Accounts	%	Saturation	1
Demand	Private Households	Southern Suburbia\cooling	Activity Level	Best Buy	%	Saturation	1
Demand	Private Households	Southern Suburbia\cooling	Activity Level	Discount	%	Saturation	1
Demand	Private Households	Southern Suburbia\cooling	Activity Level	Convenience	%	Saturation	1
Demand	Private Households	Southern Suburbia\cooling\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\cooling\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Southern Suburbia\cooling\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Southern Suburbia\cooling\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	Southern Suburbia\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Southern Suburbia\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Southern Suburbia\lighting	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Southern Suburbia\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Southern Suburbia\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Southern Suburbia\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Southern Suburbia\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	Southern Suburbia\cooking	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Southern Suburbia\cooking	Activity Level	Best Buy	%	Saturation	100

Demand	Private Households	Southern Suburbia\cooking	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Southern Suburbia\cooking	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Southern Suburbia\cooking\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\cooking\Electricity	Activity Level	Best Buy	%	Share	8.866.667
Demand	Private Households	Southern Suburbia\cooking\Electricity	Activity Level	Discount	%	Share	8.866.667
Demand	Private Households	Southern Suburbia\cooking\Electricity	Activity Level	Convenience	%	Share	8.866.667
Demand	Private Households	Southern Suburbia\cooking\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\cooking\Natural Gas	Activity Level	Best Buy	%	Share	1.133.333
Demand	Private Households	Southern Suburbia\cooking\Natural Gas	Activity Level	Discount	%	Share	1.133.333
Demand	Private Households	Southern Suburbia\cooking\Natural Gas	Activity Level	Convenience	%	Share	1.133.333
Demand	Private Households	Southern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Southern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	Southern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Southern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Southern Suburbia\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\heating\Electricity	Activity Level	Best Buy	%	Share	5,2
Demand	Private Households	Southern Suburbia\heating\Electricity	Activity Level	Discount	%	Share	5,2
Demand	Private Households	Southern Suburbia\heating\Electricity	Activity Level	Convenience	%	Share	5,2
Demand	Private Households	Southern Suburbia\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\heating\Natural Gas	Activity Level	Best Buy	%	Share	60,2
Demand	Private Households	Southern Suburbia\heating\Natural Gas	Activity Level	Discount	%	Share	60,2
Demand	Private Households	Southern Suburbia\heating\Natural Gas	Activity Level	Convenience	%	Share	60,2
Demand	Private Households	Southern Suburbia\heating\Others	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\heating\Others	Activity Level	Best Buy	%	Share	0,1
Demand	Private Households	Southern Suburbia\heating\Others	Activity Level	Discount	%	Share	0,1
Demand	Private Households	Southern Suburbia\heating\Others	Activity Level	Convenience	%	Share	0,1
Demand	Private Households	Southern Suburbia\heating\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\heating\Oil	Activity Level	Best Buy	%	Share	8,6
Demand	Private Households	Southern Suburbia\heating\Oil	Activity Level	Discount	%	Share	8,6
Demand	Private Households	Southern Suburbia\heating\Oil	Activity Level	Convenience	%	Share	8,6
Demand	Private Households	Southern Suburbia\heating\District Heat	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\heating\District Heat	Activity Level	Best Buy	%	Share	25,9
Demand	Private Households	Southern Suburbia\heating\District Heat	Activity Level	Discount	%	Share	25,9
Demand	Private Households	Southern Suburbia\heating\District Heat	Activity Level	Convenience	%	Share	25,9
Demand	Private Households	Southern Suburbia\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	Southern Suburbia\other	Activity Level	Best Buy	%	Saturation	100

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Private Households	Southern Suburbia\other	Activity Level	Discount	%	Saturation	100
Demand	Private Households	Southern Suburbia\other	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	Southern Suburbia\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	Southern Suburbia\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	Southern Suburbia\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	Southern Suburbia\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	City of Vienna	Activity Level	Current Accounts	%	Share	73,4
Demand	Private Households	City of Vienna	Activity Level	Best Buy	%	Share	Interp(2040;70; 2070;69; 2100;70)
Demand	Private Households	City of Vienna	Activity Level	Discount	%	Share	Interp(2040;65; 2070;60; 2100;58)
Demand	Private Households	City of Vienna	Activity Level	Convenience	%	Share	Smooth(2040; 70; 2070; 68; 2100; 65)
Demand	Private Households	City of Vienna\cooking	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	City of Vienna\cooking	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	City of Vienna\cooking	Activity Level	Discount	%	Saturation	100
Demand	Private Households	City of Vienna\cooking	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	City of Vienna\cooking\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\cooking\Electricity	Activity Level	Best Buy	%	Share	8.866.667
Demand	Private Households	City of Vienna\cooking\Electricity	Activity Level	Discount	%	Share	8.866.667
Demand	Private Households	City of Vienna\cooking\Electricity	Activity Level	Convenience	%	Share	8.866.667
Demand	Private Households	City of Vienna\cooking\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\cooking\Natural Gas	Activity Level	Best Buy	%	Share	1.133.333
Demand	Private Households	City of Vienna\cooking\Natural Gas	Activity Level	Discount	%	Share	1.133.333
Demand	Private Households	City of Vienna\cooking\Natural Gas	Activity Level	Convenience	%	Share	1.133.333
Demand	Private Households	City of Vienna\cooling	Activity Level	Current Accounts	%	Saturation	1
Demand	Private Households	City of Vienna\cooling	Activity Level	Best Buy	%	Saturation	1
Demand	Private Households	City of Vienna\cooling	Activity Level	Discount	%	Saturation	1
Demand	Private Households	City of Vienna\cooling	Activity Level	Convenience	%	Saturation	1
Demand	Private Households	City of Vienna\cooling\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\cooling\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	City of Vienna\cooling\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	City of Vienna\cooling\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	City of Vienna\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	City of Vienna\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	City of Vienna\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Private Households	City of Vienna\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	City of Vienna\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0

Demand	Private Households	City of Vienna\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	City of Vienna\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	City of Vienna\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	City of Vienna\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	City of Vienna\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	City of Vienna\heating	Activity Level	Discount	%	Saturation	100
Demand	Private Households	City of Vienna\heating	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	City of Vienna\heating\District Heat	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\heating\District Heat	Activity Level	Best Buy	%	Share	25,9
Demand	Private Households	City of Vienna\heating\District Heat	Activity Level	Discount	%	Share	25,9
Demand	Private Households	City of Vienna\heating\District Heat	Activity Level	Convenience	%	Share	25,9
Demand	Private Households	City of Vienna\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\heating\Electricity	Activity Level	Best Buy	%	Share	5,2
Demand	Private Households	City of Vienna\heating\Electricity	Activity Level	Discount	%	Share	5,2
Demand	Private Households	City of Vienna\heating\Electricity	Activity Level	Convenience	%	Share	5,2
Demand	Private Households	City of Vienna\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\heating\Natural Gas	Activity Level	Best Buy	%	Share	60,2
Demand	Private Households	City of Vienna\heating\Natural Gas	Activity Level	Discount	%	Share	60,2
Demand	Private Households	City of Vienna\heating\Natural Gas	Activity Level	Convenience	%	Share	60,2
Demand	Private Households	City of Vienna\heating\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\heating\Oil	Activity Level	Best Buy	%	Share	8,6
Demand	Private Households	City of Vienna\heating\Oil	Activity Level	Discount	%	Share	8,6
Demand	Private Households	City of Vienna\heating\Oil	Activity Level	Convenience	%	Share	8,6
Demand	Private Households	City of Vienna\heating\Others	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\heating\Others	Activity Level	Best Buy	%	Share	0,1
Demand	Private Households	City of Vienna\heating\Others	Activity Level	Discount	%	Share	0,1
Demand	Private Households	City of Vienna\heating\Others	Activity Level	Convenience	%	Share	0,1
Demand	Private Households	City of Vienna\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Private Households	City of Vienna\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	City of Vienna\lighting	Activity Level	Discount	%	Saturation	100
Demand	Private Households	City of Vienna\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	City of Vienna\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	City of Vienna\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	City of Vienna\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Private Households	City of Vienna\other	Activity Level	Current Accounts	%	Saturation	100

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Private Households	City of Vienna\other	Activity Level	Best Buy	%	Saturation	100
Demand	Private Households	City of Vienna\other	Activity Level	Discount	%	Saturation	100
Demand	Private Households	City of Vienna\other	Activity Level	Convenience	%	Saturation	100
Demand	Private Households	City of Vienna\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Private Households	City of Vienna\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Private Households	City of Vienna\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Private Households	City of Vienna\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Transport		Activity Level	Current Accounts		ha	7228,4
Demand	Transport		Activity Level	Best Buy		ha	Smooth(2040; 7300; 2070; 7400; 2100; 7430)
Demand	Transport		Activity Level	Discount		ha	Smooth(2040; 7700; 2070; 7950; 2100; 8300)
Demand	Transport		Activity Level	Convenience		ha	Smooth(2040; 7700; 2070; 7900; 2100; 8200)
Demand	Transport	Northern Suburbia	Activity Level	Current Accounts	%	Share	0,3
Demand	Transport	Northern Suburbia	Activity Level	Best Buy	%	Share	Smooth(2040; 0,5; 2070; 0,7; 2100; 0,8)
Demand	Transport	Northern Suburbia	Activity Level	Discount	%	Share	Smooth(2040; 1,4; 2070; 3; 2100; 4)
Demand	Transport	Northern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 0,8; 2070; 2,3; 2100; 1,9)
Demand	Transport	Northern Suburbia\Public Transport	Activity Level	Current Accounts	%	Saturation	12
Demand	Transport	Northern Suburbia\Public Transport	Activity Level	Best Buy	%	Saturation	Interp(2040; 16; 2070; 20; 2100; 22)
Demand	Transport	Northern Suburbia\Public Transport	Activity Level	Discount	%	Saturation	Smooth(2040; 13; 2070; 14; 2100; 16)
Demand	Transport	Northern Suburbia\Public Transport	Activity Level	Convenience	%	Saturation	Smooth(2040; 15; 2070; 18; 2100; 20)
Demand	Transport	Northern Suburbia\Private Transport	Activity Level	Current Accounts	%	Saturation	88
Demand	Transport	Northern Suburbia\Private Transport	Activity Level	Best Buy	%	Saturation	Interp(2040; 84; 2070; 80; 2100; 78)
Demand	Transport	Northern Suburbia\Private Transport	Activity Level	Discount	%	Saturation	Smooth(2040; 87; 2070; 86; 2100; 84)
Demand	Transport	Northern Suburbia\Private Transport	Activity Level	Convenience	%	Saturation	Smooth(2040; 85; 2070; 82; 2100; 80)
Demand	Transport	Southern Suburbia	Activity Level	Current Accounts	%	Share	2,3
Demand	Transport	Southern Suburbia	Activity Level	Best Buy	%	Share	Smooth(2040; 2,5; 2070; 2,6; 2100; 2,5)
Demand	Transport	Southern Suburbia	Activity Level	Discount	%	Share	Smooth(2040; 1,6; 2070; 3; 2100; 3)
Demand	Transport	Southern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 2,3; 2070; 2,7; 2100; 2,1)
Demand	Transport	Southern Suburbia\Public Transport	Activity Level	Current Accounts	%	Saturation	15
Demand	Transport	Southern Suburbia\Public Transport	Activity Level	Best Buy	%	Saturation	Interp(2040; 20; 2070; 23; 2100; 26)
Demand	Transport	Southern Suburbia\Public Transport	Activity Level	Discount	%	Saturation	Smooth(2040; 16; 2070; 18; 2100; 18)
Demand	Transport	Southern Suburbia\Public Transport	Activity Level	Convenience	%	Saturation	Smooth(2040; 20; 2070; 23; 2100; 25)
Demand	Transport	Southern Suburbia\Private Transport	Activity Level	Current Accounts	%	Saturation	85
Demand	Transport	Southern Suburbia\Private Transport	Activity Level	Best Buy	%	Saturation	Interp(2040; 80; 2070; 77; 2100; 74)
Demand	Transport	Southern Suburbia\Private Transport	Activity Level	Discount	%	Saturation	Smooth(2040; 84; 2070; 82; 2100; 82)
Demand	Transport	Southern Suburbia\Private Transport	Activity Level	Convenience	%	Saturation	Smooth(2040; 80; 2070; 77; 2100; 75)

Demand	Transport	City of Vienna	Activity Level	Current Accounts	%	Share	97,4
Demand	Transport	City of Vienna	Activity Level	Best Buy	%	Share	Smooth(2040; 97; 2070; 96,7; 2100; 96,7)
Demand	Transport	City of Vienna	Activity Level	Discount	%	Share	Smooth(2040; 96,4; 2070; 94; 2100; 93)
Demand	Transport	City of Vienna	Activity Level	Convenience	%	Share	Smooth(2040; 96,9; 2070; 95; 2100; 96)
Demand	Transport	City of Vienna\Public Transport	Activity Level	Current Accounts	%	Saturation	35
Demand	Transport	City of Vienna\Public Transport	Activity Level	Best Buy	%	Saturation	Smooth(2005; 40; 2040; 50; 2070; 60)
Demand	Transport	City of Vienna\Public Transport	Activity Level	Discount	%	Saturation	Smooth(2040; 37; 2070; 40; 2100; 42)
Demand	Transport	City of Vienna\Public Transport	Activity Level	Convenience	%	Saturation	Smooth(2040; 37; 2070; 40; 2100; 50)
Demand	Transport	City of Vienna\Private Transport	Activity Level	Current Accounts	%	Saturation	65
Demand	Transport	City of Vienna\Private Transport	Activity Level	Best Buy	%	Saturation	Smooth(2005; 60; 2040; 50; 2070; 40)
Demand	Transport	City of Vienna\Private Transport	Activity Level	Discount	%	Saturation	Smooth(2040; 63; 2070; 60; 2100; 58)
Demand	Transport	City of Vienna\Private Transport	Activity Level	Convenience	%	Saturation	Smooth(2040; 63; 2070; 60; 2100; 50)
Demand	Agriculture		Activity Level	Current Accounts		ha	407915,3
Demand	Agriculture		Activity Level	Best Buy		ha	Growth(0,001; 2040; 0,0004; 2070; 0,0002)
Demand	Agriculture		Activity Level	Discount		ha	Growth(-0,002%; 2040; -0,001%; 2070; -0,0005%)
Demand	Agriculture		Activity Level	Convenience		ha	Growth(0,002%; 2040; 0,0%; 2070; 0,0001%)
Demand	Agriculture	Northern Suburbia	Activity Level	Current Accounts	%	Share	64,5
Demand	Agriculture	Northern Suburbia	Activity Level	Best Buy	%	Share	Interp(2100;64,8)
Demand	Agriculture	Northern Suburbia	Activity Level	Discount	%	Share	64,5
Demand	Agriculture	Northern Suburbia	Activity Level	Convenience	%	Share	64,5
Demand	Agriculture	Northern Suburbia\industrial furnace	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Northern Suburbia\industrial furnace	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Northern Suburbia\industrial furnace	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Northern Suburbia\industrial furnace	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Northern Suburbia\industrial furnace\Coal Bit	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Northern Suburbia\industrial furnace\Coal Bit	Activity Level	Best Buy	%	Share	1.752.577
Demand	Agriculture	Northern Suburbia\industrial furnace\Coal Bit	Activity Level	Discount	%	Share	1.752.577
Demand	Agriculture	Northern Suburbia\industrial furnace\Coal Bit	Activity Level	Convenience	%	Share	1.752.577
Demand	Agriculture	Northern Suburbia\industrial furnace\Natural	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Northern Suburbia\industrial furnace\Natural	Activity Level	Best Buy	%	Share	6.185.567
Demand	Agriculture	Northern Suburbia\industrial furnace\Natural	Activity Level	Discount	%	Share	6.185.567
Demand	Agriculture	Northern Suburbia\industrial furnace\Natural	Activity Level	Convenience	%	Share	6.185.567
Demand	Agriculture	Northern Suburbia\industrial furnace\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Northern Suburbia\industrial furnace\Oil	Activity Level	Best Buy	%	Share	2.061.856
Demand	Agriculture	Northern Suburbia\industrial furnace\Oil	Activity Level	Discount	%	Share	2.061.856
Demand	Agriculture	Northern Suburbia\industrial furnace\Oil	Activity Level	Convenience	%	Share	2.061.856

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Agriculture	Northern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Northern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Northern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Northern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Northern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Northern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	Northern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	Northern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Northern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Northern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Northern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Northern Suburbia\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Northern Suburbia\heating\Natural Gas	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Northern Suburbia\heating\Natural Gas	Activity Level	Discount	%	Share	100
Demand	Agriculture	Northern Suburbia\heating\Natural Gas	Activity Level	Convenience	%	Share	100
Demand	Agriculture	Northern Suburbia\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Northern Suburbia\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Northern Suburbia\lighting	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Northern Suburbia\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Northern Suburbia\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Northern Suburbia\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Northern Suburbia\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	Northern Suburbia\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	Northern Suburbia\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Northern Suburbia\other	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Northern Suburbia\other	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Northern Suburbia\other	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Northern Suburbia\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Northern Suburbia\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Northern Suburbia\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	Northern Suburbia\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	Southern Suburbia	Activity Level	Current Accounts	%	Share	33,9
Demand	Agriculture	Southern Suburbia	Activity Level	Best Buy	%	Share	Interp(2100; 34)
Demand	Agriculture	Southern Suburbia	Activity Level	Discount	%	Share	33,9
Demand	Agriculture	Southern Suburbia	Activity Level	Convenience	%	Share	33,9

Demand	Agriculture	Southern Suburbia\industrial furnace	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Southern Suburbia\industrial furnace	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Southern Suburbia\industrial furnace	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Southern Suburbia\industrial furnace	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Best Buy	%	Share	1.752.577
Demand	Agriculture	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Discount	%	Share	1.752.577
Demand	Agriculture	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Convenience	%	Share	1.752.577
Demand	Agriculture	Southern Suburbia\industrial furnace\Natural	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Southern Suburbia\industrial furnace\Natural	Activity Level	Best Buy	%	Share	6.185.567
Demand	Agriculture	Southern Suburbia\industrial furnace\Natural	Activity Level	Discount	%	Share	6.185.567
Demand	Agriculture	Southern Suburbia\industrial furnace\Natural	Activity Level	Convenience	%	Share	6.185.567
Demand	Agriculture	Southern Suburbia\industrial furnace\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Southern Suburbia\industrial furnace\Oil	Activity Level	Best Buy	%	Share	2.061.856
Demand	Agriculture	Southern Suburbia\industrial furnace\Oil	Activity Level	Discount	%	Share	2.061.856
Demand	Agriculture	Southern Suburbia\industrial furnace\Oil	Activity Level	Convenience	%	Share	2.061.856
Demand	Agriculture	Southern Suburbia\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Southern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Southern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Southern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Southern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Southern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Southern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	Southern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	Southern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Southern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Southern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Southern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Southern Suburbia\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Southern Suburbia\heating\Natural Gas	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Southern Suburbia\heating\Natural Gas	Activity Level	Discount	%	Share	100
Demand	Agriculture	Southern Suburbia\heating\Natural Gas	Activity Level	Convenience	%	Share	100
Demand	Agriculture	Southern Suburbia\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Southern Suburbia\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Southern Suburbia\lighting	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Southern Suburbia\lighting	Activity Level	Convenience	%	Saturation	100

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Agriculture	Southern Suburbia\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Southern Suburbia\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	Southern Suburbia\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	Southern Suburbia\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	Southern Suburbia\other	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	Southern Suburbia\other	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	Southern Suburbia\other	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	Southern Suburbia\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	Southern Suburbia\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	Southern Suburbia\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	Southern Suburbia\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	City of Vienna	Activity Level	Current Accounts	%	Share	1,6
Demand	Agriculture	City of Vienna	Activity Level	Best Buy	%	Share	Interp(2100; 1,2)
Demand	Agriculture	City of Vienna	Activity Level	Discount	%	Share	1,6
Demand	Agriculture	City of Vienna	Activity Level	Convenience	%	Share	1,6
Demand	Agriculture	City of Vienna\industrial furnace	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	City of Vienna\industrial furnace	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	City of Vienna\industrial furnace	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	City of Vienna\industrial furnace	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	City of Vienna\industrial furnace\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	City of Vienna\industrial furnace\Natural Gas	Activity Level	Best Buy	%	Share	5.604.396
Demand	Agriculture	City of Vienna\industrial furnace\Natural Gas	Activity Level	Discount	%	Share	5.604.396
Demand	Agriculture	City of Vienna\industrial furnace\Natural Gas	Activity Level	Convenience	%	Share	5.604.396
Demand	Agriculture	City of Vienna\industrial furnace\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	City of Vienna\industrial furnace\Oil	Activity Level	Best Buy	%	Share	2.197.802
Demand	Agriculture	City of Vienna\industrial furnace\Oil	Activity Level	Discount	%	Share	2.197.802
Demand	Agriculture	City of Vienna\industrial furnace\Oil	Activity Level	Convenience	%	Share	2.197.802
Demand	Agriculture	City of Vienna\industrial furnace\Coal Bitumir	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	City of Vienna\industrial furnace\Coal Bitumir	Activity Level	Best Buy	%	Share	2.197.802
Demand	Agriculture	City of Vienna\industrial furnace\Coal Bitumir	Activity Level	Discount	%	Share	2.197.802
Demand	Agriculture	City of Vienna\industrial furnace\Coal Bitumir	Activity Level	Convenience	%	Share	2.197.802
Demand	Agriculture	City of Vienna\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	City of Vienna\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	City of Vienna\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	City of Vienna\electric devices	Activity Level	Convenience	%	Saturation	100

Demand	Agriculture	City of Vienna\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	City of Vienna\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	City of Vienna\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	City of Vienna\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	City of Vienna\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	City of Vienna\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	City of Vienna\heating	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	City of Vienna\heating	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	City of Vienna\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	City of Vienna\heating\Natural Gas	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	City of Vienna\heating\Natural Gas	Activity Level	Discount	%	Share	100
Demand	Agriculture	City of Vienna\heating\Natural Gas	Activity Level	Convenience	%	Share	100
Demand	Agriculture	City of Vienna\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	City of Vienna\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	City of Vienna\lighting	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	City of Vienna\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	City of Vienna\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	City of Vienna\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	City of Vienna\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	City of Vienna\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Agriculture	City of Vienna\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Agriculture	City of Vienna\other	Activity Level	Best Buy	%	Saturation	100
Demand	Agriculture	City of Vienna\other	Activity Level	Discount	%	Saturation	100
Demand	Agriculture	City of Vienna\other	Activity Level	Convenience	%	Saturation	100
Demand	Agriculture	City of Vienna\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Agriculture	City of Vienna\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Agriculture	City of Vienna\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Agriculture	City of Vienna\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial		Activity Level	Current Accounts		GRP	59826000000
Demand	Commercial		Activity Level	Best Buy		GRP	Growth(2,2%; 2040; 3,2%; 2070; 2,8%)
Demand	Commercial		Activity Level	Discount		GRP	Growth(1,6%; 2040; 0,6%; 2070; 0,8%)
Demand	Commercial		Activity Level	Convenience		GRP	Growth(2,8%; 2040; 1,4%; 2070; 2%)
Demand	Commercial	Northern Suburbia	Activity Level	Current Accounts	%	Share	5,2
Demand	Commercial	Northern Suburbia	Activity Level	Best Buy	%	Share	Interp(2040; 5,25; 2070; 5,3; 2100; 5,35)
Demand	Commercial	Northern Suburbia	Activity Level	Discount	%	Share	Smooth(2040; 5,5; 2070; 5,8; 2100; 6)
Demand	Commercial	Northern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 5,3; 2070; 5,35; 2100; 5,4)

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Commercial	Northern Suburbia\cooling	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Northern Suburbia\cooling	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Northern Suburbia\cooling	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Northern Suburbia\cooling\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Northern Suburbia\cooling\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Northern Suburbia\cooling\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Northern Suburbia\cooling\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	Northern Suburbia\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Northern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Northern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Northern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Northern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Northern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Northern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Northern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	Northern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Northern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Northern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Northern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Northern Suburbia\lighting edv	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Northern Suburbia\lighting edv	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Northern Suburbia\lighting edv	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Northern Suburbia\lighting edv	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Northern Suburbia\lighting edv\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Northern Suburbia\lighting edv\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Northern Suburbia\lighting edv\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Northern Suburbia\lighting edv\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	Northern Suburbia\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Northern Suburbia\other	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Northern Suburbia\other	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Northern Suburbia\other	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Northern Suburbia\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Northern Suburbia\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Northern Suburbia\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Northern Suburbia\other\Electricity	Activity Level	Convenience	%	Share	100

Demand	Commercial	Southern Suburbia	Activity Level	Current Accounts	%	Share	10,4
Demand	Commercial	Southern Suburbia	Activity Level	Best Buy	%	Share	Interp(2040; 10,5; 2070; 10,6; 2100; 10,4)
Demand	Commercial	Southern Suburbia	Activity Level	Discount	%	Share	Smooth(2040; 10,7; 2070; 11; 2100; 11,2)
Demand	Commercial	Southern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 10,5; 2070; 10,7; 2100; 10,9)
Demand	Commercial	Southern Suburbia\cooling	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Southern Suburbia\cooling	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Southern Suburbia\cooling	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Southern Suburbia\cooling	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Southern Suburbia\cooling\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\cooling\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Southern Suburbia\cooling\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Southern Suburbia\cooling\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	Southern Suburbia\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Southern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Southern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Southern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Southern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Southern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Southern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	Southern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Southern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Southern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Southern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Southern Suburbia\heating\District Heating	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\heating\District Heating	Activity Level	Best Buy	%	Share	5.378.227
Demand	Commercial	Southern Suburbia\heating\District Heating	Activity Level	Discount	%	Share	5.378.227
Demand	Commercial	Southern Suburbia\heating\District Heating	Activity Level	Convenience	%	Share	5.378.227
Demand	Commercial	Southern Suburbia\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\heating\Electricity	Activity Level	Best Buy	%	Share	1.445.868
Demand	Commercial	Southern Suburbia\heating\Electricity	Activity Level	Discount	%	Share	1.445.868
Demand	Commercial	Southern Suburbia\heating\Electricity	Activity Level	Convenience	%	Share	1.445.868
Demand	Commercial	Southern Suburbia\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\heating\Natural Gas	Activity Level	Best Buy	%	Share	1.472.884
Demand	Commercial	Southern Suburbia\heating\Natural Gas	Activity Level	Discount	%	Share	1.472.884
Demand	Commercial	Southern Suburbia\heating\Natural Gas	Activity Level	Convenience	%	Share	1.472.884

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Commercial	Southern Suburbia\heating\Oil	Activity Level	Best Buy	%	Share	1.013.608
Demand	Commercial	Southern Suburbia\heating\Oil	Activity Level	Discount	%	Share	1.013.608
Demand	Commercial	Southern Suburbia\heating\Oil	Activity Level	Convenience	%	Share	1.013.608
Demand	Commercial	Southern Suburbia\heating\Other	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\heating\Other	Activity Level	Best Buy	%	Share	6.894.136
Demand	Commercial	Southern Suburbia\heating\Other	Activity Level	Discount	%	Share	6.894.136
Demand	Commercial	Southern Suburbia\heating\Other	Activity Level	Convenience	%	Share	6.894.136
Demand	Commercial	Southern Suburbia\lighting edv	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Southern Suburbia\lighting edv	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Southern Suburbia\lighting edv	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Southern Suburbia\lighting edv	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Southern Suburbia\lighting edv\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\lighting edv\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Southern Suburbia\lighting edv\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Southern Suburbia\lighting edv\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	Southern Suburbia\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	Southern Suburbia\other	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	Southern Suburbia\other	Activity Level	Discount	%	Saturation	100
Demand	Commercial	Southern Suburbia\other	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	Southern Suburbia\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	Southern Suburbia\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	Southern Suburbia\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	Southern Suburbia\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	City of Vienna	Activity Level	Current Accounts	%	Share	84,4
Demand	Commercial	City of Vienna	Activity Level	Best Buy	%	Share	Interp(2040; 84,25; 2070; 84,1; 2100; 84,25)
Demand	Commercial	City of Vienna	Activity Level	Discount	%	Share	Smooth(2040; 83,8; 2070;83,2; 2100;82,8)
Demand	Commercial	City of Vienna	Activity Level	Convenience	%	Share	Smooth(2040; 84,2; 2070; 83,95; 2100; 83,7)
Demand	Commercial	City of Vienna\cooling	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	City of Vienna\cooling	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	City of Vienna\cooling	Activity Level	Discount	%	Saturation	100
Demand	Commercial	City of Vienna\cooling	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	City of Vienna\cooling\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\cooling\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	City of Vienna\cooling\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	City of Vienna\cooling\Electricity	Activity Level	Convenience	%	Share	100

Demand	Commercial	City of Vienna\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	City of Vienna\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	City of Vienna\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Commercial	City of Vienna\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	City of Vienna\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	City of Vienna\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	City of Vienna\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	City of Vienna\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	City of Vienna\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	City of Vienna\heating	Activity Level	Discount	%	Saturation	100
Demand	Commercial	City of Vienna\heating	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	City of Vienna\heating\District Heating	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\heating\District Heating	Activity Level	Best Buy	%	Share	5.378.227
Demand	Commercial	City of Vienna\heating\District Heating	Activity Level	Discount	%	Share	5.378.227
Demand	Commercial	City of Vienna\heating\District Heating	Activity Level	Convenience	%	Share	5.378.227
Demand	Commercial	City of Vienna\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\heating\Electricity	Activity Level	Best Buy	%	Share	1.445.868
Demand	Commercial	City of Vienna\heating\Electricity	Activity Level	Discount	%	Share	1.445.868
Demand	Commercial	City of Vienna\heating\Electricity	Activity Level	Convenience	%	Share	1.445.868
Demand	Commercial	City of Vienna\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\heating\Natural Gas	Activity Level	Best Buy	%	Share	1.472.884
Demand	Commercial	City of Vienna\heating\Natural Gas	Activity Level	Discount	%	Share	1.472.884
Demand	Commercial	City of Vienna\heating\Natural Gas	Activity Level	Convenience	%	Share	1.472.884
Demand	Commercial	City of Vienna\heating\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\heating\Oil	Activity Level	Best Buy	%	Share	1.013.608
Demand	Commercial	City of Vienna\heating\Oil	Activity Level	Discount	%	Share	1.013.608
Demand	Commercial	City of Vienna\heating\Oil	Activity Level	Convenience	%	Share	1.013.608
Demand	Commercial	City of Vienna\heating\Other	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\heating\Other	Activity Level	Best Buy	%	Share	6.894.136
Demand	Commercial	City of Vienna\heating\Other	Activity Level	Discount	%	Share	6.894.136
Demand	Commercial	City of Vienna\heating\Other	Activity Level	Convenience	%	Share	6.894.136
Demand	Commercial	City of Vienna\lighting edv	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	City of Vienna\lighting edv	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	City of Vienna\lighting edv	Activity Level	Discount	%	Saturation	100
Demand	Commercial	City of Vienna\lighting edv	Activity Level	Convenience	%	Saturation	100

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Commercial	City of Vienna\lighting edv\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	City of Vienna\lighting edv\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	City of Vienna\lighting edv\Electricity	Activity Level	Convenience	%	Share	100
Demand	Commercial	City of Vienna\other	Activity Level	Current Accounts	%	Saturation	100
Demand	Commercial	City of Vienna\other	Activity Level	Best Buy	%	Saturation	100
Demand	Commercial	City of Vienna\other	Activity Level	Discount	%	Saturation	100
Demand	Commercial	City of Vienna\other	Activity Level	Convenience	%	Saturation	100
Demand	Commercial	City of Vienna\other\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Commercial	City of Vienna\other\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Commercial	City of Vienna\other\Electricity	Activity Level	Discount	%	Share	100
Demand	Commercial	City of Vienna\other\Electricity	Activity Level	Convenience	%	Share	100
Demand	Industry		Activity Level	Current Accounts		GRP	14649000000
Demand	Industry		Activity Level	Best Buy		GRP	Growth(1,3%; 2040; 2,3%; 2070; 1,9%)
Demand	Industry		Activity Level	Discount		GRP	Growth(0,9%; 2040; 0,1%; 2070; 0,2%)
Demand	Industry		Activity Level	Convenience		GRP	Growth(1,3%; 2040; 0,5%; 2070; 1%)
Demand	Industry	Northern Suburbia	Activity Level	Current Accounts	%	Share	13,9
Demand	Industry	Northern Suburbia	Activity Level	Best Buy	%	Share	Interp(2040; 14; 2070; 14,1; 2100; 14)
Demand	Industry	Northern Suburbia	Activity Level	Discount	%	Share	Smooth(2040; 14,2; 2070;14,4; 2100; 14,6)
Demand	Industry	Northern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 14; 2070; 14,1; 2100; 14,2)
Demand	Industry	Northern Suburbia\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Northern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Northern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Industry	Northern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Northern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Industry	Northern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Industry	Northern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Industry	Northern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Northern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Northern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Industry	Northern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Northern Suburbia\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\heating\Electricity	Activity Level	Best Buy	%	Share	8.808.809
Demand	Industry	Northern Suburbia\heating\Electricity	Activity Level	Discount	%	Share	8.808.809
Demand	Industry	Northern Suburbia\heating\Electricity	Activity Level	Convenience	%	Share	8.808.809

Demand	Industry	Northern Suburbia\heating\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\heating\Oil	Activity Level	Best Buy	%	Share	2.882.883
Demand	Industry	Northern Suburbia\heating\Oil	Activity Level	Discount	%	Share	2.882.883
Demand	Industry	Northern Suburbia\heating\Oil	Activity Level	Convenience	%	Share	2.882.883
Demand	Industry	Northern Suburbia\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\heating\Natural Gas	Activity Level	Best Buy	%	Share	3.633.634
Demand	Industry	Northern Suburbia\heating\Natural Gas	Activity Level	Discount	%	Share	3.633.634
Demand	Industry	Northern Suburbia\heating\Natural Gas	Activity Level	Convenience	%	Share	3.633.634
Demand	Industry	Northern Suburbia\heating\District Heating	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\heating\District Heating	Activity Level	Best Buy	%	Share	2.002.002
Demand	Industry	Northern Suburbia\heating\District Heating	Activity Level	Discount	%	Share	2.002.002
Demand	Industry	Northern Suburbia\heating\District Heating	Activity Level	Convenience	%	Share	2.002.002
Demand	Industry	Northern Suburbia\heating\Other	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\heating\Other	Activity Level	Best Buy	%	Share	6.006.006
Demand	Industry	Northern Suburbia\heating\Other	Activity Level	Discount	%	Share	6.006.006
Demand	Industry	Northern Suburbia\heating\Other	Activity Level	Convenience	%	Share	6.006.006
Demand	Industry	Northern Suburbia\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Northern Suburbia\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Northern Suburbia\lighting	Activity Level	Discount	%	Saturation	100
Demand	Industry	Northern Suburbia\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Northern Suburbia\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Industry	Northern Suburbia\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Industry	Northern Suburbia\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Industry	Northern Suburbia\industrial furnace	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Northern Suburbia\industrial furnace	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Northern Suburbia\industrial furnace	Activity Level	Discount	%	Saturation	100
Demand	Industry	Northern Suburbia\industrial furnace	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Northern Suburbia\industrial furnace\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\industrial furnace\Oil	Activity Level	Best Buy	%	Share	1.752.577
Demand	Industry	Northern Suburbia\industrial furnace\Oil	Activity Level	Discount	%	Share	1.752.577
Demand	Industry	Northern Suburbia\industrial furnace\Oil	Activity Level	Convenience	%	Share	1.752.577
Demand	Industry	Northern Suburbia\industrial furnace\Natural	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\industrial furnace\Natural	Activity Level	Best Buy	%	Share	6.185.567
Demand	Industry	Northern Suburbia\industrial furnace\Natural	Activity Level	Discount	%	Share	6.185.567
Demand	Industry	Northern Suburbia\industrial furnace\Natural	Activity Level	Convenience	%	Share	6.185.567

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Industry	Northern Suburbia\industrial furnace\Coal Bit	Activity Level	Best Buy	%	Share	2.061.856
Demand	Industry	Northern Suburbia\industrial furnace\Coal Bit	Activity Level	Discount	%	Share	2.061.856
Demand	Industry	Northern Suburbia\industrial furnace\Coal Bit	Activity Level	Convenience	%	Share	2.061.856
Demand	Industry	Northern Suburbia\steam generation	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Northern Suburbia\steam generation	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Northern Suburbia\steam generation	Activity Level	Discount	%	Saturation	100
Demand	Industry	Northern Suburbia\steam generation	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Northern Suburbia\steam generation\Natural	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\steam generation\Natural	Activity Level	Best Buy	%	Share	4.594.595
Demand	Industry	Northern Suburbia\steam generation\Natural	Activity Level	Discount	%	Share	4.594.595
Demand	Industry	Northern Suburbia\steam generation\Natural	Activity Level	Convenience	%	Share	4.594.595
Demand	Industry	Northern Suburbia\steam generation\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Northern Suburbia\steam generation\Oil	Activity Level	Best Buy	%	Share	5.405.405
Demand	Industry	Northern Suburbia\steam generation\Oil	Activity Level	Discount	%	Share	5.405.405
Demand	Industry	Northern Suburbia\steam generation\Oil	Activity Level	Convenience	%	Share	5.405.405
Demand	Industry	Southern Suburbia	Activity Level	Current Accounts	%	Share	19,61
Demand	Industry	Southern Suburbia	Activity Level	Best Buy	%	Share	Interp(2040; 19,7; 2070; 20; 2100; 19,8)
Demand	Industry	Southern Suburbia	Activity Level	Discount	%	Share	Smooth(2040; 20; 2070; 20,3; 2100; 20,5)
Demand	Industry	Southern Suburbia	Activity Level	Convenience	%	Share	Smooth(2040; 19,8; 2070; 20; 2100; 20,2)
Demand	Industry	Southern Suburbia\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Southern Suburbia\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Southern Suburbia\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Industry	Southern Suburbia\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Southern Suburbia\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Industry	Southern Suburbia\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Industry	Southern Suburbia\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Industry	Southern Suburbia\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Southern Suburbia\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Southern Suburbia\heating	Activity Level	Discount	%	Saturation	100
Demand	Industry	Southern Suburbia\heating	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Southern Suburbia\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\heating\Electricity	Activity Level	Best Buy	%	Share	8.808.809
Demand	Industry	Southern Suburbia\heating\Electricity	Activity Level	Discount	%	Share	8.808.809
Demand	Industry	Southern Suburbia\heating\Electricity	Activity Level	Convenience	%	Share	8.808.809

Demand	Industry	Southern Suburbia\heating\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\heating\Oil	Activity Level	Best Buy	%	Share	2.882.883
Demand	Industry	Southern Suburbia\heating\Oil	Activity Level	Discount	%	Share	2.882.883
Demand	Industry	Southern Suburbia\heating\Oil	Activity Level	Convenience	%	Share	2.882.883
Demand	Industry	Southern Suburbia\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\heating\Natural Gas	Activity Level	Best Buy	%	Share	3.633.634
Demand	Industry	Southern Suburbia\heating\Natural Gas	Activity Level	Discount	%	Share	3.633.634
Demand	Industry	Southern Suburbia\heating\Natural Gas	Activity Level	Convenience	%	Share	3.633.634
Demand	Industry	Southern Suburbia\heating\District Heating	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\heating\District Heating	Activity Level	Best Buy	%	Share	2.002.002
Demand	Industry	Southern Suburbia\heating\District Heating	Activity Level	Discount	%	Share	2.002.002
Demand	Industry	Southern Suburbia\heating\District Heating	Activity Level	Convenience	%	Share	2.002.002
Demand	Industry	Southern Suburbia\heating\Other	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\heating\Other	Activity Level	Best Buy	%	Share	6.006.006
Demand	Industry	Southern Suburbia\heating\Other	Activity Level	Discount	%	Share	6.006.006
Demand	Industry	Southern Suburbia\heating\Other	Activity Level	Convenience	%	Share	6.006.006
Demand	Industry	Southern Suburbia\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Southern Suburbia\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Southern Suburbia\lighting	Activity Level	Discount	%	Saturation	100
Demand	Industry	Southern Suburbia\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Southern Suburbia\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Industry	Southern Suburbia\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Industry	Southern Suburbia\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Industry	Southern Suburbia\industrial furnace	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Southern Suburbia\industrial furnace	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Southern Suburbia\industrial furnace	Activity Level	Discount	%	Saturation	100
Demand	Industry	Southern Suburbia\industrial furnace	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Southern Suburbia\industrial furnace\Natural	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\industrial furnace\Natural	Activity Level	Best Buy	%	Share	5.604.396
Demand	Industry	Southern Suburbia\industrial furnace\Natural	Activity Level	Discount	%	Share	5.604.396
Demand	Industry	Southern Suburbia\industrial furnace\Natural	Activity Level	Convenience	%	Share	5.604.396
Demand	Industry	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Best Buy	%	Share	2.197.802
Demand	Industry	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Discount	%	Share	2.197.802
Demand	Industry	Southern Suburbia\industrial furnace\Coal Bit	Activity Level	Convenience	%	Share	2.197.802

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Industry	Southern Suburbia\industrial furnace\Oil	Activity Level	Best Buy	%	Share	2.197.802
Demand	Industry	Southern Suburbia\industrial furnace\Oil	Activity Level	Discount	%	Share	2.197.802
Demand	Industry	Southern Suburbia\industrial furnace\Oil	Activity Level	Convenience	%	Share	2.197.802
Demand	Industry	Southern Suburbia\steam generation	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	Southern Suburbia\steam generation	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	Southern Suburbia\steam generation	Activity Level	Discount	%	Saturation	100
Demand	Industry	Southern Suburbia\steam generation	Activity Level	Convenience	%	Saturation	100
Demand	Industry	Southern Suburbia\steam generation\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\steam generation\Oil	Activity Level	Best Buy	%	Share	4.594.595
Demand	Industry	Southern Suburbia\steam generation\Oil	Activity Level	Discount	%	Share	4.594.595
Demand	Industry	Southern Suburbia\steam generation\Oil	Activity Level	Convenience	%	Share	4.594.595
Demand	Industry	Southern Suburbia\steam generation\Natural	Activity Level	Current Accounts	%	Share	0
Demand	Industry	Southern Suburbia\steam generation\Natural	Activity Level	Best Buy	%	Share	5.405.405
Demand	Industry	Southern Suburbia\steam generation\Natural	Activity Level	Discount	%	Share	5.405.405
Demand	Industry	Southern Suburbia\steam generation\Natural	Activity Level	Convenience	%	Share	5.405.405
Demand	Industry	City of Vienna	Activity Level	Current Accounts	%	Share	66,5
Demand	Industry	City of Vienna	Activity Level	Best Buy	%	Share	Interp(2040; 66,3; 2070; 65,9; 2100; 66,2)
Demand	Industry	City of Vienna	Activity Level	Discount	%	Share	Smooth(2040; 65,8; 2070; 65,3; 2100; 64,9)
Demand	Industry	City of Vienna	Activity Level	Convenience	%	Share	Smooth(2040; 66,2; 2070; 65,9; 2100; 65,6)
Demand	Industry	City of Vienna\electric devices	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	City of Vienna\electric devices	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	City of Vienna\electric devices	Activity Level	Discount	%	Saturation	100
Demand	Industry	City of Vienna\electric devices	Activity Level	Convenience	%	Saturation	100
Demand	Industry	City of Vienna\electric devices\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\electric devices\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Industry	City of Vienna\electric devices\Electricity	Activity Level	Discount	%	Share	100
Demand	Industry	City of Vienna\electric devices\Electricity	Activity Level	Convenience	%	Share	100
Demand	Industry	City of Vienna\heating	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	City of Vienna\heating	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	City of Vienna\heating	Activity Level	Discount	%	Saturation	100
Demand	Industry	City of Vienna\heating	Activity Level	Convenience	%	Saturation	100
Demand	Industry	City of Vienna\heating\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\heating\Electricity	Activity Level	Best Buy	%	Share	8.808.809
Demand	Industry	City of Vienna\heating\Electricity	Activity Level	Discount	%	Share	8.808.809
Demand	Industry	City of Vienna\heating\Electricity	Activity Level	Convenience	%	Share	8.808.809

Demand	Industry	City of Vienna\heating\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\heating\Oil	Activity Level	Best Buy	%	Share	2.882.883
Demand	Industry	City of Vienna\heating\Oil	Activity Level	Discount	%	Share	2.882.883
Demand	Industry	City of Vienna\heating\Oil	Activity Level	Convenience	%	Share	2.882.883
Demand	Industry	City of Vienna\heating\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\heating\Natural Gas	Activity Level	Best Buy	%	Share	3.633.634
Demand	Industry	City of Vienna\heating\Natural Gas	Activity Level	Discount	%	Share	3.633.634
Demand	Industry	City of Vienna\heating\Natural Gas	Activity Level	Convenience	%	Share	3.633.634
Demand	Industry	City of Vienna\heating\District Heating	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\heating\District Heating	Activity Level	Best Buy	%	Share	2.002.002
Demand	Industry	City of Vienna\heating\District Heating	Activity Level	Discount	%	Share	2.002.002
Demand	Industry	City of Vienna\heating\District Heating	Activity Level	Convenience	%	Share	2.002.002
Demand	Industry	City of Vienna\heating\Other	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\heating\Other	Activity Level	Best Buy	%	Share	6.006.006
Demand	Industry	City of Vienna\heating\Other	Activity Level	Discount	%	Share	6.006.006
Demand	Industry	City of Vienna\heating\Other	Activity Level	Convenience	%	Share	6.006.006
Demand	Industry	City of Vienna\lighting	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	City of Vienna\lighting	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	City of Vienna\lighting	Activity Level	Discount	%	Saturation	100
Demand	Industry	City of Vienna\lighting	Activity Level	Convenience	%	Saturation	100
Demand	Industry	City of Vienna\lighting\Electricity	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\lighting\Electricity	Activity Level	Best Buy	%	Share	100
Demand	Industry	City of Vienna\lighting\Electricity	Activity Level	Discount	%	Share	100
Demand	Industry	City of Vienna\lighting\Electricity	Activity Level	Convenience	%	Share	100
Demand	Industry	City of Vienna\industrial furnace	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	City of Vienna\industrial furnace	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	City of Vienna\industrial furnace	Activity Level	Discount	%	Saturation	100
Demand	Industry	City of Vienna\industrial furnace	Activity Level	Convenience	%	Saturation	100
Demand	Industry	City of Vienna\industrial furnace\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\industrial furnace\Oil	Activity Level	Best Buy	%	Share	1.752.577
Demand	Industry	City of Vienna\industrial furnace\Oil	Activity Level	Discount	%	Share	1.752.577
Demand	Industry	City of Vienna\industrial furnace\Oil	Activity Level	Convenience	%	Share	1.752.577
Demand	Industry	City of Vienna\industrial furnace\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\industrial furnace\Natural Gas	Activity Level	Best Buy	%	Share	6.185.567
Demand	Industry	City of Vienna\industrial furnace\Natural Gas	Activity Level	Discount	%	Share	6.185.567
Demand	Industry	City of Vienna\industrial furnace\Natural Gas	Activity Level	Convenience	%	Share	6.185.567

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Expression
Demand	Industry	City of Vienna\industrial furnace\Coal Bitumir	Activity Level	Best Buy	%	Share	2.061.856
Demand	Industry	City of Vienna\industrial furnace\Coal Bitumir	Activity Level	Discount	%	Share	2.061.856
Demand	Industry	City of Vienna\industrial furnace\Coal Bitumir	Activity Level	Convenience	%	Share	2.061.856
Demand	Industry	City of Vienna\steam generation	Activity Level	Current Accounts	%	Saturation	100
Demand	Industry	City of Vienna\steam generation	Activity Level	Best Buy	%	Saturation	100
Demand	Industry	City of Vienna\steam generation	Activity Level	Discount	%	Saturation	100
Demand	Industry	City of Vienna\steam generation	Activity Level	Convenience	%	Saturation	100
Demand	Industry	City of Vienna\steam generation\Oil	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\steam generation\Oil	Activity Level	Best Buy	%	Share	4.594.595
Demand	Industry	City of Vienna\steam generation\Oil	Activity Level	Discount	%	Share	4.594.595
Demand	Industry	City of Vienna\steam generation\Oil	Activity Level	Convenience	%	Share	4.594.595
Demand	Industry	City of Vienna\steam generation\Natural Gas	Activity Level	Current Accounts	%	Share	0
Demand	Industry	City of Vienna\steam generation\Natural Gas	Activity Level	Best Buy	%	Share	5.405.405
Demand	Industry	City of Vienna\steam generation\Natural Gas	Activity Level	Discount	%	Share	5.405.405
Demand	Industry	City of Vienna\steam generation\Natural Gas	Activity Level	Convenience	%	Share	5.405.405

Energy Transformation Data (LEAP, Project Vienna 2100, 2008)

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Transmission and Distribution	Processes\Electricity	Losses	Current Accounts	%	Losses		5,22
Transformation	Transmission and Distribution	Processes\Electricity	Losses	Best Buy	%	Losses		Interp(2040; 5; 2070; 4; 2100; 3)
Transformation	Transmission and Distribution	Processes\Electricity	Losses	Discount	%	Losses		Interp(2100; 5)
Transformation	Transmission and Distribution	Processes\Electricity	Losses	Convenience	%	Losses		Smooth(2040; 5; 2070; 4,5; 2070; 4)
Transformation	Transmission and Distribution	Processes\Electricity\Feedstock Fuels\Electricity	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Transmission and Distribution	Processes\Electricity\Feedstock Fuels\Electricity	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Transmission and Distribution	Processes\Electricity\Feedstock Fuels\Electricity	Feedstock Fuel Share	Discount		Percent		100
Transformation	Transmission and Distribution	Processes\Electricity\Feedstock Fuels\Electricity	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Transmission and Distribution	Processes\Heat	Losses	Current Accounts	%	Losses		7,44
Transformation	Transmission and Distribution	Processes\Heat	Losses	Best Buy	%	Losses		Interp(2040; 6; 2070; 5; 2100; 3)
Transformation	Transmission and Distribution	Processes\Heat	Losses	Discount	%	Losses		Interp(2100; 7)
Transformation	Transmission and Distribution	Processes\Heat	Losses	Convenience	%	Losses		Smooth(2040; 6; 2070; 5; 2070; 3)
Transformation	Transmission and Distribution	Processes\Heat\Feedstock Fuels\Heat	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Transmission and Distribution	Processes\Heat\Feedstock Fuels\Heat	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Transmission and Distribution	Processes\Heat\Feedstock Fuels\Heat	Feedstock Fuel Share	Discount		Percent		100
Transformation	Transmission and Distribution	Processes\Heat\Feedstock Fuels\Heat	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Electricity Generation	Processes\Biomass	Process Shares	Current Accounts	%	Share		0,51
Transformation	Electricity Generation	Processes\Biomass	Merit Order	Current Accounts		Percent		1
Transformation	Electricity Generation	Processes\Biomass	First Simulation Year	Current Accounts		Year		2005
Transformation	Electricity Generation	Processes\Biomass	Exogenous Capacity	Current Accounts		Megawatt		7,9
Transformation	Electricity Generation	Processes\Biomass	Maximum Availability	Current Accounts	%	Percent		50
Transformation	Electricity Generation	Processes\Biomass	Historical Production	Current Accounts		Megawatt-Hour		28371
Transformation	Electricity Generation	Processes\Biomass	Efficiency	Current Accounts	%	Efficiency		25
Transformation	Electricity Generation	Processes\Biomass	Process Shares	Best Buy	%	Share		0,51
Transformation	Electricity Generation	Processes\Biomass	Merit Order	Best Buy		Percent		1
Transformation	Electricity Generation	Processes\Biomass	Exogenous Capacity	Best Buy		Megawatt		Growth(6%; 2040; 4,8%; 2070; 3%)
Transformation	Electricity Generation	Processes\Biomass	Maximum Availability	Best Buy	%	Percent		Interp(2100; 60)
Transformation	Electricity Generation	Processes\Biomass	Historical Production	Best Buy		Megawatt-Hour		28371
Transformation	Electricity Generation	Processes\Biomass	Efficiency	Best Buy	%	Efficiency		Interp(2040; 40; 2070; 60; 2100; 65)
Transformation	Electricity Generation	Processes\Biomass	Process Shares	Discount	%	Share		0,51
Transformation	Electricity Generation	Processes\Biomass	Merit Order	Discount		Percent		1
Transformation	Electricity Generation	Processes\Biomass	Exogenous Capacity	Discount		Megawatt		Growth(3,5%; 2040; 2,6%; 2070; 2%)
Transformation	Electricity Generation	Processes\Biomass	Maximum Availability	Discount	%	Percent		50
Transformation	Electricity Generation	Processes\Biomass	Historical Production	Discount		Megawatt-Hour		28371
Transformation	Electricity Generation	Processes\Biomass	Efficiency	Discount	%	Efficiency		Smooth(2040; 28; 2070; 30; 2100; 33
Transformation	Electricity Generation	Processes\Biomass	Process Shares	Convenience	%	Share		0,51
Transformation	Electricity Generation	Processes\Biomass	Merit Order	Convenience		Percent		1
Transformation	Electricity Generation	Processes\Biomass	Exogenous Capacity	Convenience		Megawatt		Growth(4%; 2040; 3,2%; 2070; 3,5%)
Transformation	Electricity Generation	Processes\Biomass	Maximum Availability	Convenience	%	Percent		Interp(2100; 55)
Transformation	Electricity Generation	Processes\Biomass	Historical Production	Convenience		Megawatt-Hour		28371
Transformation	Electricity Generation	Processes\Biomass	Efficiency	Convenience	%	Efficiency		Smooth(2040; 30; 2070; 35; 2100; 40
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Discount		Percent		100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	30
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	30
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Discount		Kilogramme	Terajoule	30

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule	30
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Current Accounts		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Best Buy		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Discount		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Convenience		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration	Process Shares	Current Accounts	%	Share		0
Transformation	Electricity Generation	Processes\Cogeneration	Merit Order	Current Accounts		Percent		1
Transformation	Electricity Generation	Processes\Cogeneration	First Simulation Year	Current Accounts		Year		2005
Transformation	Electricity Generation	Processes\Cogeneration	Exogenous Capacity	Current Accounts		Megawatt		63,2
Transformation	Electricity Generation	Processes\Cogeneration	Maximum Availability	Current Accounts	%	Percent		85
Transformation	Electricity Generation	Processes\Cogeneration	Historical Production	Current Accounts		Megawatt-Hour		2242
Transformation	Electricity Generation	Processes\Cogeneration	Efficiency	Current Accounts	%	Efficiency		45
Transformation	Electricity Generation	Processes\Cogeneration	Process Shares	Best Buy	%	Share		0
Transformation	Electricity Generation	Processes\Cogeneration	Merit Order	Best Buy		Percent		1
Transformation	Electricity Generation	Processes\Cogeneration	Exogenous Capacity	Best Buy		Megawatt		Growth(1%; 2040; 1,3%; 2070; 1,4%)
Transformation	Electricity Generation	Processes\Cogeneration	Maximum Availability	Best Buy	%	Percent		85
Transformation	Electricity Generation	Processes\Cogeneration	Historical Production	Best Buy		Megawatt-Hour		2242
Transformation	Electricity Generation	Processes\Cogeneration	Efficiency	Best Buy	%	Efficiency		Interp(2040; 50; 2070;60; 2100;70)
Transformation	Electricity Generation	Processes\Cogeneration	Process Shares	Discount	%	Share		0
Transformation	Electricity Generation	Processes\Cogeneration	Merit Order	Discount		Percent		1
Transformation	Electricity Generation	Processes\Cogeneration	Exogenous Capacity	Discount		Megawatt		Growth(1%; 2040; 0,6%; 2070; 0,4%)
Transformation	Electricity Generation	Processes\Cogeneration	Maximum Availability	Discount	%	Percent		85
Transformation	Electricity Generation	Processes\Cogeneration	Historical Production	Discount		Megawatt-Hour		2242
Transformation	Electricity Generation	Processes\Cogeneration	Efficiency	Discount	%	Efficiency		Smooth(2040; 46; 2070; 48; 2100; 50
Transformation	Electricity Generation	Processes\Cogeneration	Process Shares	Convenience	%	Share		0
Transformation	Electricity Generation	Processes\Cogeneration	Merit Order	Convenience		Percent		1
Transformation	Electricity Generation	Processes\Cogeneration	Exogenous Capacity	Convenience		Megawatt		Growth(1%; 2040; 0,8%; 2070; 0,5%)
Transformation	Electricity Generation	Processes\Cogeneration	Maximum Availability	Convenience	%	Percent		85
Transformation	Electricity Generation	Processes\Cogeneration	Historical Production	Convenience		Megawatt-Hour		2242
Transformation	Electricity Generation	Processes\Cogeneration	Efficiency	Convenience	%	Efficiency		Smooth(2040; 46; 2070; 48; 2100; 50
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Current Accounts		Percent		50
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Best Buy		Percent		Interp(2100; 40)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Discount		Percent		50
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Convenience		Percent		Interp(2100; 45)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	1

Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Discount	Kilogramme	Terajoule	1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Convenience	Kilogramme	Terajoule	1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Comp	Environmental Loading	Current Accounts	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Comp	Environmental Loading	Best Buy	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Comp	Environmental Loading	Discount	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Comp	Environmental Loading	Convenience	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Current Accounts	Kilogramme	Terajoule	150
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Best Buy	Kilogramme	Terajoule	150
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Discount	Kilogramme	Terajoule	150
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Convenience	Kilogramme	Terajoule	150
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Current Accounts	Kilogramme	Terajoule	0,1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Best Buy	Kilogramme	Terajoule	0,1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Discount	Kilogramme	Terajoule	0,1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Convenience	Kilogramme	Terajoule	0,1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Current Accounts	Kilogramme	Kilogramme	0
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Best Buy	Kilogramme	Kilogramme	0
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Discount	Kilogramme	Kilogramme	0
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Convenience	Kilogramme	Kilogramme	0
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Current Accounts	Percent		10
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Best Buy	Percent		Interp(2100; 0)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Discount	Percent		10
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Convenience	Percent		Interp(2100; 5)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Current Accounts	Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Best Buy	Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Discount	Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Convenience	Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Current Accounts	Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Best Buy	Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Discount	Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Convenience	Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Methane	Environmental Loading	Current Accounts	Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Methane	Environmental Loading	Best Buy	Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Methane	Environmental Loading	Discount	Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Methane	Environmental Loading	Convenience	Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Current Accounts	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Best Buy	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Discount	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Convenience	Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Current Accounts	Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Best Buy	Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Discount	Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Convenience	Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Current Accounts	Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Best Buy	Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Discount	Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Convenience	Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Current Accounts	Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Best Buy	Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Discount	Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Convenience	Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Current Accounts	Percent		10
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Best Buy	Percent		Interp(2100; 0)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Discount	Percent		10
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Convenience	Percent		Interp(2100; 5)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Dioxide Non Biogenic	Environmental Loading	Current Accounts	Metric Tonne	Terajoule	25,8 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Dioxide Non Biogenic	Environmental Loading	Best Buy	Metric Tonne	Terajoule	25,8 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Dioxide Non Biogenic	Environmental Loading	Discount	Metric Tonne	Terajoule	25,8 * fractionoxidized * (co2/c)

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Dioxide Non Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	25,8 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	20
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Methane	Environmental Loading	Discount		Kilogramme	Terajoule	1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule	1
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Non Methane Volatile Organic C	Environmental Loading	Current Accounts		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Non Methane Volatile Organic C	Environmental Loading	Best Buy		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Non Methane Volatile Organic C	Environmental Loading	Discount		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Non Methane Volatile Organic C	Environmental Loading	Convenience		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule	300
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule	300
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule	300
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule	300
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	1,4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	1,4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule	1,4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule	1,4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Current Accounts		Percent		30
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Best Buy		Percent		Interp(2100; 60)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Discount		Percent		30
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Convenience		Percent		Interp(2100; 45)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	1000
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	30
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	30
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Methane	Environmental Loading	Discount		Kilogramme	Terajoule	30
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule	30
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compour	Environmental Loading	Current Accounts		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compour	Environmental Loading	Best Buy		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compour	Environmental Loading	Discount		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compour	Environmental Loading	Convenience		Kilogramme	Terajoule	50
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule	100
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule	4
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)

Transformation	Electricity Generation	Processes\Cogeneration\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Combustion	Process Shares	Current Accounts	%	Share	90,73
Transformation	Electricity Generation	Processes\Combustion	Merit Order	Current Accounts		Percent	1
Transformation	Electricity Generation	Processes\Combustion	First Simulation Year	Current Accounts		Year	2005
Transformation	Electricity Generation	Processes\Combustion	Exogenous Capacity	Current Accounts		Megawatt	1370,4
Transformation	Electricity Generation	Processes\Combustion	Maximum Availability	Current Accounts	%	Percent	85
Transformation	Electricity Generation	Processes\Combustion	Historical Production	Current Accounts		Megawatt-Hour	5083464
Transformation	Electricity Generation	Processes\Combustion	Efficiency	Current Accounts	%	Efficiency	58
Transformation	Electricity Generation	Processes\Combustion	Process Shares	Best Buy	%	Share	90,73
Transformation	Electricity Generation	Processes\Combustion	Merit Order	Best Buy		Percent	1
Transformation	Electricity Generation	Processes\Combustion	Exogenous Capacity	Best Buy		Megawatt	Growth(-0,8%; 2040; -1,3%; 2070; -1
Transformation	Electricity Generation	Processes\Combustion	Maximum Availability	Best Buy	%	Percent	85
Transformation	Electricity Generation	Processes\Combustion	Historical Production	Best Buy		Megawatt-Hour	5083464
Transformation	Electricity Generation	Processes\Combustion	Efficiency	Best Buy	%	Efficiency	Interp(2040; 65,5; 2070; 70; 2100; 80
Transformation	Electricity Generation	Processes\Combustion	Process Shares	Discount	%	Share	90,73
Transformation	Electricity Generation	Processes\Combustion	Merit Order	Discount		Percent	1
Transformation	Electricity Generation	Processes\Combustion	Exogenous Capacity	Discount		Megawatt	Growth(-0,1%; 2040; -0,7%; 2070; -0,
Transformation	Electricity Generation	Processes\Combustion	Maximum Availability	Discount	%	Percent	85
Transformation	Electricity Generation	Processes\Combustion	Historical Production	Discount		Megawatt-Hour	5083464
Transformation	Electricity Generation	Processes\Combustion	Efficiency	Discount	%	Efficiency	Smooth(2040; 58,5; 2070; 59; 2100; 6
Transformation	Electricity Generation	Processes\Combustion	Process Shares	Convenience	%	Share	90,73
Transformation	Electricity Generation	Processes\Combustion	Merit Order	Convenience		Percent	1
Transformation	Electricity Generation	Processes\Combustion	Exogenous Capacity	Convenience		Megawatt	Growth(-0,2%; 2040; -0,5%; 2070; -0,
Transformation	Electricity Generation	Processes\Combustion	Maximum Availability	Convenience	%	Percent	85
Transformation	Electricity Generation	Processes\Combustion	Historical Production	Convenience		Megawatt-Hour	5083464
Transformation	Electricity Generation	Processes\Combustion	Efficiency	Convenience	%	Efficiency	Smooth(2040; 58,5; 2070; 59; 2100; 6
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Current Accounts		Percent	65
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Best Buy		Percent	65
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Discount		Percent	65
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Convenience		Percent	65
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule 15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule 15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule 15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule 15,3 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule 20
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule 20
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule 20
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule 20
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule 1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule 1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Discount		Kilogramme	Terajoule 1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule 1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Current Accounts		Kilogramme	Terajoule 5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Best Buy		Kilogramme	Terajoule 5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Discount		Kilogramme	Terajoule 5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Convenience		Kilogramme	Terajoule 5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule 150
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule 150
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule 150
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule 150
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule 0,1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule 0,1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule 0,1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule 0,1
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme 0
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme 0
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme 0

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme	0
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Current Accounts		Percent		35
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Best Buy		Percent		35
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Discount		Percent		35
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Convenience		Percent		35
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	15
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Discount		Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule	3
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Current Accounts		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Best Buy		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Discount		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Convenience		Kilogramme	Terajoule	5
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule	200
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule	0,6
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Electricity Generation	Processes\Hydro	Process Shares	Current Accounts	%	Share		7,68
Transformation	Electricity Generation	Processes\Hydro	Merit Order	Current Accounts		Percent		1
Transformation	Electricity Generation	Processes\Hydro	First Simulation Year	Current Accounts		Year		2005
Transformation	Electricity Generation	Processes\Hydro	Exogenous Capacity	Current Accounts		Megawatt		121,7
Transformation	Electricity Generation	Processes\Hydro	Maximum Availability	Current Accounts	%	Percent		70
Transformation	Electricity Generation	Processes\Hydro	Historical Production	Current Accounts		Megawatt-Hour		430506
Transformation	Electricity Generation	Processes\Hydro	Efficiency	Current Accounts	%	Efficiency		90
Transformation	Electricity Generation	Processes\Hydro	Process Shares	Best Buy	%	Share		7,68
Transformation	Electricity Generation	Processes\Hydro	Merit Order	Best Buy		Percent		1
Transformation	Electricity Generation	Processes\Hydro	Exogenous Capacity	Best Buy		Megawatt		Smooth(2040; 180; 2070; 250; 2100;
Transformation	Electricity Generation	Processes\Hydro	Maximum Availability	Best Buy	%	Percent		70
Transformation	Electricity Generation	Processes\Hydro	Historical Production	Best Buy		Megawatt-Hour		430506
Transformation	Electricity Generation	Processes\Hydro	Efficiency	Best Buy	%	Efficiency		Interp(2040; 93; 2070;94; 2100;95)
Transformation	Electricity Generation	Processes\Hydro	Process Shares	Discount	%	Share		7,68
Transformation	Electricity Generation	Processes\Hydro	Merit Order	Discount		Percent		1
Transformation	Electricity Generation	Processes\Hydro	Exogenous Capacity	Discount		Megawatt		Smooth(2040; 140; 2070; 160; 2100;
Transformation	Electricity Generation	Processes\Hydro	Maximum Availability	Discount	%	Percent		70
Transformation	Electricity Generation	Processes\Hydro	Historical Production	Discount		Megawatt-Hour		430506
Transformation	Electricity Generation	Processes\Hydro	Efficiency	Discount	%	Efficiency		Smooth(2040; 92; 2070; 93; 2100; 94
Transformation	Electricity Generation	Processes\Hydro	Process Shares	Convenience	%	Share		7,68
Transformation	Electricity Generation	Processes\Hydro	Merit Order	Convenience		Percent		1
Transformation	Electricity Generation	Processes\Hydro	Exogenous Capacity	Convenience		Megawatt		Smooth(2040; 160; 2070; 180; 2100;
Transformation	Electricity Generation	Processes\Hydro	Maximum Availability	Convenience	%	Percent		70

Transformation	Electricity Generation	Processes\Hydro	Historical Production	Convenience		Megawatt-Hour		430506
Transformation	Electricity Generation	Processes\Hydro	Efficiency	Convenience	%	Efficiency		Smooth(2040; 92; 2070; 94; 2100; 95
Transformation	Electricity Generation	Processes\Hydro\Feedstock Fuels\Hydro	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Electricity Generation	Processes\Hydro\Feedstock Fuels\Hydro	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Electricity Generation	Processes\Hydro\Feedstock Fuels\Hydro	Feedstock Fuel Share	Discount		Percent		100
Transformation	Electricity Generation	Processes\Hydro\Feedstock Fuels\Hydro	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Process Shares	Current Accounts	%	Share		0,21
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Merit Order	Current Accounts		Percent		1
Transformation	Electricity Generation	Processes\Municipal Solid Waste	First Simulation Year	Current Accounts		Year		2005
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Current Accounts		Megawatt		3,16
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Maximum Availability	Current Accounts	%	Percent		80
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Historical Production	Current Accounts		Megawatt-Hour		11616
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Efficiency	Current Accounts	%	Efficiency		45
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Process Shares	Best Buy	%	Share		0,21
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Merit Order	Best Buy		Percent		1
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Best Buy		Megawatt		Growth(1%; 2040; 1,3%; 2070; 1,4%)
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Maximum Availability	Best Buy	%	Percent		80
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Historical Production	Best Buy		Megawatt-Hour		11616
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Efficiency	Best Buy	%	Efficiency		Interp(2040; 50; 2070;60; 2100;70)
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Process Shares	Discount	%	Share		0,21
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Merit Order	Discount		Percent		1
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Discount		Megawatt		Growth(1,1%; 2040; 1,2%; 2070; 1,1%
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Maximum Availability	Discount	%	Percent		80
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Historical Production	Discount		Megawatt-Hour		11616
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Efficiency	Discount	%	Efficiency		Smooth(2040; 46; 2070; 48; 2100; 50
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Process Shares	Convenience	%	Share		0,21
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Merit Order	Convenience		Percent		1
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Convenience		Megawatt		Growth(1%; 2040; 1,2%; 2070; 1,3%)
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Maximum Availability	Convenience	%	Percent		80
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Historical Production	Convenience		Megawatt-Hour		11616
Transformation	Electricity Generation	Processes\Municipal Solid Waste	Efficiency	Convenience	%	Efficiency		Smooth(2040; 46; 2070; 48; 2100; 50
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Discount		Percent		100
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Best Buy		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Discount		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Convenience		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	22
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	22
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	22
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	22
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides N	Environmental Loading	Current Accounts		Kilogramme	Terajoule	170
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides N	Environmental Loading	Best Buy		Kilogramme	Terajoule	170
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides N	Environmental Loading	Discount		Kilogramme	Terajoule	170
Transformation	Electricity Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides N	Environmental Loading	Convenience		Kilogramme	Terajoule	170
Transformation	Electricity Generation	Processes\Other	Process Shares	Current Accounts	%	Share		0,04
Transformation	Electricity Generation	Processes\Other	Merit Order	Current Accounts		Percent		1
Transformation	Electricity Generation	Processes\Other	First Simulation Year	Current Accounts		Year		2005
Transformation	Electricity Generation	Processes\Other	Exogenous Capacity	Current Accounts		Megawatt		0,6
Transformation	Electricity Generation	Processes\Other	Maximum Availability	Current Accounts	%	Percent		75
Transformation	Electricity Generation	Processes\Other	Historical Production	Current Accounts		Megawatt-Hour		2207
Transformation	Electricity Generation	Processes\Other	Efficiency	Current Accounts	%	Efficiency		45
Transformation	Electricity Generation	Processes\Other	Process Shares	Best Buy	%	Share		0,04
Transformation	Electricity Generation	Processes\Other	Merit Order	Best Buy		Percent		1
Transformation	Electricity Generation	Processes\Other	Exogenous Capacity	Best Buy		Megawatt		Growth(1,8%; 2040; 2,3%; 2070; 2,1%

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Electricity Generation	Processes\Other	Maximum Availability	Best Buy	%	Percent		75
Transformation	Electricity Generation	Processes\Other	Historical Production	Best Buy		Megawatt-Hour		2207
Transformation	Electricity Generation	Processes\Other	Efficiency	Best Buy	%	Efficiency		Interp(2040; 50; 2070;60; 2100;70)
Transformation	Electricity Generation	Processes\Other	Process Shares	Discount	%	Share		0,04
Transformation	Electricity Generation	Processes\Other	Merit Order	Discount		Percent		1
Transformation	Electricity Generation	Processes\Other	Exogenous Capacity	Discount		Megawatt		Growth(0,5%; 2040; 0,4%; 2070; 0,3
Transformation	Electricity Generation	Processes\Other	Maximum Availability	Discount	%	Percent		75
Transformation	Electricity Generation	Processes\Other	Historical Production	Discount		Megawatt-Hour		2207
Transformation	Electricity Generation	Processes\Other	Efficiency	Discount	%	Efficiency		Smooth(2040; 47; 2070; 49; 2100; 52
Transformation	Electricity Generation	Processes\Other	Process Shares	Convenience	%	Share		0,04
Transformation	Electricity Generation	Processes\Other	Merit Order	Convenience		Percent		1
Transformation	Electricity Generation	Processes\Other	Exogenous Capacity	Convenience		Megawatt		Growth(0,2%; 2040; 0,5%; 2070; 0,4
Transformation	Electricity Generation	Processes\Other	Maximum Availability	Convenience	%	Percent		75
Transformation	Electricity Generation	Processes\Other	Historical Production	Convenience		Megawatt-Hour		2207
Transformation	Electricity Generation	Processes\Other	Efficiency	Convenience	%	Efficiency		Smooth(2040; 50; 2070; 60; 2100; 65
Transformation	Electricity Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Electricity Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Electricity Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Discount		Percent		100
Transformation	Electricity Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Electricity Generation	Processes\Solar	Process Shares	Current Accounts	%	Share		0
Transformation	Electricity Generation	Processes\Solar	Merit Order	Current Accounts		Percent		1
Transformation	Electricity Generation	Processes\Solar	First Simulation Year	Current Accounts		Year		2005
Transformation	Electricity Generation	Processes\Solar	Exogenous Capacity	Current Accounts		Megawatt		0
Transformation	Electricity Generation	Processes\Solar	Maximum Availability	Current Accounts	%	Percent		30
Transformation	Electricity Generation	Processes\Solar	Historical Production	Current Accounts		Megawatt-Hour		0
Transformation	Electricity Generation	Processes\Solar	Efficiency	Current Accounts	%	Efficiency		10
Transformation	Electricity Generation	Processes\Solar	Process Shares	Best Buy	%	Share		0
Transformation	Electricity Generation	Processes\Solar	Merit Order	Best Buy		Percent		1
Transformation	Electricity Generation	Processes\Solar	Exogenous Capacity	Best Buy		Megawatt		Smooth(2040; 170; 2070; 350; 2100;
Transformation	Electricity Generation	Processes\Solar	Maximum Availability	Best Buy	%	Percent		Interp(2100; 50)
Transformation	Electricity Generation	Processes\Solar	Historical Production	Best Buy		Megawatt-Hour		0
Transformation	Electricity Generation	Processes\Solar	Efficiency	Best Buy	%	Efficiency		Interp(2040; 30; 2070;50; 2100;60)
Transformation	Electricity Generation	Processes\Solar	Process Shares	Discount	%	Share		0
Transformation	Electricity Generation	Processes\Solar	Merit Order	Discount		Percent		1
Transformation	Electricity Generation	Processes\Solar	Exogenous Capacity	Discount		Megawatt		Smooth(2040; 50; 2070; 80; 2100; 15
Transformation	Electricity Generation	Processes\Solar	Maximum Availability	Discount	%	Percent		Interp(2100; 35)
Transformation	Electricity Generation	Processes\Solar	Historical Production	Discount		Megawatt-Hour		0
Transformation	Electricity Generation	Processes\Solar	Efficiency	Discount	%	Efficiency		Smooth(2040; 15; 2070; 20; 2100; 30
Transformation	Electricity Generation	Processes\Solar	Process Shares	Convenience	%	Share		0
Transformation	Electricity Generation	Processes\Solar	Merit Order	Convenience		Percent		1
Transformation	Electricity Generation	Processes\Solar	Exogenous Capacity	Convenience		Megawatt		Smooth(2040; 100; 2070; 160; 2100;
Transformation	Electricity Generation	Processes\Solar	Maximum Availability	Convenience	%	Percent		Interp(2100; 45)
Transformation	Electricity Generation	Processes\Solar	Historical Production	Convenience		Megawatt-Hour		0
Transformation	Electricity Generation	Processes\Solar	Efficiency	Convenience	%	Efficiency		Smooth(2040; 15; 2070; 35; 2100; 50
Transformation	Electricity Generation	Processes\Solar\Feedstock Fuels\Solar	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Electricity Generation	Processes\Solar\Feedstock Fuels\Solar	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Electricity Generation	Processes\Solar\Feedstock Fuels\Solar	Feedstock Fuel Share	Discount		Percent		100
Transformation	Electricity Generation	Processes\Solar\Feedstock Fuels\Solar	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Electricity Generation	Processes\Wind	Process Shares	Current Accounts	%	Share		0,83
Transformation	Electricity Generation	Processes\Wind	Merit Order	Current Accounts		Percent		1
Transformation	Electricity Generation	Processes\Wind	First Simulation Year	Current Accounts		Year		2005
Transformation	Electricity Generation	Processes\Wind	Exogenous Capacity	Current Accounts		Megawatt		12,6
Transformation	Electricity Generation	Processes\Wind	Maximum Availability	Current Accounts	%	Percent		30
Transformation	Electricity Generation	Processes\Wind	Historical Production	Current Accounts		Megawatt-Hour		46678
Transformation	Electricity Generation	Processes\Wind	Efficiency	Current Accounts	%	Efficiency		50
Transformation	Electricity Generation	Processes\Wind	Process Shares	Best Buy	%	Share		0,83

Transformation	Electricity Generation	Processes\Wind	Merit Order	Best Buy		Percent		1
Transformation	Electricity Generation	Processes\Wind	Exogenous Capacity	Best Buy		Megawatt		Smooth(2040; 60; 2070; 200; 2100; 2
Transformation	Electricity Generation	Processes\Wind	Maximum Availability	Best Buy	%	Percent		Interp(2100; 50)
Transformation	Electricity Generation	Processes\Wind	Historical Production	Best Buy		Megawatt-Hour		46678
Transformation	Electricity Generation	Processes\Wind	Efficiency	Best Buy	%	Efficiency		Interp(2040; 59; 2070;59; 2100;59)
Transformation	Electricity Generation	Processes\Wind	Process Shares	Discount	%	Share		0,83
Transformation	Electricity Generation	Processes\Wind	Merit Order	Discount		Percent		1
Transformation	Electricity Generation	Processes\Wind	Exogenous Capacity	Discount		Megawatt		Smooth(2040; 30; 2070; 50; 2100; 80
Transformation	Electricity Generation	Processes\Wind	Maximum Availability	Discount	%	Percent		Interp(2100; 35)
Transformation	Electricity Generation	Processes\Wind	Historical Production	Discount		Megawatt-Hour		46678
Transformation	Electricity Generation	Processes\Wind	Efficiency	Discount	%	Efficiency		Smooth(2040; 52; 2070; 53; 2100; 54
Transformation	Electricity Generation	Processes\Wind	Process Shares	Convenience	%	Share		0,83
Transformation	Electricity Generation	Processes\Wind	Merit Order	Convenience		Percent		1
Transformation	Electricity Generation	Processes\Wind	Exogenous Capacity	Convenience		Megawatt		Smooth(2040; 60; 2070; 120; 2100; 2
Transformation	Electricity Generation	Processes\Wind	Maximum Availability	Convenience	%	Percent		Interp(2100; 45)
Transformation	Electricity Generation	Processes\Wind	Historical Production	Convenience		Megawatt-Hour		46678
Transformation	Electricity Generation	Processes\Wind	Efficiency	Convenience	%	Efficiency		Smooth(2040; 54; 2070; 57; 2100; 59
Transformation	Electricity Generation	Processes\Wind\Feedstock Fuels\Wind	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Electricity Generation	Processes\Wind\Feedstock Fuels\Wind	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Electricity Generation	Processes\Wind\Feedstock Fuels\Wind	Feedstock Fuel Share	Discount		Percent		100
Transformation	Electricity Generation	Processes\Wind\Feedstock Fuels\Wind	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Heat Generation	Output Fuels\Heat	Output Share	Current Accounts	%	Share		100
Transformation	Heat Generation	Output Fuels\Heat	Output Share	Best Buy	%	Share		100
Transformation	Heat Generation	Output Fuels\Heat	Output Share	Discount	%	Share		100
Transformation	Heat Generation	Output Fuels\Heat	Output Share	Convenience	%	Share		100
Transformation	Heat Generation	Processes\Biomass	Process Shares	Current Accounts	%	Share		0,68
Transformation	Heat Generation	Processes\Biomass	Merit Order	Current Accounts		Percent		1
Transformation	Heat Generation	Processes\Biomass	First Simulation Year	Current Accounts		Year		2005
Transformation	Heat Generation	Processes\Biomass	Exogenous Capacity	Current Accounts		Megawatt		19,8
Transformation	Heat Generation	Processes\Biomass	Maximum Availability	Current Accounts	%	Percent		50
Transformation	Heat Generation	Processes\Biomass	Historical Production	Current Accounts		Megawatt-Hour		38308
Transformation	Heat Generation	Processes\Biomass	Efficiency	Current Accounts	%	Efficiency		70
Transformation	Heat Generation	Processes\Biomass	Process Shares	Best Buy	%	Share		0,68
Transformation	Heat Generation	Processes\Biomass	Merit Order	Best Buy		Percent		1
Transformation	Heat Generation	Processes\Biomass	Exogenous Capacity	Best Buy		Megawatt		Growth(6%; 2040; 4%; 2070; 1,5%)
Transformation	Heat Generation	Processes\Biomass	Maximum Availability	Best Buy	%	Percent		50
Transformation	Heat Generation	Processes\Biomass	Historical Production	Best Buy		Megawatt-Hour		38308
Transformation	Heat Generation	Processes\Biomass	Efficiency	Best Buy	%	Efficiency		Interp(2040; 80; 2070; 85; 2100; 90)
Transformation	Heat Generation	Processes\Biomass	Process Shares	Discount	%	Share		0,68
Transformation	Heat Generation	Processes\Biomass	Merit Order	Discount		Percent		1
Transformation	Heat Generation	Processes\Biomass	Exogenous Capacity	Discount		Megawatt		Growth(2,5%; 2040;1,8%; 2070; 1,5%
Transformation	Heat Generation	Processes\Biomass	Maximum Availability	Discount	%	Percent		50
Transformation	Heat Generation	Processes\Biomass	Historical Production	Discount		Megawatt-Hour		38308
Transformation	Heat Generation	Processes\Biomass	Efficiency	Discount	%	Efficiency		Smooth(2040; 73; 2070; 77; 2100; 80
Transformation	Heat Generation	Processes\Biomass	Process Shares	Convenience	%	Share		0,68
Transformation	Heat Generation	Processes\Biomass	Merit Order	Convenience		Percent		1
Transformation	Heat Generation	Processes\Biomass	Exogenous Capacity	Convenience		Megawatt		Growth(4%; 2040; 3,2%; 2070; 3%)
Transformation	Heat Generation	Processes\Biomass	Maximum Availability	Convenience	%	Percent		50
Transformation	Heat Generation	Processes\Biomass	Historical Production	Convenience		Megawatt-Hour		38308
Transformation	Heat Generation	Processes\Biomass	Efficiency	Convenience	%	Efficiency		Smooth(2040; 75; 2070; 80; 2100; 85
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Discount		Percent		100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Dioxide Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	29,9 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	1000
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	1000
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	1000
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	1000
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	30
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	30
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Discount		Kilogramme	Terajoule	30
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule	30
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Current Accounts		Kilogramme	Terajoule	50
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Best Buy		Kilogramme	Terajoule	50
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Discount		Kilogramme	Terajoule	50
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Non Methane Volatile Organic Compounds	Environmental Loading	Convenience		Kilogramme	Terajoule	50
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule	100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule	100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule	100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule	100
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	4
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	4
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule	4
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule	4
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Biomass\Feedstock Fuels\Biomass\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Cogeneration	Process Shares	Current Accounts	%	Share		65,53
Transformation	Heat Generation	Processes\Cogeneration	Merit Order	Current Accounts		Percent		1
Transformation	Heat Generation	Processes\Cogeneration	First Simulation Year	Current Accounts		Year		2005
Transformation	Heat Generation	Processes\Cogeneration	Exogenous Capacity	Current Accounts		Megawatt		1937,6
Transformation	Heat Generation	Processes\Cogeneration	Maximum Availability	Current Accounts	%	Percent		85
Transformation	Heat Generation	Processes\Cogeneration	Historical Production	Current Accounts		Megawatt-Hour		3715299
Transformation	Heat Generation	Processes\Cogeneration	Efficiency	Current Accounts	%	Efficiency		80
Transformation	Heat Generation	Processes\Cogeneration	Process Shares	Best Buy	%	Share		65,53
Transformation	Heat Generation	Processes\Cogeneration	Merit Order	Best Buy		Percent		1
Transformation	Heat Generation	Processes\Cogeneration	Exogenous Capacity	Best Buy		Megawatt		Growth(-1%; 2040; -1,5%; 2070; -1%
Transformation	Heat Generation	Processes\Cogeneration	Maximum Availability	Best Buy	%	Percent		85
Transformation	Heat Generation	Processes\Cogeneration	Historical Production	Best Buy		Megawatt-Hour		3715299
Transformation	Heat Generation	Processes\Cogeneration	Efficiency	Best Buy	%	Efficiency		Interp(2040; 90; 2070; 92; 2100;94)
Transformation	Heat Generation	Processes\Cogeneration	Process Shares	Discount	%	Share		65,53
Transformation	Heat Generation	Processes\Cogeneration	Merit Order	Discount		Percent		1
Transformation	Heat Generation	Processes\Cogeneration	Exogenous Capacity	Discount		Megawatt		Growth(1,2%; 2040; 0,6%; 2070; 0,4
Transformation	Heat Generation	Processes\Cogeneration	Maximum Availability	Discount	%	Percent		85
Transformation	Heat Generation	Processes\Cogeneration	Historical Production	Discount		Megawatt-Hour		3715299
Transformation	Heat Generation	Processes\Cogeneration	Efficiency	Discount	%	Efficiency		Smooth(2040; 87; 2070; 89; 2100; 90
Transformation	Heat Generation	Processes\Cogeneration	Process Shares	Convenience	%	Share		65,53
Transformation	Heat Generation	Processes\Cogeneration	Merit Order	Convenience		Percent		1
Transformation	Heat Generation	Processes\Cogeneration	Exogenous Capacity	Convenience		Megawatt		Growth(1%; 2040; 0,8%; 2070; 0,2%)
Transformation	Heat Generation	Processes\Cogeneration	Maximum Availability	Convenience	%	Percent		85
Transformation	Heat Generation	Processes\Cogeneration	Historical Production	Convenience		Megawatt-Hour		3715299
Transformation	Heat Generation	Processes\Cogeneration	Efficiency	Convenience	%	Efficiency		Smooth(2040; 87; 2070; 90; 2100; 92
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Current Accounts		Percent		50
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Best Buy		Percent		Interp(2100; 40)
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Discount		Percent		50
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Convenience		Percent		Interp(2100; 45)
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Current Accounts		Percent		10
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Best Buy		Percent		Interp(2100; 0)

Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Discount		Percent		10
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Oil	Feedstock Fuel Share	Convenience		Percent		Interp(2100; 5)
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Current Accounts		Percent		10
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Best Buy		Percent		Interp(2100; 0)
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Discount		Percent		10
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Coal Bituminous	Feedstock Fuel Share	Convenience		Percent		Interp(2100; 5)
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Current Accounts		Percent		30
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Best Buy		Percent		Interp(2100; 60)
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Discount		Percent		30
Transformation	Heat Generation	Processes\Cogeneration\Feedstock Fuels\Biomass	Feedstock Fuel Share	Convenience		Percent		Interp(2100;45)
Transformation	Heat Generation	Processes\Combustion	Process Shares	Current Accounts	%	Share		7,79
Transformation	Heat Generation	Processes\Combustion	Merit Order	Current Accounts		Percent		1
Transformation	Heat Generation	Processes\Combustion	First Simulation Year	Current Accounts		Year		2005
Transformation	Heat Generation	Processes\Combustion	Exogenous Capacity	Current Accounts		Megawatt		231,1
Transformation	Heat Generation	Processes\Combustion	Maximum Availability	Current Accounts	%	Percent		85
Transformation	Heat Generation	Processes\Combustion	Historical Production	Current Accounts		Megawatt-Hour		441416
Transformation	Heat Generation	Processes\Combustion	Efficiency	Current Accounts	%	Efficiency		90
Transformation	Heat Generation	Processes\Combustion	Process Shares	Best Buy	%	Share		7,79
Transformation	Heat Generation	Processes\Combustion	Merit Order	Best Buy		Percent		1
Transformation	Heat Generation	Processes\Combustion	Exogenous Capacity	Best Buy		Megawatt		Growth(-2%; 2040; -1,5%; 2070; -0,5
Transformation	Heat Generation	Processes\Combustion	Maximum Availability	Best Buy	%	Percent		85
Transformation	Heat Generation	Processes\Combustion	Historical Production	Best Buy		Megawatt-Hour		441416
Transformation	Heat Generation	Processes\Combustion	Efficiency	Best Buy	%	Efficiency		Interp(2100;95)
Transformation	Heat Generation	Processes\Combustion	Process Shares	Discount	%	Share		7,79
Transformation	Heat Generation	Processes\Combustion	Merit Order	Discount		Percent		1
Transformation	Heat Generation	Processes\Combustion	Exogenous Capacity	Discount		Megawatt		Growth(0,7%; 2040; -0,5%; 2070; -0,
Transformation	Heat Generation	Processes\Combustion	Maximum Availability	Discount	%	Percent		85
Transformation	Heat Generation	Processes\Combustion	Historical Production	Discount		Megawatt-Hour		441416
Transformation	Heat Generation	Processes\Combustion	Efficiency	Discount	%	Efficiency		90
Transformation	Heat Generation	Processes\Combustion	Process Shares	Convenience	%	Share		7,79
Transformation	Heat Generation	Processes\Combustion	Merit Order	Convenience		Percent		1
Transformation	Heat Generation	Processes\Combustion	Exogenous Capacity	Convenience		Megawatt		Growth(0,9%; 2040; -0,3%; 2070; -0,
Transformation	Heat Generation	Processes\Combustion	Maximum Availability	Convenience	%	Percent		85
Transformation	Heat Generation	Processes\Combustion	Historical Production	Convenience		Megawatt-Hour		441416
Transformation	Heat Generation	Processes\Combustion	Efficiency	Convenience	%	Efficiency		Interp(2100; 95)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Current Accounts		Percent		65
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Best Buy		Percent		65
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Discount		Percent		65
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas	Feedstock Fuel Share	Convenience		Percent		65
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Dioxide Non Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	15,3 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	20
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	20
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	20
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	20
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Discount		Kilogramme	Terajoule	1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule	1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Current Accounts		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Best Buy		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Discount		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Non Methane Volatile Organic Compo	Environmental Loading	Convenience		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule	150
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule	150

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule	150
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule	150
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	0,1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	0,1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule	0,1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule	0,1
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	0
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme	0
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme	0
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Natural Gas\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme	0
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Current Accounts		Percent		35
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Best Buy		Percent		35
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Discount		Percent		35
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil	Feedstock Fuel Share	Convenience		Percent		35
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Current Accounts		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Best Buy		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Discount		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Dioxide Non Biogenic	Environmental Loading	Convenience		Metric Tonne	Terajoule	20 * fractionoxidized * (co2/c)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	15
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	15
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	15
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	15
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Current Accounts		Kilogramme	Terajoule	3
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Best Buy		Kilogramme	Terajoule	3
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Discount		Kilogramme	Terajoule	3
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Methane	Environmental Loading	Convenience		Kilogramme	Terajoule	3
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Current Accounts		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Best Buy		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Discount		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Non Methane Volatile Organic Compounds	Environmental Loading	Convenience		Kilogramme	Terajoule	5
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Current Accounts		Kilogramme	Terajoule	200
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Best Buy		Kilogramme	Terajoule	200
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Discount		Kilogramme	Terajoule	200
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrogen Oxides NOx	Environmental Loading	Convenience		Kilogramme	Terajoule	200
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	0,6
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	0,6
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Discount		Kilogramme	Terajoule	0,6
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Nitrous Oxide	Environmental Loading	Convenience		Kilogramme	Terajoule	0,6
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Best Buy		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Discount		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Combustion\Feedstock Fuels\Oil\Sulfur Dioxide	Environmental Loading	Convenience		Kilogramme	Kilogramme	sulfurcontent*(1-sulfurretention)*(so2/s)
Transformation	Heat Generation	Processes\Geothermal	Process Shares	Current Accounts	%	Share		0
Transformation	Heat Generation	Processes\Geothermal	Merit Order	Current Accounts		Percent		1
Transformation	Heat Generation	Processes\Geothermal	First Simulation Year	Current Accounts		Year		2005
Transformation	Heat Generation	Processes\Geothermal	Exogenous Capacity	Current Accounts		Megawatt		0
Transformation	Heat Generation	Processes\Geothermal	Maximum Availability	Current Accounts	%	Percent		80
Transformation	Heat Generation	Processes\Geothermal	Historical Production	Current Accounts		Megawatt-Hour		0
Transformation	Heat Generation	Processes\Geothermal	Efficiency	Current Accounts	%	Efficiency		95
Transformation	Heat Generation	Processes\Geothermal	Process Shares	Best Buy	%	Share		0
Transformation	Heat Generation	Processes\Geothermal	Merit Order	Best Buy		Percent		1
Transformation	Heat Generation	Processes\Geothermal	Exogenous Capacity	Best Buy		Megawatt		Smooth(2040; 300; 2070; 600; 2100;
Transformation	Heat Generation	Processes\Geothermal	Maximum Availability	Best Buy	%	Percent		Interp(2100; 90)
Transformation	Heat Generation	Processes\Geothermal	Historical Production	Best Buy		Megawatt-Hour		0
Transformation	Heat Generation	Processes\Geothermal	Efficiency	Best Buy	%	Efficiency		95
Transformation	Heat Generation	Processes\Geothermal	Process Shares	Discount	%	Share		0

Transformation	Heat Generation	Processes\Geothermal	Merit Order	Discount		Percent		1
Transformation	Heat Generation	Processes\Geothermal	Exogenous Capacity	Discount		Megawatt		Smooth(2040; 50; 2070; 80; 2100; 13
Transformation	Heat Generation	Processes\Geothermal	Maximum Availability	Discount	%	Percent		80
Transformation	Heat Generation	Processes\Geothermal	Historical Production	Discount		Megawatt-Hour		0
Transformation	Heat Generation	Processes\Geothermal	Efficiency	Discount	%	Efficiency		95
Transformation	Heat Generation	Processes\Geothermal	Process Shares	Convenience	%	Share		0
Transformation	Heat Generation	Processes\Geothermal	Merit Order	Convenience		Percent		1
Transformation	Heat Generation	Processes\Geothermal	Exogenous Capacity	Convenience		Megawatt		Smooth(2040; 100; 2070; 200; 2100;
Transformation	Heat Generation	Processes\Geothermal	Maximum Availability	Convenience	%	Percent		Interp(2100; 85)
Transformation	Heat Generation	Processes\Geothermal	Historical Production	Convenience		Megawatt-Hour		0
Transformation	Heat Generation	Processes\Geothermal	Efficiency	Convenience	%	Efficiency		95
Transformation	Heat Generation	Processes\Geothermal\Feedstock Fuels\Geothermal	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Heat Generation	Processes\Geothermal\Feedstock Fuels\Geothermal	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Heat Generation	Processes\Geothermal\Feedstock Fuels\Geothermal	Feedstock Fuel Share	Discount		Percent		100
Transformation	Heat Generation	Processes\Geothermal\Feedstock Fuels\Geothermal	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Heat Generation	Processes\Municipal Solid Waste	Process Shares	Current Accounts	%	Share		24,31
Transformation	Heat Generation	Processes\Municipal Solid Waste	Merit Order	Current Accounts		Percent		1
Transformation	Heat Generation	Processes\Municipal Solid Waste	First Simulation Year	Current Accounts		Year		2005
Transformation	Heat Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Current Accounts		Megawatt		718,8
Transformation	Heat Generation	Processes\Municipal Solid Waste	Maximum Availability	Current Accounts	%	Percent		80
Transformation	Heat Generation	Processes\Municipal Solid Waste	Historical Production	Current Accounts		Megawatt-Hour		1378149
Transformation	Heat Generation	Processes\Municipal Solid Waste	Efficiency	Current Accounts	%	Efficiency		45
Transformation	Heat Generation	Processes\Municipal Solid Waste	Process Shares	Best Buy	%	Share		24,31
Transformation	Heat Generation	Processes\Municipal Solid Waste	Merit Order	Best Buy		Percent		1
Transformation	Heat Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Best Buy		Megawatt		Growth(0,8%; 2040; 0,4%; 2070; 0,3%
Transformation	Heat Generation	Processes\Municipal Solid Waste	Maximum Availability	Best Buy	%	Percent		80
Transformation	Heat Generation	Processes\Municipal Solid Waste	Historical Production	Best Buy		Megawatt-Hour		1378149
Transformation	Heat Generation	Processes\Municipal Solid Waste	Efficiency	Best Buy	%	Efficiency		Interp(2040; 50; 2070;60; 2100;70)
Transformation	Heat Generation	Processes\Municipal Solid Waste	Process Shares	Discount	%	Share		24,31
Transformation	Heat Generation	Processes\Municipal Solid Waste	Merit Order	Discount		Percent		1
Transformation	Heat Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Discount		Megawatt		Growth(1,1%; 2040; 1,2%; 2070; 1,3%
Transformation	Heat Generation	Processes\Municipal Solid Waste	Maximum Availability	Discount	%	Percent		80
Transformation	Heat Generation	Processes\Municipal Solid Waste	Historical Production	Discount		Megawatt-Hour		1378149
Transformation	Heat Generation	Processes\Municipal Solid Waste	Efficiency	Discount	%	Efficiency		Smooth(2040; 46; 2070; 48; 2100; 50
Transformation	Heat Generation	Processes\Municipal Solid Waste	Process Shares	Convenience	%	Share		24,31
Transformation	Heat Generation	Processes\Municipal Solid Waste	Merit Order	Convenience		Percent		1
Transformation	Heat Generation	Processes\Municipal Solid Waste	Exogenous Capacity	Convenience		Megawatt		Growth(1%; 2040; 0,2%; 2070; 0,3%)
Transformation	Heat Generation	Processes\Municipal Solid Waste	Maximum Availability	Convenience	%	Percent		80
Transformation	Heat Generation	Processes\Municipal Solid Waste	Historical Production	Convenience		Megawatt-Hour		1378149
Transformation	Heat Generation	Processes\Municipal Solid Waste	Efficiency	Convenience	%	Efficiency		Smooth(2040; 50; 2070; 60; 2100; 65
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Discount		Percent		100
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste	Feedstock Fuel Share	Convenience		Percent		100
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Current Accounts		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Best Buy		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Discount		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Dioxide B	Environmental Loading	Convenience		Kilogramme	Kilogramme	carboncontent*fractionoxidized*(co2/c)
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Current Accounts		Kilogramme	Terajoule	22
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Best Buy		Kilogramme	Terajoule	22
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Discount		Kilogramme	Terajoule	22
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Carbon Monoxide	Environmental Loading	Convenience		Kilogramme	Terajoule	22
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides	Environmental Loading	Current Accounts		Kilogramme	Terajoule	170
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides	Environmental Loading	Best Buy		Kilogramme	Terajoule	170
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides	Environmental Loading	Discount		Kilogramme	Terajoule	170
Transformation	Heat Generation	Processes\Municipal Solid Waste\Feedstock Fuels\Municipal Solid Waste\Nitrogen Oxides	Environmental Loading	Convenience		Kilogramme	Terajoule	170
Transformation	Heat Generation	Processes\Other	Process Shares	Current Accounts	%	Share		1,7

Level 1	Level 3	Level 4...	Variable	Scenario	Scale	Units	Per...	Expression
Transformation	Heat Generation	Processes\Other	Merit Order	Current Accounts		Percent		1
Transformation	Heat Generation	Processes\Other	First Simulation Year	Current Accounts		Year		2005
Transformation	Heat Generation	Processes\Other	Exogenous Capacity	Current Accounts		Megawatt		43,4
Transformation	Heat Generation	Processes\Other	Maximum Availability	Current Accounts	%	Percent		75
Transformation	Heat Generation	Processes\Other	Historical Production	Current Accounts		Megawatt-Hour		96100
Transformation	Heat Generation	Processes\Other	Efficiency	Current Accounts	%	Efficiency		45
Transformation	Heat Generation	Processes\Other	Process Shares	Best Buy	%	Share		1,7
Transformation	Heat Generation	Processes\Other	Merit Order	Best Buy		Percent		1
Transformation	Heat Generation	Processes\Other	Exogenous Capacity	Best Buy		Megawatt		Growth(0,5%; 2040; 0,4%; 2070; 0,4%
Transformation	Heat Generation	Processes\Other	Maximum Availability	Best Buy	%	Percent		75
Transformation	Heat Generation	Processes\Other	Historical Production	Best Buy		Megawatt-Hour		96100
Transformation	Heat Generation	Processes\Other	Efficiency	Best Buy	%	Efficiency		Interp(2040; 50; 2070;65; 2100;75)
Transformation	Heat Generation	Processes\Other	Process Shares	Discount	%	Share		1,7
Transformation	Heat Generation	Processes\Other	Merit Order	Discount		Percent		1
Transformation	Heat Generation	Processes\Other	Exogenous Capacity	Discount		Megawatt		Growth(0,5%; 2040; 0,4%; 2070; 0,3%
Transformation	Heat Generation	Processes\Other	Maximum Availability	Discount	%	Percent		75
Transformation	Heat Generation	Processes\Other	Historical Production	Discount		Megawatt-Hour		96100
Transformation	Heat Generation	Processes\Other	Efficiency	Discount	%	Efficiency		Smooth(2040; 46; 2070; 48; 2100; 50
Transformation	Heat Generation	Processes\Other	Process Shares	Convenience	%	Share		1,7
Transformation	Heat Generation	Processes\Other	Merit Order	Convenience		Percent		1
Transformation	Heat Generation	Processes\Other	Exogenous Capacity	Convenience		Megawatt		Growth(0,2%; 2040; 0,5%; 2070; 0,4%
Transformation	Heat Generation	Processes\Other	Maximum Availability	Convenience	%	Percent		75
Transformation	Heat Generation	Processes\Other	Historical Production	Convenience		Megawatt-Hour		96100
Transformation	Heat Generation	Processes\Other	Efficiency	Convenience	%	Efficiency		Smooth(2040; 50; 2070; 60; 2100; 65
Transformation	Heat Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Current Accounts		Percent		100
Transformation	Heat Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Best Buy		Percent		100
Transformation	Heat Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Discount		Percent		100
Transformation	Heat Generation	Processes\Other\Feedstock Fuels\Other	Feedstock Fuel Share	Convenience		Percent		100

List of Main Abbreviations and Acronyms

AEA	Austrian Energy Agency
ASPO	Association for the Study of Peak Oil and Gas
BMWA	Bundesministerium für Wirtschaft und Arbeit (Federal Ministry for Economy and Labor)
EIA	Energy Information Administration (US Dept. of Energy)
EVN	Energieversorgung Niederösterreich (Lower Austrian Energy Provider)
EWG	Energy Watch Group
FED	Final Energy Demand
HDD/ CDD	Heating Degree Day/ Cooling Degree Day
ICLEI	International Council for Local Environmental Initiatives
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
IPCC	Intergovernmental Panel on Climate Change
IRP	Integrated Resource Planning (Intergrierte Ressourcenplanung)
KliP	Klimaschutzporgramm der Stadt Wien (climate protection program of the city of Vienna)
LEAP	Long-range Energy Alternatives Planning
MA	Magistratsabteilung
NUTS	Nomenclature des unités territoriales statistiques
ÖROK	Österreichische Raumordnungskonferenz (Austrian Conference on Spatial Planning)
PED	Primary Energy Demand
PGO	Planungsgemeinschaft Ost (Spatial Planning Association for Eastern Austria)
REMO/UBA	Regionales Klimamodell/ Umweltbundesamt Berlin (regional climate model from the Federal Environmental Agency of Germany)
RSD	Regional Sustainable Development
SEI	Stockholm Environment Institute
SEP	Städtisches Energieeffizienzprogramm (Municipal Energy Efficiency Program)
SRES	Special Report on Emissions Scenarios
UHI	Urban Heat Island
WIFO	Österreichisches Insitut für Wirtschaftsforschung (Austrian Institute of Economic Research)
WMO	World Meteorological Association

Kerstin DAMERAU

Forsthausgasse 2-8/ 2836
1200 Wien/ Austria
+43 650 405 1223
kerstin.damerau@boku.ac.at

EDUCATION

10/2006-10/2008 — University of Vienna/ University of Natural Resources and Applied Life Sciences/ Austria
Studies of theoretical and applied geography
- Specialization in global change, further economic geography and hazard research
- Member of EGEA (European Geography Association), coordination of special events

09/2005-04/2006 — Università di Bologna/ Italy
Studies of geographical sciences
- Exchange student within the European Community program ERASMUS

09/2003-08/2005 — Rheinische Friedrich–Wilhelms-Universität Bonn/ Germany
Studies of geography, meteorology and political science
- Preliminary examinations for the diploma
- Student representative to the department student association
- Member of EGEA, coordination of special events

09/1995-06/2003 — Secondary school "Fridericianum", Rudolstadt/ Germany

EXPERIENCE

01-10/2008 — Freytag-Berndt u. Ataria KG, Vienna/ Austria
- Part-time job at the cartography department

03-09/2008 — University of Vienna/ Austria
- Tutor for economic geography

07-09/2006 — GENI Global Energy Network Institute, San Diego/ USA
- Internship with a non-profit organization

04/2001 — Meteomedia Deutschland GmbH, Bochum/ Germany
- Internship with a meteorological service

ADDITIONAL

I hold a state-approved certificate in project management. My language skills comprise German (mother tongue), English and Italian (fluently) as well as basic French.

Acknowledgements

First of all, I would like to thank my supervisor Prof. Helga Kromp-Kolb for all the help and support I got during this thesis. Without her the realization of this work had not been possible. Further I express my sincere appreciation to the whole team of the Institute of Meteorology, Department of Water, Atmosphere and Environment, University of Natural Resources and Applied Life Sciences, Vienna, Austria, as they welcomed me warmly and supported me during the last months, in particular I owe thanks to Dr. Herbert Formayer, Thomas Gerersdorfer and Dr. Patrick Haas who always offered advice and qualified support.

Special thanks go to Dr. Charlie Heaps from the SEI who provided great expert guidance and assistance. In addition, I would like to thank Elisabeth Stix and Alois Humer from ÖROK who were very helpful in providing information as well as Prof. Nakicenovic who gave his personal advice, further Prof. Fassmann, Dr. Lebhart and Marco Helbich for their support in demographic issues. They all have been helping to make my work not just productive but also a great experience.