



## **Urban energy planning in Eskilstuna**


### **[PLEEC Report D4.2 / Eskilstuna]**

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**Deliverable 4.2 / Eskilstuna**  
**Urban energy planning in Eskilstuna**

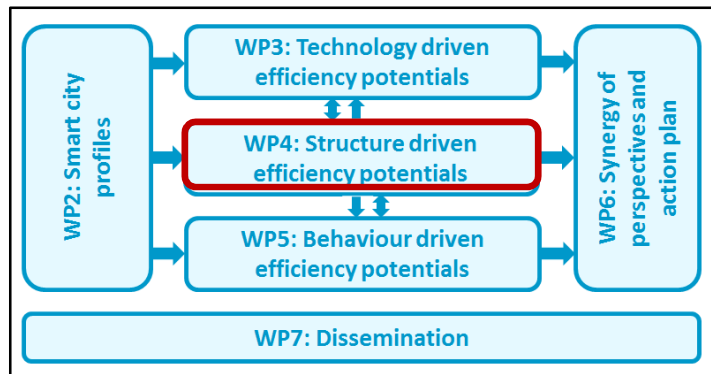
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## Abstract

### Main aim of report

The purpose of Deliverable 4.2 is to give an overview of urban energy planning in the 6 PLEEC partner cities. The 6 reports illustrate how cities deal with different challenges of the urban energy transformation from a structural perspective including issues of urban governance and spatial planning. The 6 reports will provide input for the following cross-thematic report (D4.3).



WP4 location in PLEEC project

### Target group

The main addressee is the WP4-team (universities and cities) who will work on the cross-thematic report (D4.3). The reports will also support a learning process between the cities. Further, they are relevant for a wider group of PLEEC partners to discuss the relationship between the three pillars (technology, structure, behaviour) in each of the cities.

### Main findings/conclusions

Eskilstuna has introduced energy and climate policies in most sectors, enterprise and planning. It thus offers an excellent study field.

Energy and climate policy is divided into *two policy arenas*: The arena of the municipality acting as a concern and the arena of the municipality acting as a stakeholder of energy initiatives towards the general public. The efficiency of the first is very high, due to an omnipresence of ‘sustainability thinking’. The total effect of the latter is, however, much larger, due to the size of the arena.

Principles of *urban development* are generally acknowledged as an important instrument for sustainability. Urban densification and urban connectivity to transport routes facilitated by public transport are the two main principles.

Policies of sustainability are of ‘*second-order*’ as compared to the economic driven changes of the urban system. A prime ‘*first-order*’ development is regional enlargement synonymous with increased transport. Second-order policies are modal split initiatives aiming at public rather than private transportation facilitated by infrastructure and infrastructure lead urban development.

The largest amount of energy consumption is in the sectors of transport, households and industry. *Potentials reduction of CO2 emissions vary*: Transportation depends on fossil fuels, difficult to cope with, whereas energy consumption in households is composed by a number of energy sources, including an increasing amount of renewables operated by large district heating plants as well as by individual house owners’ initiatives.

Thus, national measures are efficiently introduced in the conversion of district heating into renewables as well as conversion of the heating of single family dwellings using heat pumps and solar cells. Designing incentives to reduce fossil fuels in transport remains the key challenge.

At municipal level the consumption of *electricity* is of special concern. Only about 25% of electricity it is possible to produce by local combined power and district heating plants. Some small additional power may be provided locally by e.g. solar cells. But for the remaining part consumers are dependent upon national grids, i.e. power produced by energy sources that are beyond the control of the municipality.

### **Activities carried out including methodology used**

The 6 reports are based on workshops (Stoke-on-Trent, Turku), field work (interviews with stakeholders) in the cities, the analysis of local reports as well as close contact with our city partners. This is more described in the methodology chapter.

### **The PLEEC project**

Energy efficiency is high on the European agenda. One of the goals of the European Union's 20-20-20 plan is to improve energy efficiency by 20% in 2020. However, holistic knowledge about energy efficiency potentials in cities is far from complete. Currently, a variety of individual strategies and approaches by different stakeholders tackling separate key aspects hinders strategic energy efficiency planning.

For this reason, the PLEEC project – "Planning for Energy Efficient Cities" – funded by the EU Seventh Framework Programme uses an integrative approach to achieve the sustainable, energy-efficient, smart city. By coordinating strategies and combining best practices, PLEEC will develop a general model for energy efficiency and sustainable city planning. By connecting scientific excellence and innovative enterprises in the energy sector with ambitious and well-organized cities, the project aims to reduce energy use in Europe in the near future and will therefore be an important tool contributing to the EU's 20-20-20 targets.

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## 1 Introduction

This is one of six case-studies in the PLEEC project, the goal of which is to describe how cities deal with climate planning and strategies. In focus are relations between ‘the urban’ and energy and key climate measures. By ‘urban’, we mean the structure of the city, its density and the cohesion between the built environment and the infrastructure. Along with this, we examine relations between the city and other cities, i.e. the urban system in a regional context. Finally, we discuss urban issues concerned with managing a city’s infrastructure, its energy systems and services. Eskilstuna is very keen on distinguishing the action arenas of the municipality as an *enterprise* and as a *partner*. As an enterprise, the municipality is in full control of decisions, project and administration of municipal infrastructure and services. As a partner, the municipality tries to inform and persuade private companies, organizations and households to act in their own best interests on behalf of the climate. As we shall see, the distinction makes sense in understanding the number of different instruments needed as well as the diversity of efficiency of climate policies.

This case study was elaborated by the Copenhagen team, except for Chapter 8 on pilot projects and urban planning. This section illustrates how climate perspectives have been integrated into projects and development schemes. In order to allow for a comprehensive explanation of the climate intention behind the projects, Eskilstuna edited this section.

## 2 Methods

The case-study was elaborated in three tiers. First, a template on content was discussed between the researchers at the backdrop of the first data collected about the six cities. Second, a field trip to Eskilstuna was planned, beginning with discussions at the joint meeting in Turku March 25<sup>nd</sup>– 28<sup>th</sup> 2014 between researchers and representatives of the cities. The meeting was an excellent opportunity to start corresponding on key issues prior to the field trip. It thus facilitated editing a DRAFT case-report that was submitted prior to the actual field trip. Finally, the field trip was organized, and the new data obtained added to the final draft, which was submitted for comments.

Due to the complexity of urban affairs and the wide diversity of the six cities, the research was oriented more towards a phenomenological understanding than positive comparison on fixed parameters. At one of the Skype meetings between the Delft and Copenhagen teams, it was decided to delay the comparative study until the six case-study reports have shown what is possible and reasonable to compare.

This case study report was developed in close cooperation with the municipality of Eskilstuna. Vanessa Scheffler offered us an excellent selection of plans, reports, data and maps and arranged the meetings in Eskilstuna on 6<sup>th</sup> and 7<sup>th</sup> May 2014.

At every meeting in Eskilstuna, the hosts had carefully prepared introductions, which were followed by intense discussions. The meetings are documented by recordings and by files of the PowerPoint presentations. The agenda of the field study is shown in Table 1 below.

Table 1. Field study agenda in Eskilstuna 6-7 May 2014.

Wednesday 6th May 2014			Hosts / interviewee
08:30	10:00	District Heating	Ulf Björklund, head of heating & Torsten Karlsson, engineer
10:30	11:45	Water – waste water	Jörgen Westlund, head of planning water & sewage water
Lunch			
13:00	14:30	Urban Planning	Pernilla Lindström, comprehensive planner
15:00	16:00	Study tour in the city	Vanessa Scheffler
16:00	16:30	Feedback	Vanessa Scheffler
Thursday 7th May 2014			
08:30	09:30	History of Eskilstuna	Anna Götzlinger, curator heritage
10:00	11:00	Climate plan	Lotta Ek, developer
11:00	12:00	Traffic plans	Sheraz Iqbal, traffic planner
Lunch			
13:00	13:45	Bicycle plan	Sheraz Iqbal, traffic planner
13:45	14:30	New parking norms	Olov Åslund, project coordinator
15:00	16:30	Swimming Hall and Arena	John Sorber, Consultant, WSP Environmental
16:30	17:00	Study tour in the city	Vanessa Scheffler

### 3 The regional setting

Eskilstuna is situated in the Stockholm-Mälaren Region and the county Södermanland and is involved in different regional or urban co-operations.

#### 3.1 The Stockholm-Mälaren Region

The Stockholm-Mälaren Region is situated on both sides of the lake Mälaren and consists of the five counties (“län”) of Stockholm, Uppsala, Västmanland, Södermanland and Örebro. It is a polycentric region and home to approximately 3 million people, which is about a third of Sweden's total population.

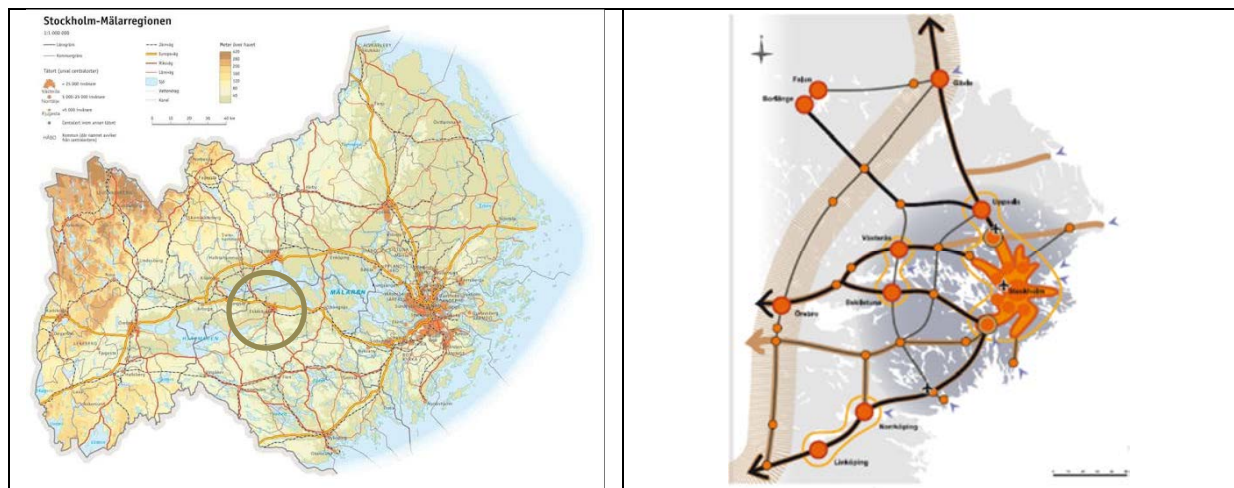


Figure 1. Left: Stockholm-Mälaren region. Circle shows the location of Eskilstuna. Right: Vision for the eastern Mid-Sweden. A joint vision for a nodal and polycentric development and main infrastructure in Stockholm-Mälaren region jointly with eastern Mid-Sweden. The vision is part of the RUFSS 2010, a regional development strategy for Stockholm.

The Council for the Stockholm-Mälaren Region (“Mälardalsrådet”) is a voluntary cooperation between municipalities and county councils in the Stockholm-Mälaren Region centered around Stockholm. It was founded 1992 and aims to promote the development of the Stockholm-Mälaren Region as an attractive region of the future in an integrated Europe.



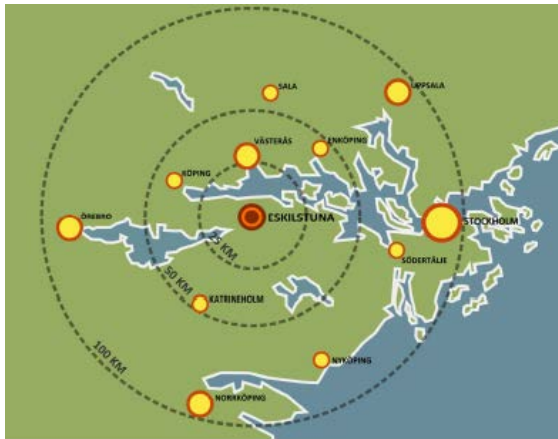


Figure 2. Stockholm-Mälaren Region.

### 3.2 The county Södermanland

The county Södermanland consists of 9 municipalities, in proximity west to Stockholm, cf. figure 3.



Figure 3. Left: The landscape of Södermanland. Right: Södermanland County (right).

The County Administrative Board („Länsstyrelsen“) represents the Central Government in the County. The authority is an important link between the municipal authorities on the one hand and the government, parliament and central authorities on the other. The County Administrative Board works towards sustainable development in the county and is among others responsible for ensuring that decisions from parliament and the Government are implemented in the county. The work includes issues like:

- regional growth
- infrastructure planning
- sustainable community planning and housing
- energy and climate
- nature conservation and environmental and public health

### 3.3 The regional Council Sörmland

The Regional Council Sörmland ("Regionförbundet Sörmland") is a political arena and co-operation of nine municipalities and county councils in Sörmland. The aim is to work with Sörmlands possibilities within the functional region Stockholm-Mälardalen Region. The Regional Council works with regional co-operation within the fields of infrastructure and transportation, economics, innovation, competences and environmental- and climate questions.

### 3.4 Municipal cooperations

The cities Västerås, Eskilstuna, Enköping, and Strängnäs have signed a letter of intent about co-operation on improvements within eight policy areas:

1. Protection of Mälaren, a common environmental asset and a common resource for drinking water;
2. A common skilled and inclusive labour market;
3. Sustainable transport and modern infrastructure around Mälaren;
4. Efficient collective transport as an asset for commuting;
5. Supply of attractive and safe living environments, varied recreation and rich cultural life;
6. Sustainable growth including a strong economic life, open for the formation of new companies and investments;
7. Tourism;
8. Reduction and efficient use of energy.

Since 2009, there has been a co-operation agreement (so called „societal contract“) between Eskilstuna municipality, Västerås municipality and the common Mälardalen University of the two cities. The aim of the agreement is to attract students and companies. Other focus issues are school, care and the future manpower.

### 3.5 Eskilstuna - a brief overview

Eskilstuna is situated 110 km west to the Swedish capital Stockholm. Together with Norrtälje, Södertälje, Uppsala, Västerås and Nyköping, it constitutes part of the 'hub and spoke' urban pattern at distances of 70-115 km from the national capital.

The municipality is 1250 km<sup>2</sup>, with about 150 km<sup>2</sup> surface of water, some of which is part of the big lake Mälaren running all the way from the middle of Sweden via Stockholm to the Baltic Sea and the lake Hjälmaren in the south-west. The municipality consists of two cities – Eskilstuna and Torshälla. In 2014 the number of inhabitants passed 100,000. 2/3 of the people live within 3 km from the city centre in Eskilstuna.

The city of Eskilstuna developed in the 1950s and 1960s as one of Sweden's fastest growing cities, driven by big companies in the steel- and metal tools sector. Deindustrialization in the 1970s caused a pronounced decline in the number of jobs, making the city ripe for an urban restructuring. The outcome of this restructuring was not seen until the end of the century and was driven by developments in the industry and health sectors in Eskilstuna as well by the inclusion of Eskilstuna in the enlarging Stockholm regional labour and housing markets. A

pronounced increase in commuting, especially from Eskilstuna to Stockholm County, is evidence of this regional enlargement.

The return to growth was highly appreciated by Eskilstuna. Thus, the municipality was trying to stimulate in-migration of people while accelerating the ongoing regional enlargement. Further signalling the restructuring process is the establishment of the twin Mälardalen University Sweden (“Mälardalens högskola Eskilstuna Västerås - MDH”) in 1977. The university has two campuses, one in Eskilstuna and the main campus in the northern neighbour town of Västerås. The university has 13,000 students and 900 employees’.

In 2010, 96,311 people lived in the municipality, 64,679 persons in the city of Eskilstuna and 7,612 in the second largest city, Torshälla. In 2014, Eskilstuna has passed 100,000 inhabitants. Until 2030, Eskilstuna expects to grow with 500-600 persons per year.

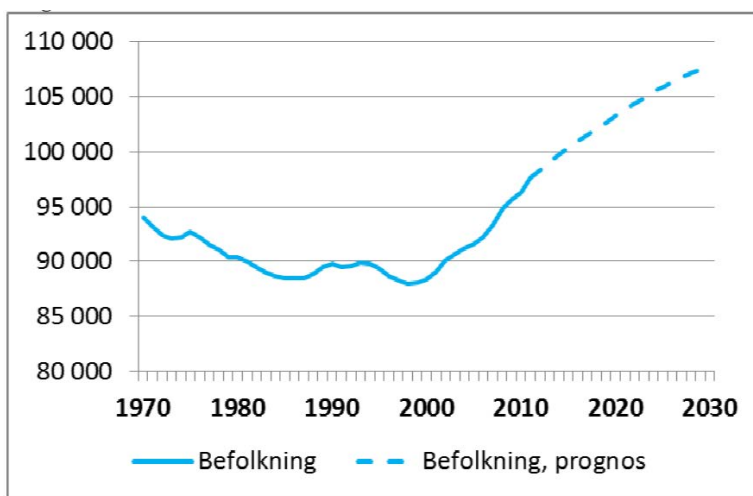


Figure 4. Inhabitants of Eskilstuna 1970 – 2030 (Eskilstuna kommun, 2012a).

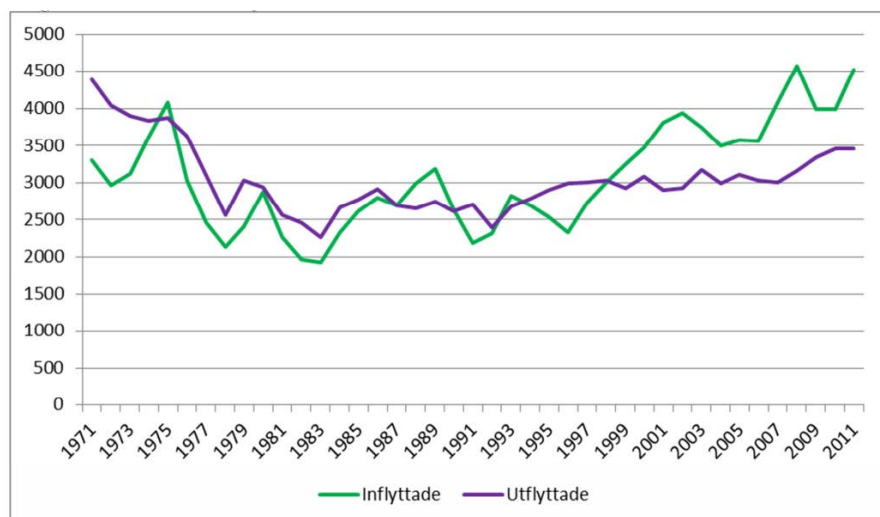


Figure 5. In-migration (green) and out-migration (blue) to/from Eskilstuna 1971–2011. Source: (Eskilstuna kommun, 2012a) After 1999 in-migration exceeds out-migration by far, causing a change in the overall population development (cf. figure 4) and an increase in commuting.



Figure 6. Municipality of Eskilstuna in its regional settings

The regional enlargement is taking place along with an increased daily commuting for work, facilitated by the introduction of a new railway track in 1997 (Mälars- and Svealands Railway) and an extension of the highway from Eskilstuna to Stockholm (Eskilstuna kommun, 2005 b, p. 14). The share of the workforce that commutes has almost doubled in twenty years. From 1990 to 2009 the share of people commuting daily to Eskilstuna increased from 9% to 15% of all people working during daytime in Eskilstuna, while the share of workers who were living in but commuting out of Eskilstuna increased even more, from 8% to 16%. These figures testify to the trends of regional enlargement; and the increasing out-commuting towards Stockholm indicates that Eskilstuna has become a kind of ‘metropolitan suburb’. Thus, in 2009 2180 (33%) of all out commuters headed at the Stockholm Län and 1209 (19%) at Stockholm (see Figure 8). This linkage with Stockholm is expected to become closer due to further investments in traffic structure like Citybanan in Stockholm 2017 and a planned second railway track between Stockholm and Strängnäs (2018). See annex 2.

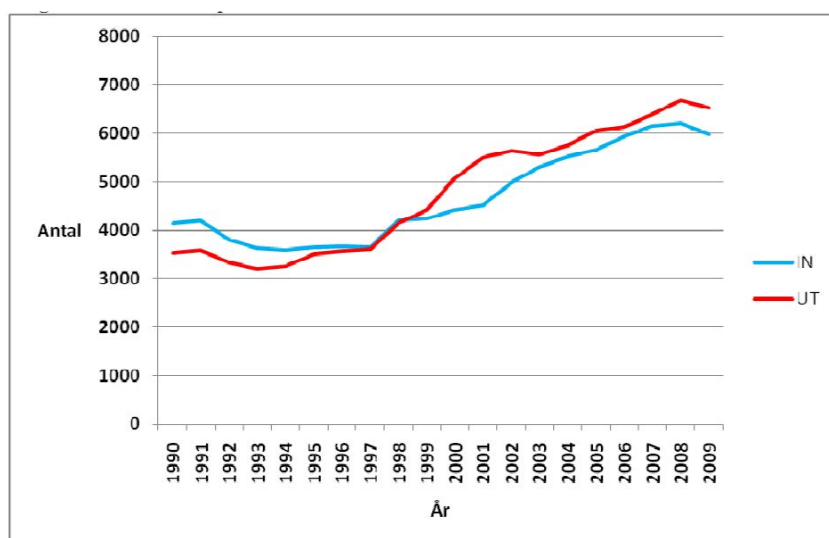


Figure 7. Number of commuters to/from Eskilstuna (Eskilstuna kommun, 2011a).

Blue: in-commuters; Red: out-commuters. From 1998 in- and out-commuting increase, with out-commuting exceeding in-commuting.

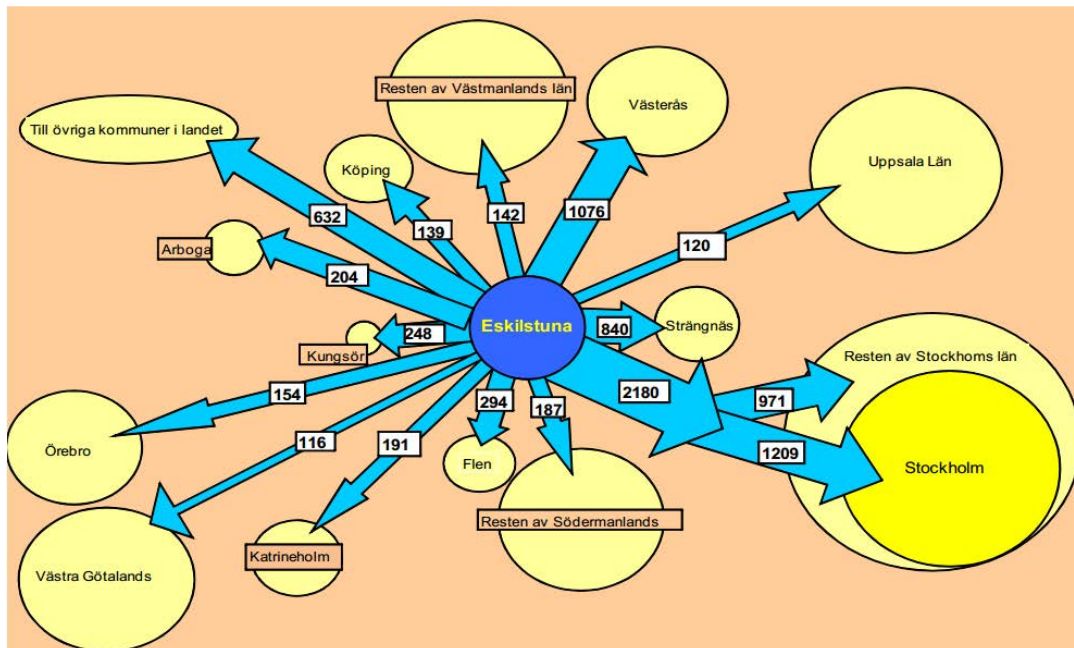
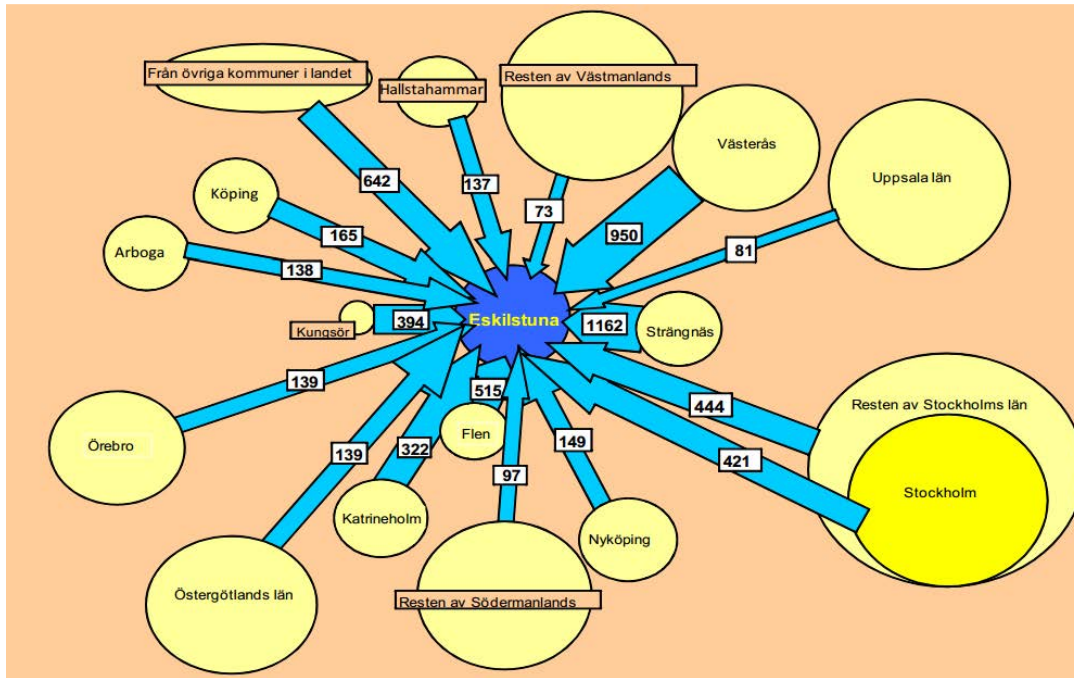


Figure 8. Commuting to (upper) and from (lower) Eskilstuna, 2009 (Eskilstuna kommun, 2011a).

The figure reveals pronounced out-commuting to the east (i.e. Stockholm city-region and Strängnäs) but also almost even commuting at a high level with Västerås, north to Eskilstuna.

#### 4 Historical Urban development

The city of Eskilstuna developed from medieval times on both sides of the river Eskilstuna running north to the lake Mälaren. The development of the town, as it appears on the left part of Figure 9, began on the eastern side of the river in connection with a medieval monastery. After the Reformation, the monastery became a royal palace (“Eskilstuna slott”) called Eskilstuna House (“Eskilstuna huus”). After the reformation the monastery was demolished and later a royal palace was built on the same location. It was destroyed by a fire in 1680, and the county administration was moved to Nyköping. The location of the

castle is still signified by local names such as ‘Slottsskolan’, ‘Slottsgatan’ and ‘Klostergatan’ (‘Castle School’, ‘Castle Street’ and ‘Monastery Street’), see Figure 9.

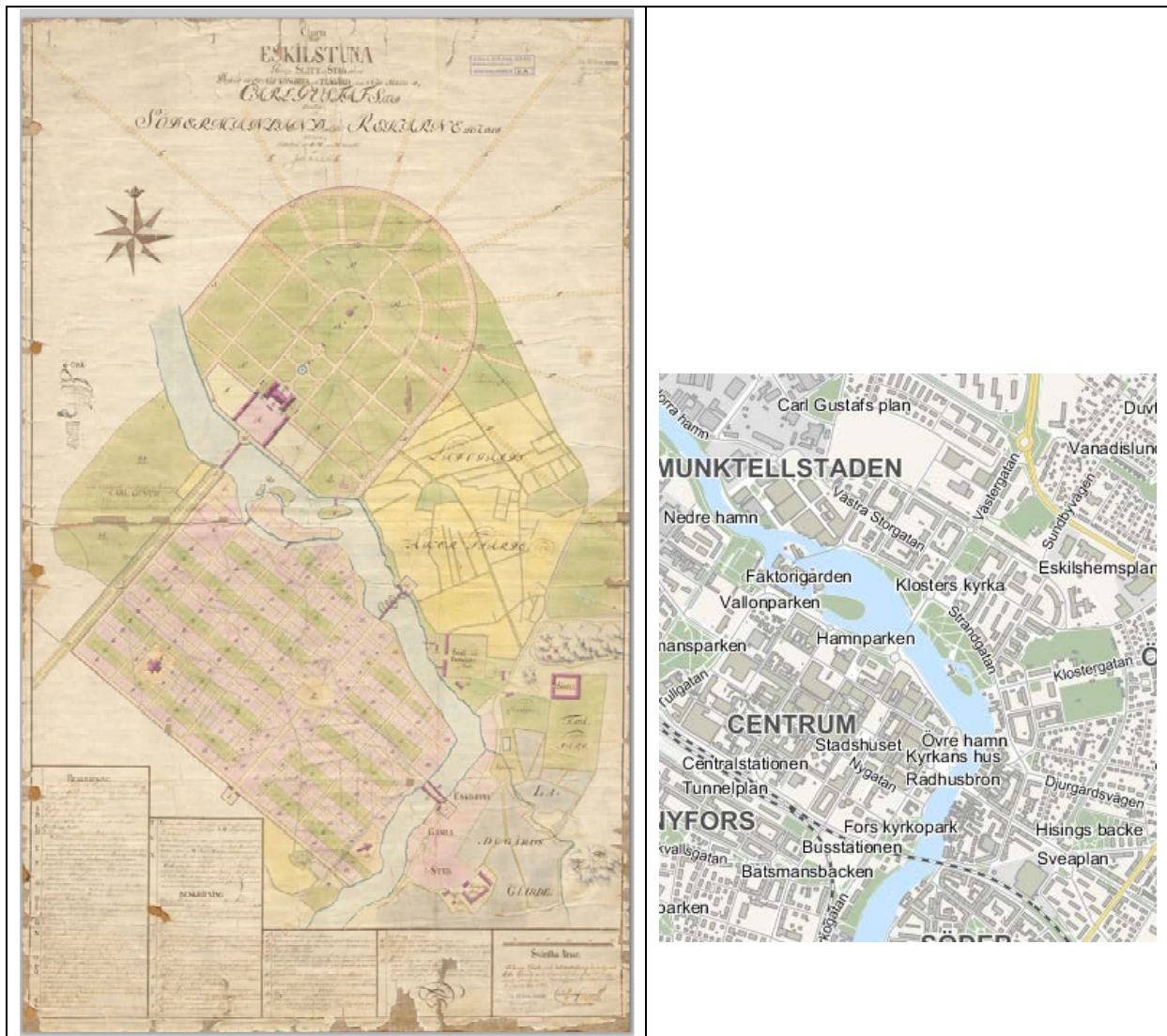


Figure 9. Maps of Eskilstuna.

Left: 1658, by Jean De la Vallée. The Royal Castle on the eastern side of the river and the old town closer to the river. On the western side is the Renaissance town, characterized by the rectangular street grid. Right: present situation of the same location, showing the Renaissance town in the center of the city, connected with the ‘old town’ by the Rådhusbron on the eastern side of the bridge.

In the 17th century, an iron working industry was established at the request of the king, and the city began developing on the west bank of the river, as revealed by the rectangular grid on Figure 9 (left). The development of the city in late 18<sup>th</sup> century was stimulated by the appointment of about two-thirds of the western most part of the grid city as a ‘free-city’ (“Fristaden”), allowing steel manufacturers to settle and manufacture free from the obligation to belong to a guild. They were also granted all sorts of privileges including tax reliefs and exemption from payment of custom duties. Thus, in the early 19<sup>th</sup> century the city consisted of the ‘the old city’ (“Gamla staden”) on the eastern side of the river, the ‘New City’ (“Nystaden”) at the eastern most part of the grid city, and the ‘Free City’ (“Fristaden”) - all of which were merged into ‘Eskilstuna Free City’ (“Eskilstuna Fristaden”) in 1833 (Götzlinger, 2006).



Figure 10. From left: The Free City, the New City and the Old Town

In 1840, the first factories were located in Eskilstuna. Many factories producing steel and processing steel products followed in the central part of the city. Industrialization demanded space and access to infrastructure. Thus new industrial areas developed along the river bank, west of the town. At the same time, Eskilstuna expanded with industries and housing quarters moving continuously outwards from the old town-center, the 'onion' type of urban development (examples Nyfors, Norr, parts of Söder). This development was sparked by the merger of Eskilstuna and two neighbouring parishes (Fors and Klosters socknar). Towards the mid-20<sup>th</sup> century, the continuous urban expansion was overtaken by the development of separate industrial districts and residential neighbourhoods, most notably the Fröslunda Neighbourhood and the Vilsta industrial area. The planning of these two urban districts signified the introduction of the separation of urban functions as a planning principle. The two areas were intended to form a self-sustaining urban unit, including housing and job functions, service and leisure amenities.

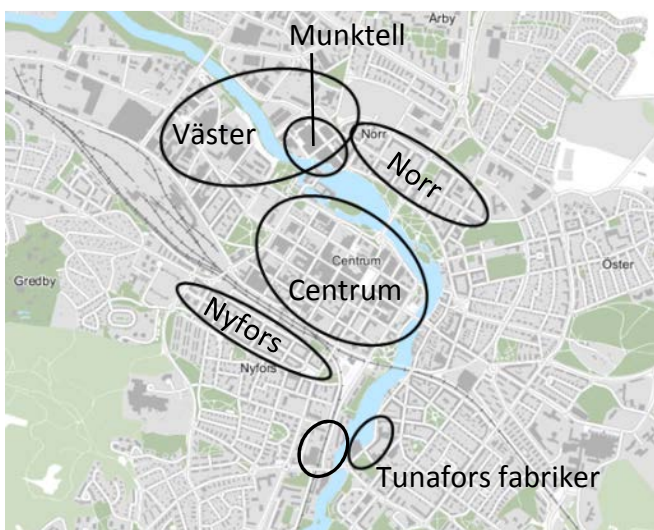


Figure 11. Industrialization 1850 – 1960

During 1960s and 1970s industrial enterprises began relocating from the centre to new industrial zones. The municipality facilitated this process by offering new sites outside the

town and buying up the old premises in order to start an urban renewal process that would replace the old industrial buildings with new offices and shops. This planned urban renewal came to a standstill due to the downturn of the economy in the 1970s (Götzlinger, 2006, p. 11). In the wake of the deindustrialization starting from mid 1970s, the industrial premises in the centre of Eskilstuna have taken on other uses, such as university, municipal administration, culture and sports facilities and housing, e.g. the Tunafors Industries. Other areas are still ripe for transformation, notably the Väster district.



Figure 12. The post-industrial city.

Upper left: Eskilstuna is endowed with a plethora of industrial buildings inherited from the first period of industrialization in the second half of the 18<sup>th</sup> century. After de-industrialization from early 1970s, many industrial buildings have been transformed into other usages. Upper right: Former Eskilstuna Stålpressingsaktiebolag (Eskilstuna Steel Pressing Joint-stock Company), now one of the Eskilstuna municipal administration building. Lower left: Business incubators in former Munktell Industries. Lower right: Former industrial building transformed into attractive riverside apartments.

The development of the first separate neighborhood, Fröslunda, was one of the markers of the increasing building activity that took place after the Second World War in Eskilstuna and throughout Sweden. In order to keep and stimulate the activities, a national housing construction program, the ‘million-program’ (“miljonprogrammet”), was carried out from 1965 to 1974.

In Eskilstuna, several residential neighbourhoods financed by this national housing program were built, including Årby, Skogsängen, Viptorp, Lagersberg, Råbergstorp and Skiftinge.



### The 'million program'

"One million apartments in ten years" was put on the agenda by the social democratic party in Sweden during the election period 1966. Any political decision about the program was, however, never taken. Thus, the 'million program' was used in retrospect characterising the million apartments that in fact were built in the period 1965-1974. The building activity during that period was resulting from a broad political commitment to cope with the shortage and low standards of housing. In 1964 about 90,000 apartments were built and the speed was kept during in ten years to follow. The very word 'million program' makes people associate with large scale high-rise residential areas in grey concrete. However, a large amount of the apartments from the period are situated in only three story houses with plaster and decorated. About 1/3 of the apartments are situated in one family houses or terraced houses.

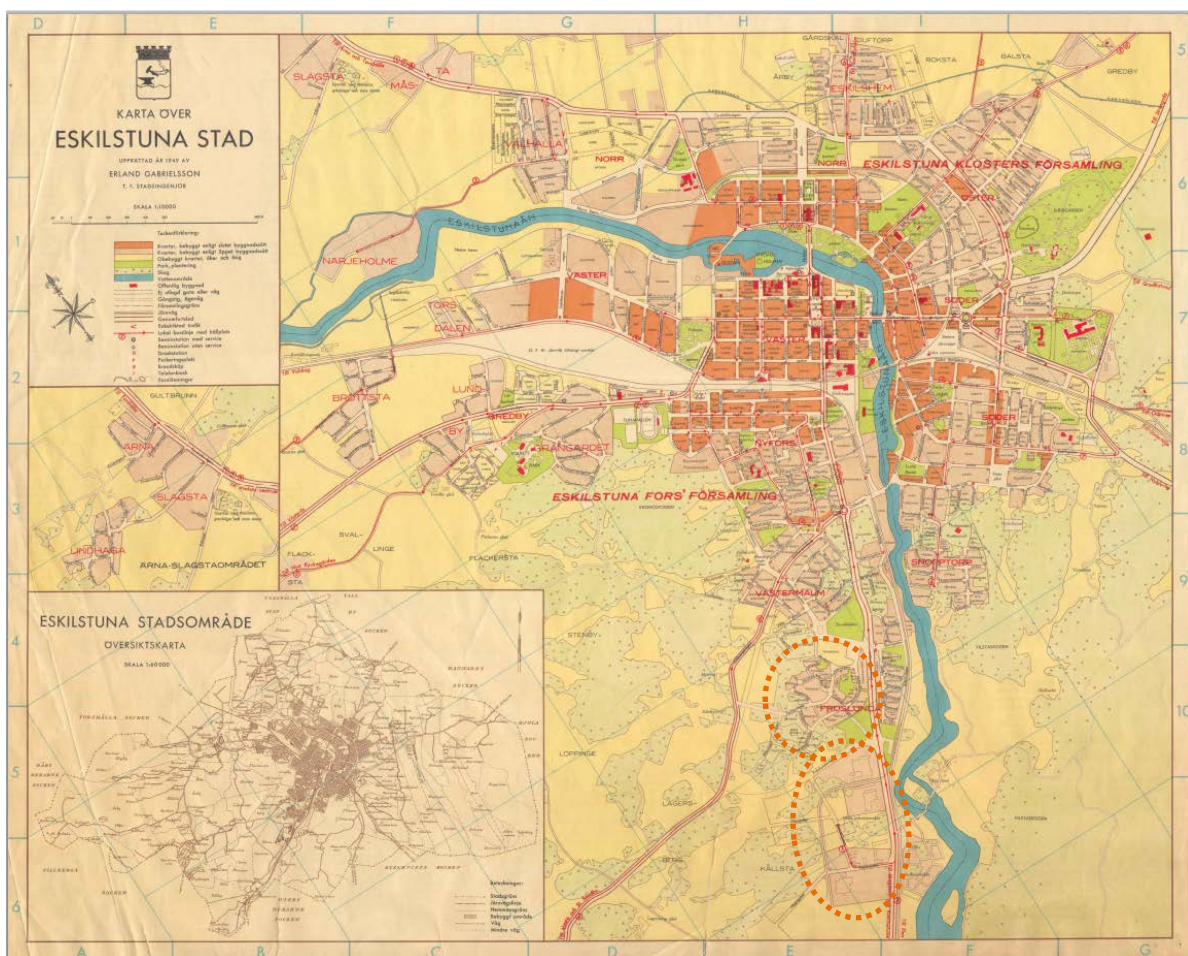


Figure 13. Eskilstuna 1949.

In 1949, new, separate industry and housing districts were established beyond the continuous urban expansion from the center, notably the residential neighborhood Fröslunda and the industrial district Vilsta to the south (dotted circle and ellipsis).

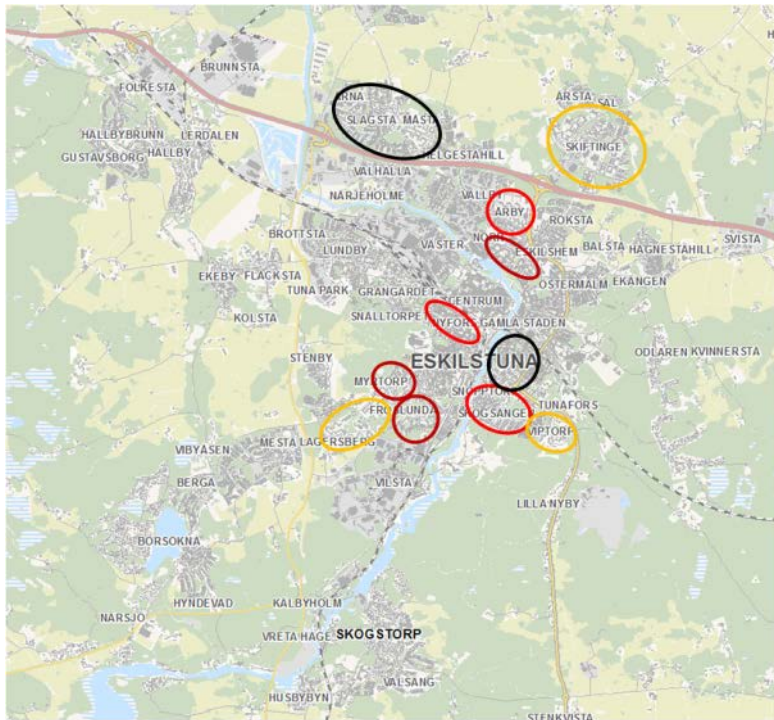


Figure 14. Housing areas built during 1950 – 1970

Dark red: 1950s, light red: 1960s, yellow: 1970s, black: earlier or during a longer time-period. See also figure 16

The lay-out of these new neighbourhoods varied from single family housing to multi-story apartment blocks. The apartment construction followed planning paradigms and norms that resulted in environments that now require refurbishment and further integration in the city. The planning paradigms were greatly influenced by the increasing car-ownership and resulted in a very rigid separation of vehicular and pedestrian traffic lay-outs. In order to deal with the needs for refurbishment, Eskilstuna Municipality has set up a program on sustainability for Lagersberg (“Projekt Sköna gröna Lagersberg”) and a project aiming at the integration of Årby, Råbergstorp and Lagersberg into the surrounding city (“Stadsläkning” see also– pilot projects, below) .



Figure 15. Urban integration of a residential neighbourhood (Eskilstuna kommun, 2013d, p. 9).

Årby, one of the self-sufficient residential neighborhoods built during the Million Housing Program (1965-1974), now ripe for integration with the surrounding Eskilstuna city.

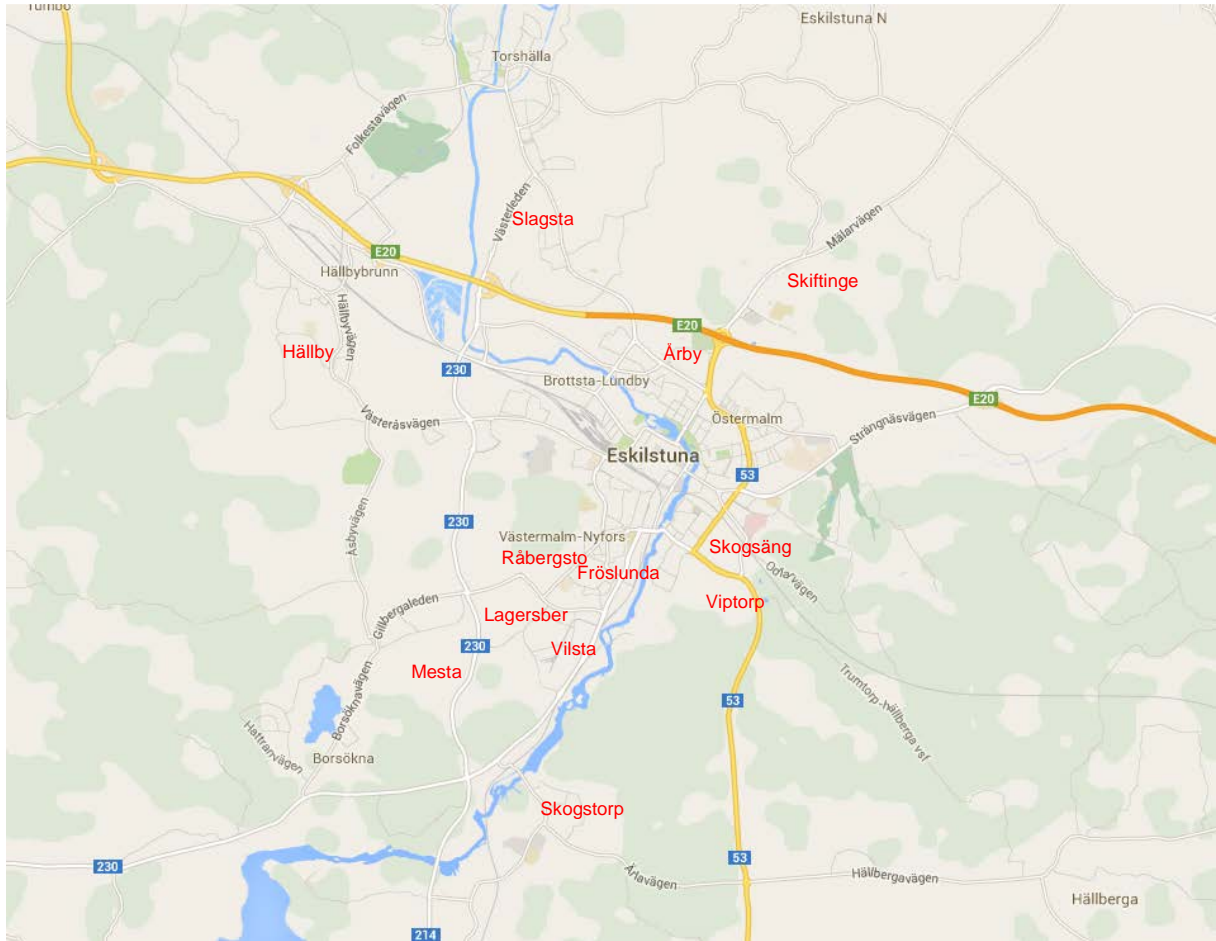


Figure 16. Residential Eskilstuna city.

Outside the central part of Eskilstuna, the city developed in the 1900s. Hällby and Skogstorp are old small towns turned into suburbs with individual single family houses. Just after the war, in 1946-1957, Fröslunda, followed by Årby, developed as the first separate urban districts outside central Eskilstuna. They were followed by the industrial districts, Vilsta and Brottsta-Lundby, in the early 1960s. During the 1965-1974 period, several residential neighbourhoods financed by the 'Million Programme' followed. These new neighbourhoods were planned as self-sufficient residential units including schools, nurseries, churches, public spaces, libraries and meeting halls. The standard apartment was with three rooms of 75 m<sup>2</sup>. In Eskilstuna, the neighbourhoods of Skogsängen, Viptorp, Lagersberg, Råberstorp and Skiftinge belonged to the programme.



Figure 17. Postwar urban development.

After the war, housing demands and new planning ideals led to renewed urban development projects in self-sufficient residential neighbourhoods. These were equipped with services, schools and stores and were functionally separated from the new industrial districts. Upper row: Fröslunda from the 1940s. The scale of buildings is still modest, and segregation of pedestrian from vehicular traffic has not yet taken place. The neighbourhood has succeeded in keeping many shops and functions until today. Next row left, Vilsta, the first industrial district outside the coherent Eskilstuna urban fabric. Vilsta is the southern neighbour to Fröslunda. The two districts are planned as functionally coherent but physically separated residential and working areas, a self-sustained city within the larger city. Mid-right: Throughout Eskilstuna, terraced houses and single family houses complement the otherwise dominant 3–5 storey apartment houses. Bottom: Two residential neighbourhoods from the million unit housing program: Årby (left) and Lagersberg (right). Pedestrian and vehicular traffic are separated from each other. Cars remain outside the perimeter of the courtyards formed by the apartment blocks. Inside, safe environments for children are established, but the scale is much larger. In both areas, residential usage of the ground floor has been withdrawn, leaving the ground floor space anonymous and closed for human interaction other than entering or departing the buildings, garaging cars or other functional activities.

Outside Eskilstuna, urban development took place in Torshälla, dominated by steel works and along the coast of the Mälaren, with about 12.000 inhabitants situated in single family homes, including summer cottages, many of which are being turned into permanent housing. Living in this area has become so popular that Eskilstuna municipality drew up a detailed comprehensive spatial plan in order to monitor housing in the area endowed with many natural and cultural assets (Eskilstuna kommun, 2005a). The size and growth pattern of the towns and settlements is shown in figure 18.

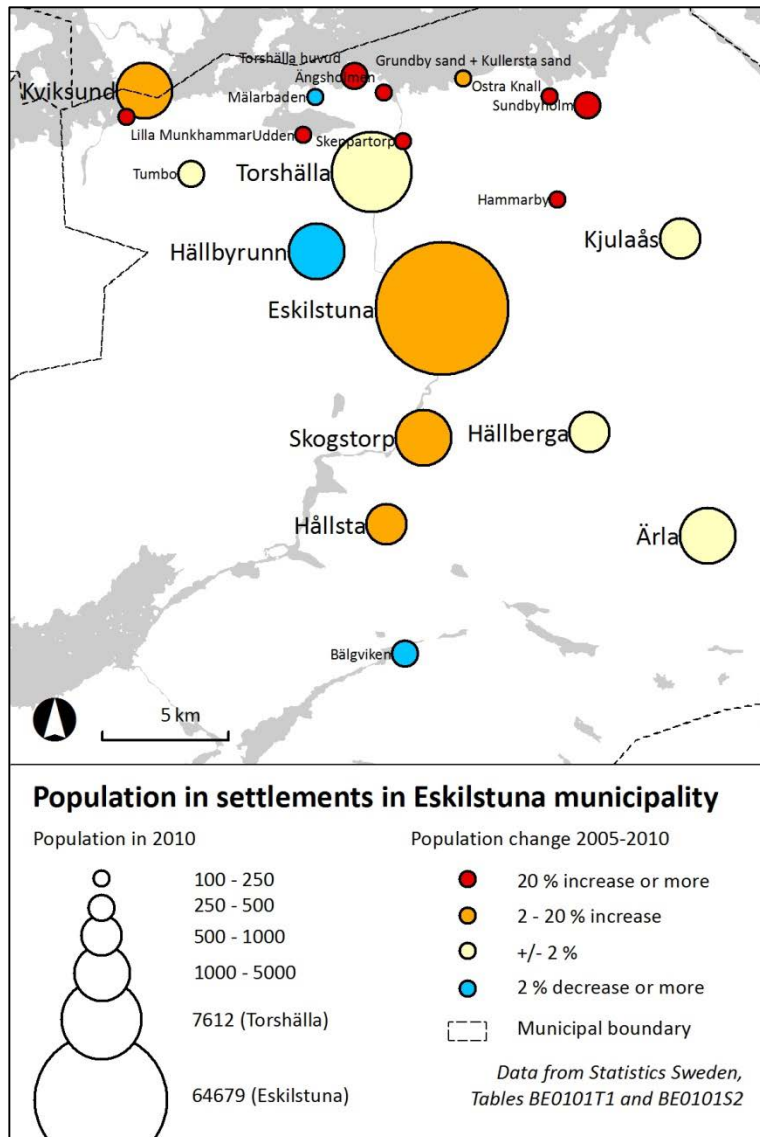


Figure 18. Urban settlements in Eskilstuna. The lions share of the population is situated in Eksilstuna, Kvicksund and Torshälla. But in relative figures, the small settlements in the coastal area of the Mälaren were the fastest growing.

The morphological pattern of the urban structure of Eskilstuna is characterized by a coherent large urban centre supplemented by scattered settlements adjacent to major roads and the Mälaren coast (“Mälärstranden”), cf. Figure 19.



Figure 19. Towns and settlements in Eskilstuna municipality.

## 5 National and municipal energy planning

Climate planning is conducted as a cooperative endeavour between national policy frameworks and municipal plans and projects, although the number of initiatives and expertise in the municipalities may give the impression that climate initiatives originate from the municipality. The interplay between the local plans and initiatives and the national frameworks was, however, emphasized by the people we met in Eskilstuna.

### 5.1 National and municipal goals

National targets on energy and climate policy were set by the Swedish Government in 2009 as follows (Regeringskansliet, 2014b):

By 2020:

- 40% reduction in greenhouse gases compared to 1990;
- At least 50% share of renewable energy in the energy mix;
- At least 10% share of renewable energy in the transport sector;
- 20% more efficient use of energy compared to 2008.

Long-term priorities and vision beyond 2020:

- By 2030, Sweden should have a vehicle stock that is independent of fossil fuels;
- Sweden's electricity production today is essentially based on only two sources: hydro and nuclear power; dependence on these sources should be reduced significantly by cogeneration of wind and other renewable power;
- By 2050, Sweden will have no net emissions of greenhouse gases in the atmosphere;

These national targets have been considered in the formulation of the goals of the Eskilstuna climate plan (Eskilstuna kommun, 2013f):

- Reduction of greenhouse gas emissions;
- Conversion to renewable energy;

- Increasing the efficiency of energy use;
- Reduction of fossil fuels and electricity for heating;
- Reduction of CO2 emissions from transport;
- Reduced climate impact from food and consumption.

## 5.2 National policy measures

To achieve the climate goals, national policy measures have been adopted, the most important of which are: energy taxation, taxation of CO2 emissions and tradable green certificates.

Energy taxation was introduced as a mere fiscal instrument several decades ago, prior to the global climate concern. In the 1990s, a CO2 tax was introduced aimed at the reduction of the use of fossil fuels. The tax has successfully caused a pronounced increase in the use of biomass in Sweden. Finally, a green electricity certificate system was introduced in 2003, tailored to the promotion of the production of electricity from renewable energy sources. This system directs money directly from consumers to producers of electricity when investing in power production based on renewable energy (Regeringskansliet, 2014a).

The Swedish National Board of Housing, Building and Planning, adopted energy regulations in housing in order to sharpen the demands for energy efficiency.

## 5.3 Municipal initiatives

The national policy measures comprise a framework for initiatives to be taken by the municipalities and other operators on the energy market. Most of Eskilstuna's climate-related planning, projects and initiatives are thus responses to national goals and initiatives.

National subsidies corresponded to approximately 25% of the investments needed for the transformation of the Eskilstuna district heating plant in 2000. Thus, the municipal company Eskilstuna Energy & Environment ("Eskilstuna Energi & Miljö AB - EEM") received a subsidy of 120 million SEK from the Government as part of the 450 million SEK in conversion costs. In addition, the green power certification system has generated an income of 35–70 million SEK per year for the municipal company Eskilstuna Energy & Environment.

Currently, a relocation of the plant is being considered, thereby generating a new portfolio of green power certificates for a 15-year period.

Besides the bio-based production of heat and electricity, Eskilstuna Energy & Environment has invested in solar cells and wind turbines, but only in minor shares. One reason for this is that the certification system applies best to bio-energy-based systems. The system does not provide enough money to fully finance investments in, for example, wind turbines.

National policy measures include the active involvement of municipalities in sustainable activities. One such example is the national corporation program for sustainable municipalities ("Uthållig kommun"). About 35 municipalities take part, including Eskilstuna.

It is not just the municipality that responds to the national incentives. The national subsidies also encourage private homeowners to invest e.g. in solar cells, currently with subsidies of up to 35% of the purchase and installation.

In order to fulfil international and national aims for energy use, the Swedish National Board of Housing, Building and Planning has adopted energy regulations within building licenses regulating the energy level for buildings. There are three climate zones for Sweden setting the levels of energy use in new buildings. Eskilstuna is situated in the so called 'climate zone III', allowing energy use per m<sup>2</sup> up to 90 kWh per m<sup>2</sup> for houses with other heating than electricity and 55 kWh for houses with electricity heating.

#### **5.4 Top-down and bottom-up**

As we shall see in section 0 on the climate plan below, Eskilstuna has initiated a large number of climate related initiatives affecting various sectors and levels of the municipal policy, services and administration. Many such initiatives are not exclusively related to 'hard' national incentives or legal obligations. Rather, a kind of mutual understanding and agreement on the climate issue is operating. Therefore, the municipality does not just wait for national guidelines. In many instances, the municipality takes climate-related initiatives led, for example, by concern from the public or as a strategy to brand the municipality on the basis of its climate initiatives.

Thus, the interplay between national frameworks and municipal execution of climate measures seems so closely connected that it is difficult to characterize the municipality as simply an executor of national policies. The idea of sustainable development and protection of the climate seems as if it has been assimilated by the public, local politicians and companies to the extent that new ideas and experiments are produced locally in their own right, occasionally turning top-down policy making into bottom-up interventions.

## **6 Management of urban planning and energy today**

The growing interest for sustainable development has had its impact on spatial planning as well as on traffic planning and planning and investments in the energy and environment sectors. In fact sustainability has become an omnipresent issue not only in planning but also in the daily management of public affairs.

### **6.1 Comprehensive spatial planning 1990 - 2013**

In what follows, the development of spatial planning in Eskilstuna is considered, focusing on how the planning agenda changed from mere environmental protection to proactive response on new regionally based development options as well as a growing concern about the energy and sustainability. It is in brief a story about balancing during shifting economic conjunctures the two traditional concerns of planning: protection and development. A more full description of the planning system and plans prepared by Vanessa Scheffler, Eskilstuna, is to be found in Annex 1.

The comprehensive spatial plans formulated by the municipality of Eskilstuna echo the strong planning tradition in Sweden focusing on the protection of spatial interests. Accordingly, the municipal plan is "the frame for continuously testing future plans and



projects consuming land and water areas” (Eskilstuna kommun, 2005b, p. 4 our translation). So far, urban development seems to be prioritized secondary to protection of environment and national interests. However, it is possible also to detect some positive development concepts behind the plans, as shown in Figure 20. These concepts favor urban development closely connected with the existing urban structure, as formulated in the comprehensive spatial plans from 1990 and 2005 and further developed in the 2013 plan (Eskilstuna kommun, 1990, 2005b and 2013h).

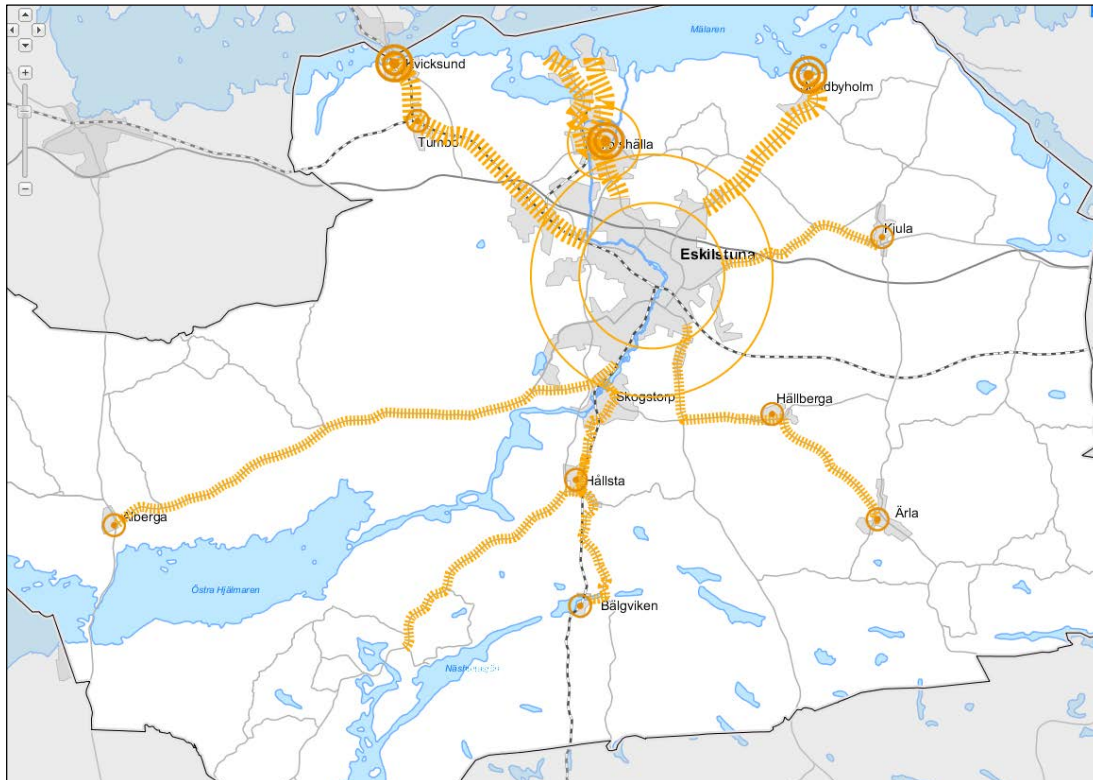


Figure 20. Development concepts of Eskilstuna comprehensive spatial plan (2013, with planning horizon 2030).

(1) Densification zones (the larger circles around Eskilstuna and Torshälla), (2) nodes appointed for special development purposes (bold double-circles around Kvikksund, Torshälla, Sundbyholm), (3) nodes for rural towns (small circles around Årila, Hällberga, ...) and (4) zones along public traffic routes in rural areas for complementary single buildings (hatched lines).

Planning principles develop in the three generations of comprehensive plans. As mentioned, all the three plans (1990, 2005 and 2013/2030) reveal a concern for protection of natural assets and rural areas, national and sector interests, while taking as a point of departure the historical development of the small rural towns surrounding Eskilstuna and the functional towns and resort settlements north to Eskilstuna. In addition to protection, the 2013 plan (called ‘2030’ because of its planning horizon, in contrast to earlier plans that were named according to their year of approval) introduces some positive development concepts closely connected with the existing urban settlement structure, opting for nodal development supplemented by linear development attached to the radials connecting Eskilstuna and the nodes around the city. Principles for energy savings are prioritized within the framework of the historical urban pattern: densification of the main city Eskilstuna and Torshälla and urban development outside the two cities restricted along traffic corridors and rural towns endowed with public transport. Outside this existing ‘hub and spoke’ build up structure, scattered urban development seems to be prevented by the consolidated protection policy, hence working hand in hand with principles for energy saving.

In one important aspect, however, the 2005 and 2013 plans reveal a thorough concern with mobility at a higher level, i.e. the regional. On the backcloth of the former urban decline of the 1970s, 1980s and 1990s there are no alternatives to the ongoing integration of Eskilstuna into the enlarging Stockholm-Mälars Region, due to the economic prospects of integration. Regional integration, however, involves a major increase in daily commuting:

Through the years, the relations between places for living and for work or study have weakened and, in turn, created an important background for the development of Eskilstuna. The growth of Stockholm and the Stockholm-Mälars Region is positive to Eskilstuna and an important driver for the development of the population as well. To Eskilstuna, this development is facilitated by the construction of roads and railway tracks, facilitating long distance commuting. The regional enlargement contributes to an increased demand for housing and workplaces in the municipality. To an increasing extent, it becomes obvious that new housing has a greater impact on the population growth than the local labor market (Eskilstuna kommun, 2005b, p. 14).

From an energy point of view, increased commuting is unsustainable. It derives from the logic of regional enlargement, a structural process, market driven and policy facilitated. To control regional enlargement in order to maintain commuting at a lower level is not an option to second order cities such as Eskilstuna, since the alternative to urban decline in the 1970s and 1980s is to develop themselves as residential areas in larger regional labor markets. This is what was emphasized by the Eskilstuna planners (above) and it is documented by a more intense commuting from 'residential Eskilstuna' to the labour market of Stockholm than from the 'residential Stockholm' to the labour market of Eskilstuna, see Figure 8.

Another city in the Stockholm-based hub-and-spoke urban system of Stockholm, Nyköping, launched an annual marketing campaign to recruit new residents in the Stockholm press and subway. The campaign was part of a proactive strategy to turn Nyköping from an industrial city of its own into an attractive metropolitan suburb of Stockholm. The sales promotion argument is that just outside Stockholm, in the vicinity of the metropolis, a family could purchase a house that is cheaper and close to nature, if daily commuting is accepted.

In Eskilstuna, regional attractive housing is justified by the planners, observing that the former trends of people moving to the location of their workplaces is being replaced by 'firms following people' (Eskilstuna kommun, 2005b, p. 31). However, it is worth noting the 2013 plan cancelled the detailed comprehensive plan for the Mälaren seaside (Eskilstuna kommun, 2005a). This plan, supplementary to the 2005 comprehensive plan for the municipality, was elaborated in order to respond to a pronounced interest for enhancing the possibilities for attractive housing in the area. Like its southernmost urban counterpart, Nyköping, Eskilstuna conducted promotion campaigns in Stockholm to benefit from immigration from the metropolis. "The aim was to attract attention to Eskilstuna as a residential town and a possible alternative when moving plans were going to be realized."<sup>1</sup> With the 2013 plan, however, it was envisaged that the building opportunities along the coast north to Eskilstuna, were costly to supply with infrastructure, and hence contradictory

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<sup>1</sup> Lena Sjöberg, Eskilstuna Department of Communication

to the stronger commitments to sustainable urban development launched by the 2013 plan (cf. Figure 20). Thus, it was decided to cancel the Mälärstrand comprehensive plan, although traces of the Mälärstrand plan remain visible, as revealed by figure 21.

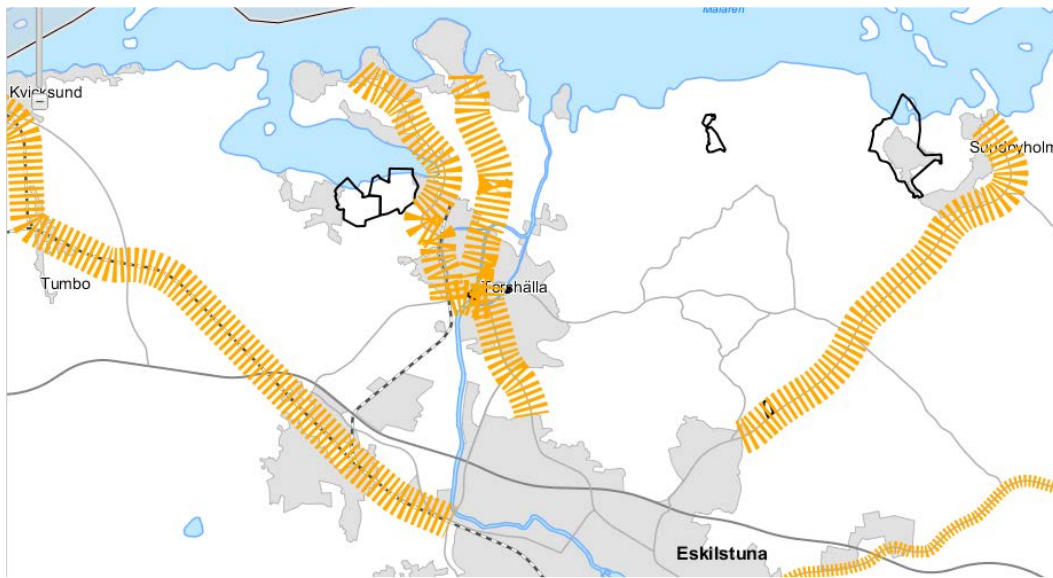


Figure 21. Areas with unexploited current building rights as approved according to detailed development plans based on the Mälaren seaside comprehensive plan 2005.

In searching for urban structural driven potentials for energy savings, as we do in the present PLEEC project, we find regional enlargement contradictory to the aims of sustainability. The extent to which the ongoing regional enlargement can be founded upon public rather than private transport, however, remains crucial. In Eskilstuna, the opening of the Svealandsbanan is a promising example. Construction of this rail line has been a decisive factor, it seems, for the inclusion of Eskilstuna in the Stockholm-Mälär regional enlargement process. Once set in motion, however, regional enlargement has included road commuting at a higher level rather than the rail commuting (Eskilstuna kommun, 2012b, p. 55).

As indicated, planning as a tool for monitoring urban development has developed in Eskilstuna during the three generations of plans, the 1990 plan, the 2005 and the 2013 ('2030') plan. All plans are focused on identifying and protecting spatial interests. In the 1990 plan, the spatial mapping of interests is seen as a frame of reference for taking concrete decisions on future projects. This is an authoritative legal plan aimed at development control. The municipality acts as a curator on behalf of spatial interests. The 2005 plan included an analysis of the world outside Eskilstuna, thereby signaling a turn from control to strategy, since strategy is about forming relations with the outside world (Agersnap, 1976). Most influential was the analysis of the regional world outside Eskilstuna, bringing Stockholm within the vicinity of commuting. Accordingly, a development perspective, i.e. integration in the Stockholm labor and housing market, was added to the former protection perspective.

Finally, the 2013 ('2030') plan has benefitted from the development prospects of the 2005 plan, although retreating from the strategic to the managerial planning. This retreat is not of the former juridical type but a more active type of planning centered around the performance of the Eskilstuna Municipality as a joint concern of all municipal services,

building and environmental controls, public supply and enterprises owned by the municipality (Eskilstuna kommun, 2012c) and (Eskilstuna kommun, 2009). The municipal concern is run by a hierarchy of goals from vision via strategic and procedural goals to actions and daily service provision. The vision<sup>2</sup> is settled by the political council, in the backdrop of a widely publicized commitment for sustainable development. Protection of spatial interests is still an issue, as in 1990. However, this protection is now supplemented by an agenda of goal achievement in services and projects run by the Eskilstuna Concern, the most important of which is sustainability.

Thus, this new monitoring system tries to monitor large projects along with the daily municipal services under the umbrella of sustainability. It seems as if Eskilstuna has turned from a position as curator of land use interests in the 1990s to a responsible driver of sustainable development in the 2010s. The commitment at all levels in the concern is exemplified by two pamphlets issued in 2012, when Eskilstuna was cited as the most sustainable municipality in Sweden. One of the pamphlets is entitled: “Change is taking place! 150 *large and small* steps towards a sustainable Eskilstuna” (Eskilstuna kommun, 2013g, our translation and emphasis”).

## 6.2 Eskilstuna traffic plan

The Eskilstuna traffic plan includes all relevant aspects of traffic in the municipality, such as matching the urban structure with relevant traffic solutions, safety and security and environmental impacts.

The aims of the plan are related to the climate issue. Thus, one key aim is contributing to a sustainable development of society, and the traffic plan is considered a key contribution for the comprehensive spatial plan. Relevant issues of the spatial plan are stressed, i.e. regional connections, dense urban structure and accessibility.

The plan established goals for the future division between traffic modes: private car, public transport, bicycle and walking. In 2020, use of public transport and bicycling shall double at the expense of the private car, see Figure 22.



Figure 22. Goals for the traffic modes (Eskilstuna kommun, 2012f, p. 4).

<sup>2</sup> "2020 Eskilstuna – the proud free city"

One of the means to approach these goals is by using ‘mobility management’, which concerns intensifying sustainable transport by influencing people’s attitudes and behavior – not by economic incentives but using information, communication, organization of services and coordination of different stakeholders (Eskilstuna kommun, 2012f, p. 3).

Some local transportation aims with relation to energy issues are linked to aspects like:

- Eskilstuna urban structure
  - Increase of density in the cities (“Stadsbygden”) (mentioned in the comprehensive plan as well)
  - New housing at the countryside has to be located to existing and new connections with public transport (mentioned in the comprehensive plan as well)
  - The need of transportation by car in new housing areas should be less than in already existing housing areas (new parking-norm)
- Traffic system/network
  - There should be an attractive, comprehensive, linked and gent network for pedestrians and cyclists
  - There should be an attractive, effective public transport network with good accessibility
- Environmental impact
  - The share of goods transport on road must be reduced
  - The use of private car (person-kilometres) must be reduced by 10% before 2020 as compared with year 2010 (mentioned in the climate plan as well)<sup>3</sup>

Means to reach the aims are among others the new prioritizing of the transportation modes: 1. Pedestrians, 2. Bicycles, 3. Public transport and 4. Cars.

### 6.2.1 Urban structure

The traffic strategy emphasizes the close relations between traffic and the built environment of Eskilstuna and the small towns of the municipality. Probably due to the long time horizon for changing the urban structure, it is seen as a precondition rather than as an instrument for reducing transport needs.

It is, thus, acknowledged that with the generally improved welfare of the society, including increasing car ownership and housing demands, Eskilstuna expanded in an increasing multiplier relation with population growth. While the population increased by 10% from 1960 to 1995, the urban area increased by more than 100% in a process of “thinning out” the urban environment and increasing the car-dependency. As an example, north to Eskilstuna, at the Mälaren Lake, urbanization has taken place attracted by the access to nature. The areal expansion is functionally being accompanied by a scattered concentration of some urban functions, e.g. the establishment of external retail centers, contributing to an increasing transportation, see Figure 23.

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<sup>3</sup> It is worth noticing that the most recent figures on personal use of private cars in Eskilstuna, as measure in ‘yearly personal kilometers’, has decreased from 6210 km in 2005 to 5790 km in 2011.

The plan recommends the development of retail and service centers attached to their own hinterland, i.e. a neighborhood and urban quarter rather than large centers in different external locations competing for the same customers and causing excessive traffic. In line with this, the plan recommends the reduction of the functional division between residential area, workplaces and services.



Figure 23. Retail structure in Eskilstuna (Eskilstuna kommun, 2012e, p. 15).

## 6.2.2 Challenges

Some of the most important climate relevant challenges summarized in the plan are:

- The scattered urban development;
- Low priority given to bicycle and public transport;
- Lack of capacity in the regional traffic system, especially the railway;
- Low and decreasing shares of bicycle and public transport;
- Physical barriers in the traffic environment.

In an analysis of the trends and challenges in the outside world, the Sörmland Regional Cooperation addresses most of these challenges as follows: Although the national transit traffic is responsible for the larger part of CO<sub>2</sub> emissions, it is the regional problems that have been considered for a decade due to the needs for greater improvements in accessibility in the western part of the region. Thus, railway lines in the area suffer from a lack of capacity, including the ordinary southern and eastern railways and the Svealand Railway (Regionalförbundet Sörmland, 2012, p.20). The report notes that public transport has been regulated by a new law since 1 January 2012. The law emphasizes the political responsibilities for traffic policies, but it also makes it possible for commercial traffic to replace public transport. New regional public transport authorities have been set up with new responsibilities for prioritizing transport routes that should be subsidized by the taxpayers and which should be obligatory routes (Eskilstuna kommun, 2012d, p.25).

To meet the above mentioned challenges, four types of means are suggested and presented in a table showing the relevance in the years 2010, 2020 and 2050, as well as each of their potentials for contributing to the reduction of CO2 emissions.

Table 2. The potentials of different means of actions (share in %) on the reduction of the CO2 emissions from road transport.

Year	Societal (spatial ) planning	Legal regulations & economic incentives	Infrastructure, transport supply and new techniques	Behavior	Total effect on CO2 emissions 1000 KT CO2
2010	4%	67%	12%	17%	-5,0
2020	14%	50%	24%	13%	-9,4
2050	13%	33%	45%	8%	-19,8
influence at municipal level	Large	Small	little / medium	medium	

Source: (Eskilstuna kommun, 2012e, p. 45).

According to the table, the total effect of reducing CO2 emissions will increase from 2010 to 2050, especially due to projected increasing effects of infrastructure, transport supply and new technologies. Societal planning and influencing people’s behavior are the two most

**6.2.3 The traffic plan and spatial planning**

The traffic plan is the result of close interplay with the climate plan and comprehensive plan. Thus, the traffic plan is based on the aims and strategies of the comprehensive plan 2030 and an important thematic deepening of traffic issues for the comprehensive plan and climate plan. Thus the new traffic plan represents a paradigm shift in both traffic and spatial planning. The traffic plan itself is further deepened by a bicycle plan (approved 2013), and a public transport plan and a pedestrian plan are currently being prepared.

As an example of the topical relation between the plans, planned zones for pedestrians as well as bicycle routes are dealt with in the comprehensive plan, see figure 24 and figure 25

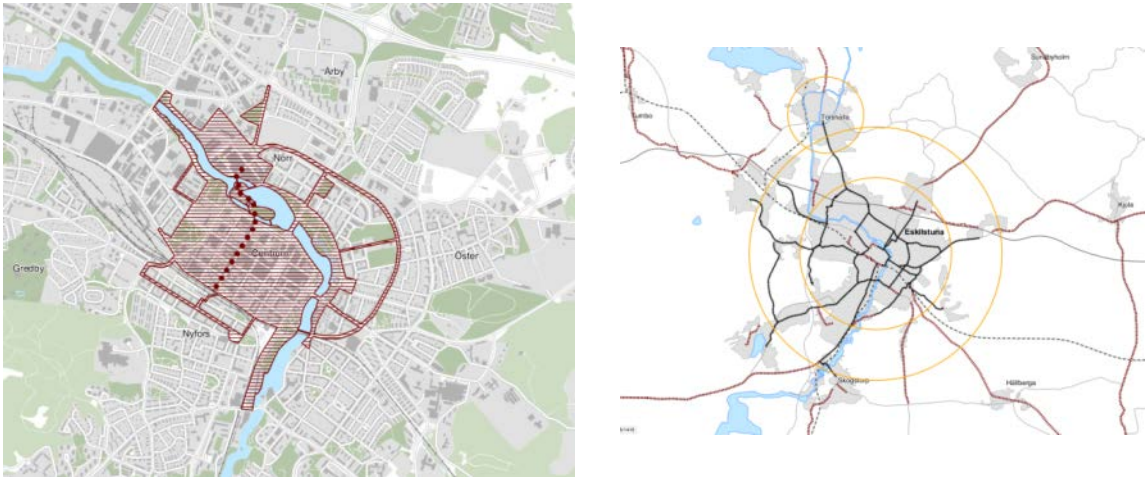


Figure 24. Traffic issues dealt with in the comprehensive plan  
 Left: Planned zones for pedestrians shown, a tool for pedestrian accessibility. Right: Bicycle routes



Figure 25. Zones for potential urban development  
Density within bicycle distance (3-5 km), housing development in proximity to public transport and nodes for intermodality.

### 6.3 Public projects and building control

The corporate commitments on sustainability are demonstrated by a number of municipal initiatives on building regulations for the private developer as well as standards set in municipal projects issued between 2011 and 2014. Examples of building regulations include energy demands on new buildings (Eskilstuna kommun, 2013b) and parking norms (Eskilstuna kommun, 2013i). The new parking norms are made more flexible in order to respond to the diversity of real situations and the need for different groups of people and thereby to facilitate a more compact development of the city.

Examples of standards of own activities and projects are the demand for environmental certification and investment in solar energy in municipal institutions and enterprises (Eskilstuna kommun, 2013a), terms of reference for urban restructuring programs aimed at densification of centrally located areas of Eskilstuna and Torshälla (Eskilstuna kommun, 2011b) and (Eskilstuna kommun, 2013e), municipal building projects (Eskilstuna kommun, 2013c) and (Eskilstuna kommun, 2014) refurbishing of a housing area up to current standards of energy consumption and general living environment (Eskilstuna Kommunfastigheter AB, 2014). The latter project area is also part of a project aimed at integrating three 1970 segregated housing areas into the surrounding Eskilstuna city.

As a tool for municipal energy advice, a sun map has been created to visualize potentials for solar energy on existing buildings and premises.

### 6.4 The climate plan

The municipal climate plan, approved in December 2012, combines statutory climate planning with Eskilstuna's own partnerships in climate policies, such as the partnership of the Swedish Energy Agency's 'Sustainable Municipalities' program ("Uthållig kommun"), the partnership of Swedish 'Climate Municipalities' and local partnerships with private enterprises and public institutions, such as the university.



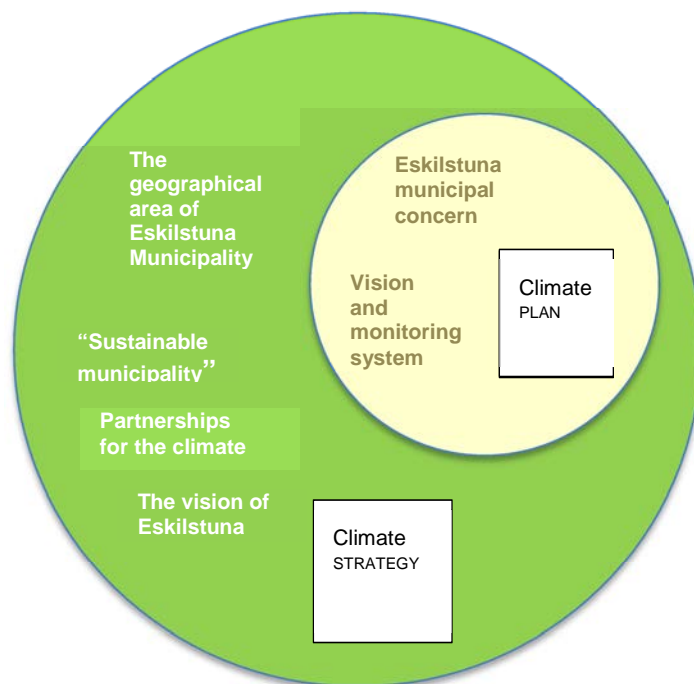


Figure 26. Elements of Eskilstuna’s work on climate plans and strategies.

The diagram emphasizes the interaction between decisions of the municipality as a concern (corporate planning) and negotiations between Eskilstuna and other public and private enterprises and organisations on climate issues, e.g. Swedish Energy Agency and Swedish ‘Climate Municipalities’ (strategy making) (Eskilstuna kommun, 2013f).

The plan has been set up in accordance with the regional climate plan of Södermanland County as well as national and EU goals. In this hierarchy of climate policies, Eskilstuna has taken on the role of operational agency.

#### 6.4.1 Breaking former hierarchies of planning

The climate plan is supposed to have a wide say in current sector and spatial planning. A new hierarchy - or network – of planning seems to be envisaged by the authors of the plan: “Due to the stronger positions achieved by energy and climate aspects, the climate plan may contribute to a pronounced change of the future organizing of working routines in the entire municipal organization” (Eskilstuna kommun, 2013f, p. 17, our translation).

#### 6.4.2 Structure of the plan

The following sectors are influenced by the plan: Housing and buildings, industry, transport, consumption, spatial planning and project development, all of which will contribute to seven goals:

1. Reduction of climate gases
2. Renewable energy
3. Efficient energy consumption
4. Reduction of fossil fuels and electricity for heating
5. Reduction of fossil fuels for transportation
6. Reduced climate impacts of food and consumptions
7. Active purchase of municipal goods and service

For each of the seven goals, milestones are established for three time horizons (2013, 2020 and 2050) for achievements by the Eskilstuna concern and the municipal area outside the concern (see figure 26).

To meet the goals, 48 initiatives are established within the following fields of action:

1. Societal planning
2. Energy
3. Transportation
4. Food and consumption
5. Information and communication
6. Climate adaptation

Within the 2020 time horizon, the consumption of energy and the CO<sub>2</sub> emissions are reduced, especially within the Eskilstuna Municipality Concern. The positive achievements of the policies, however, reveal a few contradictions in climate and energy policies. Energy savings in the consumption of heat may cause an increase in production of electricity from supplementary sources in the European electricity grid, where marginal production is usually based on fossil fuels. If a reduction of district heating is not compensated by an increased share of the local market, e.g. by extension of the district heating districts, or by growth of population and industry, savings of energy will lead to higher energy prices. These kinds of contradictions are generally caused by the sensitivity of large integrated systems.

#### 6.4.3 Current achievements and challenges - overview

The climate plan is not the kick-off of climate initiatives in Eskilstuna. Rather, the plan is part of a series of earlier climate initiatives within the municipal concern, the most important of which are:

1. Conversion of Eskilstuna Heat plant to bio fuels
2. Construction of a combined heat and power plant
3. A well-developed district heating system covering 65% of heating of buildings
4. Conversion of local heat plants to bio fuels - contributing to fossil-free heating of all municipal buildings
5. Production of bio-gas at the Eskilstuna waste water treatment plant - contributing to bio-gas driven local busses and municipal vehicles
6. Introduction of energy and efficiency standards in municipal buildings.
7. Optical sorting within waste treatment, making recycling easier for inhabitants

Currently, the most challenging area of action is the reduction of CO<sub>2</sub> from traffic. As noted earlier, regional enlargement is a structural driver of increased CO<sub>2</sub> emissions. However, counteracting Eskilstuna's new role in the regional labour and housing market is not an option. Strategic decisions were taken in 2005 on this issue. Therefore, focus is on improving public transport and logistical hubs for modal splits favouring railroad transport (e.g., the Folkesta lorry-rail terminal) at the regional level and on improving bicycling and bus transport at city levels.

#### 6.4.4 A statistic overview

The total energy supply in Eskilstuna municipality combines almost even shares of fossil fuels, bio fuels and electricity. As shown in Figure 27, a reduction of fossil fuels is expected until 2020. After 2020, forecasting is difficult due to the invention of as yet unknown

technologies. However, it is expected that already known technologies for electricity production from water, wind and sun are likely to come into use in the long run. The fruits of current investments in energy efficiency are not fully displayed by the figure. This is due to an expected increase in energy consumption following the ongoing population growth and increased commuting.

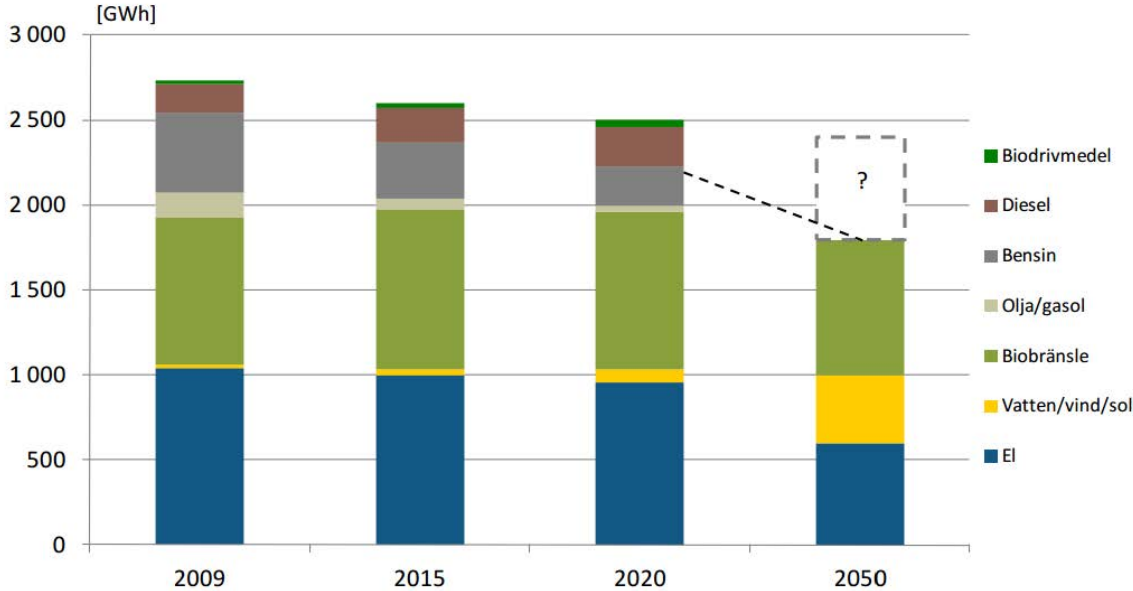


Figure 27. Total energy supply to Eskilstuna municipality, incl. industry and transport (GWh) Source: Eskilstuna kommun, 2013f, p. 39)

The supply of electricity is crucial. As shown in Figure 28, most electricity is ‘imported’ from the national electricity grid. It is not replaceable by a local increase of current electricity production, which is combined with the production of heat in the Eskilstuna heat and power plant. Here, an overproduction of heat would occur. Only by major investments in other techniques, such as water- and wind-turbines and solar cells, could the imported electricity be replaced by local production, as shown in the ‘2050’ column in Figure 27.

A most important tool for enhancing sustainable production of electricity is the national certification system from 2003. The system conveys a flow of financial means from consumers of electricity to producers of renewable electricity. Producers of renewable electricity are rewarded with certificates that consumers of electricity are compelled to purchase.

The consumers are the daily consumers as represented by energy companies distributing electricity, as well as large, e.g. industrial, single electricity consumers and consumers buying electricity from the Nordic energy grid. Every year, these consumers are assigned an obligatory quota of certificates for purchasing electricity from the renewable energy producers. The end-purchasers of the certificates are the daily consumers and the customers of the industrial goods.

The incentives to invest in renewable electricity are rather intense. Thus, in 2000, the municipal Eskilstuna Energy & Environment enterprise was paid large national subsidies to support construction of the combined heat and electricity plant in 2000. In addition,

Eskilstuna Energy & Environment received national certificates, conveying extra ‘free’ money of about 70 million SEK. If Eskilstuna builds the new plant in Kjula (see section 6.5), the enterprise will be rewarded by yearly incomes from yearly certificates in 15 years.

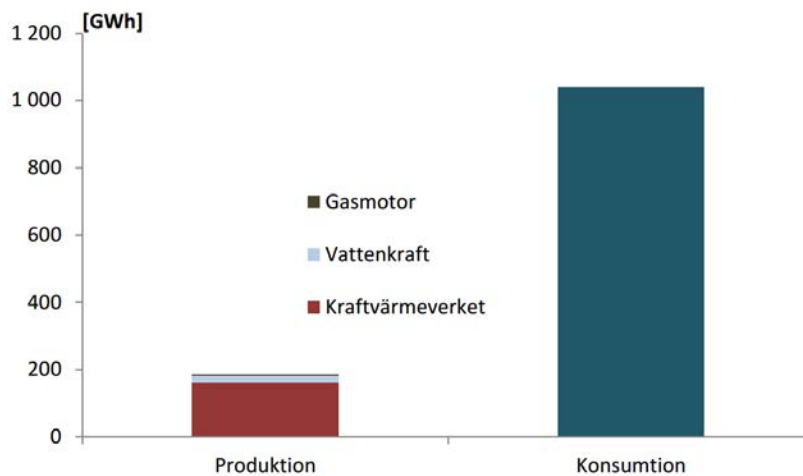


Figure 27. Consumption and production of electricity (Eskilstuna kommun, 2013f, p. 54).

Total electricity consumption (right). Most of the local electricity production (left) comes from the Eskilstuna heat and power plant, supplemented by smaller amounts from water-turbines and gas motors.

As shown in figure 26, the climate plan includes activities directly monitored by the Eskilstuna Municipal Concern as well as activities outside the Concern’s direct control, e.g., to be negotiated in partnerships. The focus of the plan, however, is on energy initiatives to be taken by the Concern. From the perspective of performance, it seems to be a sound decision. But the potentials for reducing emissions lay in the much larger municipal arena outside the Concern. This is revealed by Figure 29 and Figure 30, showing CO2 emission forecasts for 2020 by a number of different actions in the domain of the Eskilstuna Concern and the domain of the entire Eskilstuna Municipality. According to Figure 30, the Eskilstuna Municipal Concern, according to the forecast, should be able to reduce CO2 emissions by 38,000 tons - below zero – in 2020! In relative figures, this is impressive and beyond the reach of what could possibly be achieved in the entire municipality. In absolute figures, however, the 2020 forecast of CO2 emissions in the entire municipality contributes by a much larger net reduction of 126,000 tons (527,000 – 401,000); see Figure 29.

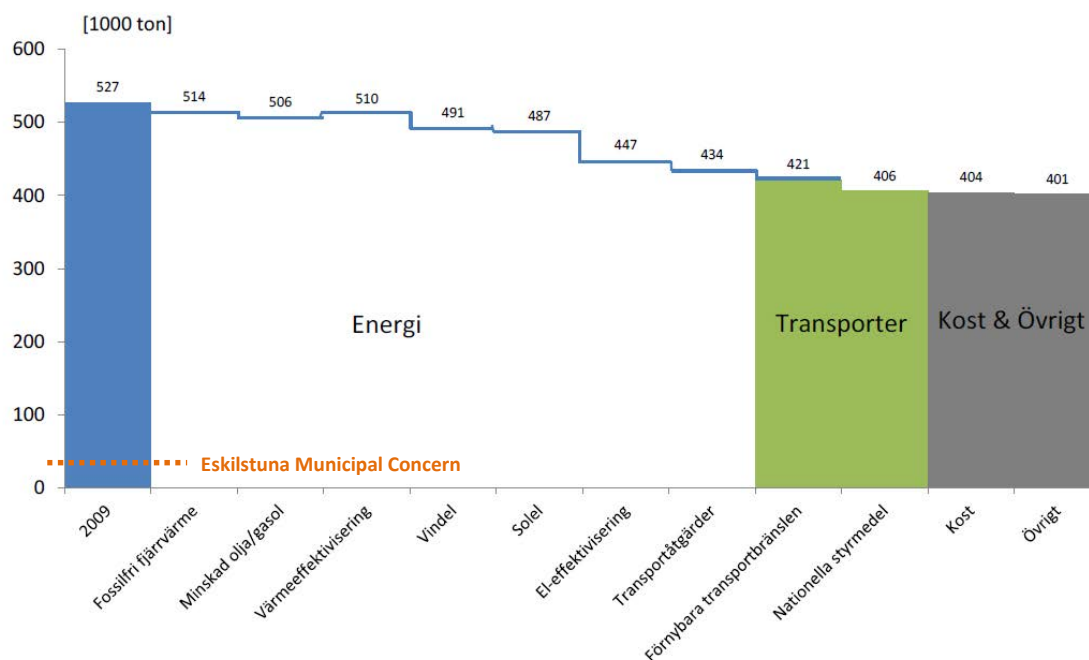


Figure 29. Forecast 2020. Reduction of CO2 emissions by different kinds of energy initiatives. Eskilstuna Municipality (Eskilstuna Kommun, 2013f, p. 45). From left to right: CO2 emissions 2009, fossil free district heating, reduction of oil consumption, more efficient heating, electricity from wind, electricity from sun, more efficient use of electricity, transport initiatives, renewable fuels in transport, national monitoring tools, food, other.

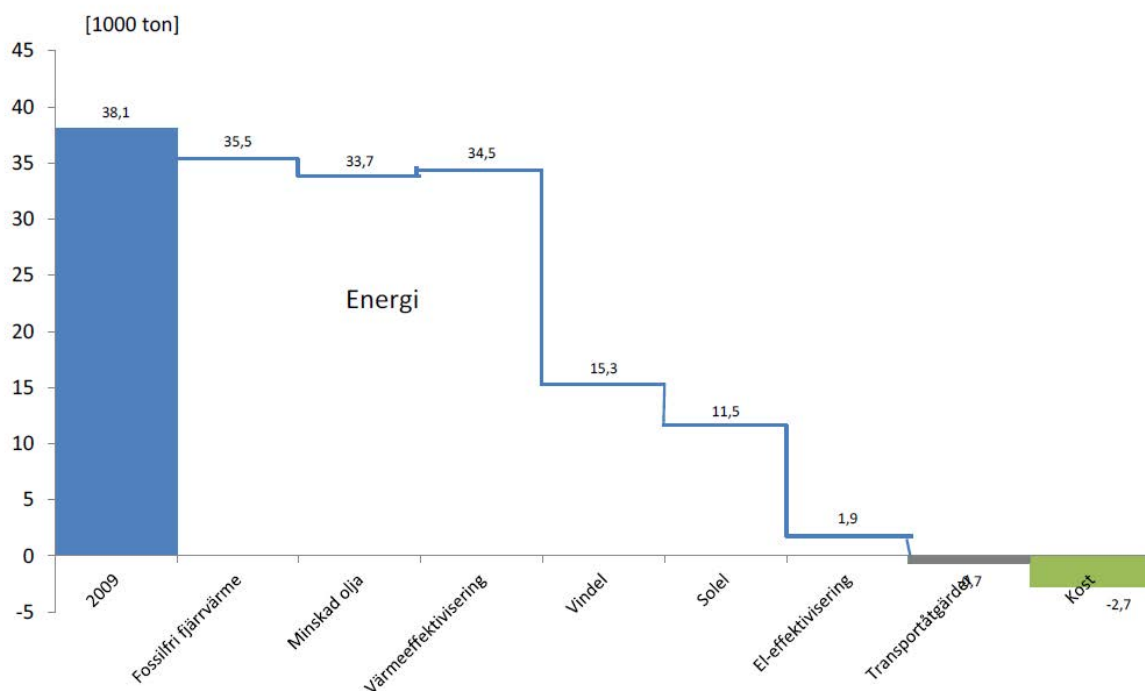


Figure 30. Forecast 2020. Reduction of CO2 emissions by different kinds of energy initiatives - Eskilstuna Municipal Concern (Eskilstuna Kommun, 2013 6 /id /ft, op. 46). From left to right: CO2 emission in 2009, district heating based on renewables, reduction of oil consumption, more efficient use of heating, electricity from wind turbines, electricity from solar cells, more efficient electricity consumption, transport initiatives, food.

From a wider climate policy perspective, the successful performance by the municipal concern may form a platform for a public-private dialogue on energy and climate issues – and the potentials identified in the entire municipality may form a platform for a dialogue

between municipalities and the state on suitable tools for encouraging for further energy and climate initiatives in the private sector.

An overview of the three major energy consuming sectors is shown in Figure 31. Most energy consumption is in the housing sector, including heat and electric appliances ('energy systems'). Worth noticing is the high share of bio fuels. The crucial tasks are related to domestic electricity consumption and to transport.

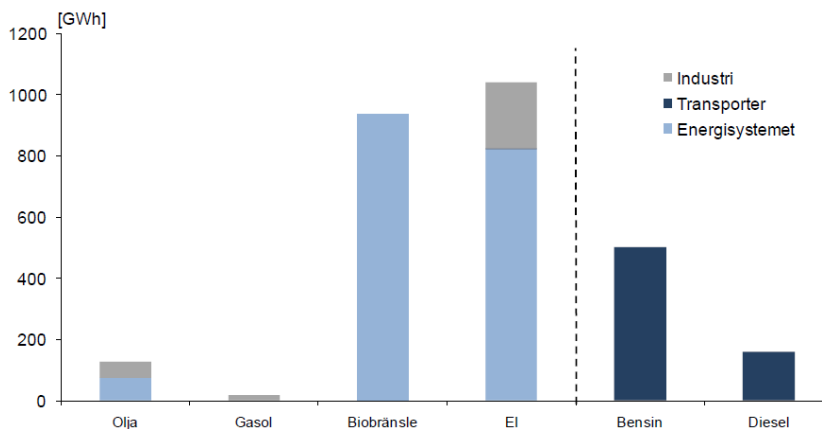


Figure 31. Total energy consumption in Eskilstuna Municipality per sector and per energy media (Eskilstuna kommun, 2013f, p. 51). Energy sectors: Industry, Transport and Energy systems (housing and related rooms, heat and electrical appliances).

Figure 32 shows energy consumption in all buildings of different usage. District heating is most frequently used (65% of all heating). Worth noticing is that district heating is used in all kinds of buildings, though most frequently in apartment houses. The diversity of types of energy consumption in single family homes reveals the diversity and individualism of this kind of housing and decisions on energy supply. Due to the scattered settlement structure, some of the single family homes cannot be connected to the district heating grid. On the other hand, individual decisions are taken so as to introduce bio energy. However, reducing consumption of direct electric heating poses a special challenge. Direct electric heating has become widely used in Sweden due to formerly very low prices for electrical energy. In the diagram, the column 'electricity consumption' exaggerates direct electricity heating, since electrical air heating units (heat pumps) are also included.

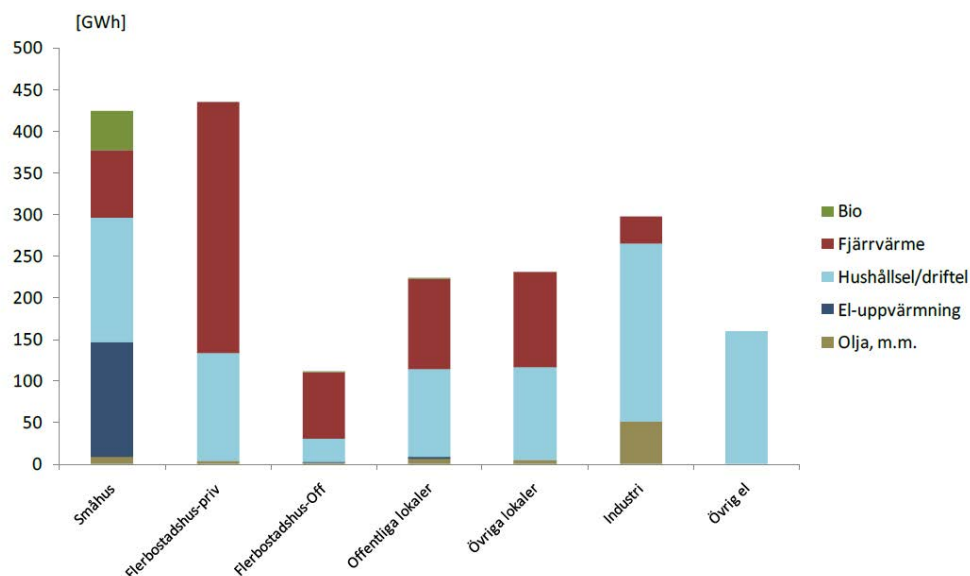


Figure 32. Energy consumption in buildings – per building use and energy type (Eskilstuna kommun, 2013f, p. 52). *Building use* from left: detached one family houses, apartment house – private, apartment house – public, public premises, other premises, industrial premises, other use of electricity. *Energy type* legend from top to bottom: bio, district heating, electric appliances, electric heating, oil.

#### 6.4.5 The climate plan and spatial planning

As mentioned above, the climate plan includes six areas of action. The 48 actions are located within the fields of action, as shown in Table 2. Most of the actions are taken by initiatives directly related to energy and alongside this, the fossil-fuel consuming transport. In the context of the PLEEC project, however, actions within societal planning are of special interest.

Table 3. Fields and number of actions in the climate plan.

Policy fields	Number of actions
1. Societal planning	5
2. Energy	18
3. Transportation	10
4. Food and consumption	5
5. Information and communication	7
6. Climate adaptation	3

The preamble to the societal planning document states:

the structure of the built environment and the population structure are a challenge as well as an option for sustainable development of society. Societal planning and especially spatial planning have a major impact on the structure and density of the built environment. The planning monopoly of the municipality regulates to a high extent the use of land and water in its own geographical area. Common infrastructure, mobility across municipal and national borders and other border crossing questions poses demands on inter-municipal and regional interaction. Therefore, societal planning is one of the most important tools for reduction of emissions of greenhouse gasses as well as more efficient use of energy. Using long term societal planning, the municipality can promote a structure of society that promotes sustainable transports and energy efficient buildings (Eskilstuna kommun, 2013f, p. 25).

Accordingly,

... the structure of the built environment has a major impact on energy consumption as well as transport needs. Housing and enterprises should be localized so that transport and energy consumption is minimized. Buildings should be situated where renewable energy or district heating is available. New build-up areas should be located in proximity to attractive public transport. Carefully planned apartment housing with good accessibility is an attractive alternative to the more scattered single family housing (Eskilstuna Kommun, 2013f, p. 26).

The five actions on societal planning are as follows:

1. Documentation of current decisions on localization and land use
2. Regulations to be included in local plans on energy, e.g. on building forms and density and performance of heating
3. Regulations on passive and low-energy buildings
4. Development of indicators for evaluation of planning alternatives
5. Proposal for establishment of climate partnerships.

The questions of the structure, density of the built environment and proximity to traffic corridor as mentioned in the preamble are not dealt with by the five actions. However, action 1 and 4 might be stepping stones for highlighting these issues, some of which have already been dealt with in the comprehensive spatial plan. To fully integrate energy and climate concerns in the spatial plan is challenging, especially if the plan should also deal with the structural questions on further integration of Eskilstuna in the Stockholm-Mälars Region.

## 6.5 Eskilstuna Energy & Environment

Eskilstuna Energy & Environment ("Eskilstuna Energi & Miljö AB") is a municipal company responsible for energy, district heating, cooling grid, electricity and network, water supply and waste-water treatment and waste treatment/recycling. In some of these areas, such as water and sewage water, cooperation with neighbouring municipalities is taking place. Hence, in December 2013, Eskilstuna Energy and Environment and the municipal district heating enterprise in the neighbouring municipality of Strängnäs established a jointly owned operating company called Eskilstuna Strängnäs Energy & Environment AB. This cooperation has led to planning and investigation of major expansions of the underground infrastructure (such as district heating, water supply and waste water treatment, broadband and electricity grid). The economy of scale is favorable to such inter-municipal 'underground urbanism'. Here we shall focus on the present district heating in Eskilstuna and the bio-gas production from waste-water.

### 6.5.1 District heating

As mentioned earlier, district heating is a key element in the climate plan. Of all heating in the municipality, 65% is carried out by district heating. Inside the Eskilstuna city, the combined heat and power district plant delivers 95% of the heating during the winter and 25% of the electricity demand. The figures 27 and 28 illustrate the earlier mentioned feature of combined heat and power, and that extra production of electricity is needed to meet the total energy needs of the municipality.

The district heating from the central heating and power plant is supplemented by smaller local district heating plants that provide heating to more outlying districts such as Kvicksund



and Ärla, see Figure 34. Outside the district heating districts, direct electric heating is supplemented by e.g. heat pumps.



Figure 28. Distribution network for district heating

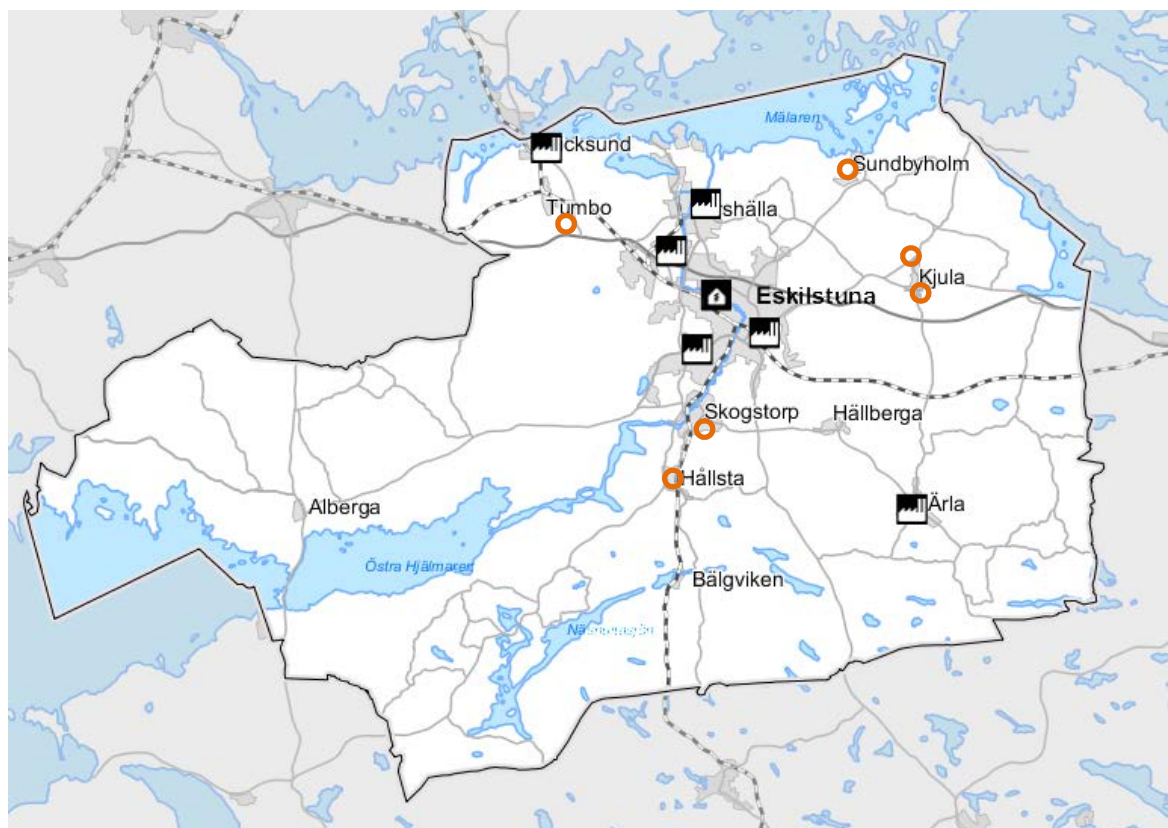


Figure 29. District heating plants in Eskilstuna.

Seven district heating plants in Eskilstuna owned by the municipal Eskilstuna Energy and Environment enterprise. Six plants, indicated by pictograms of industrial buildings with two chimneys, are single heat producers, some of them are used as reserve such as the one in Torshälla. Only one, the largest, is a combined heat and power producing plant, situated in the middle of Eskilstuna city (just left of where the city's name appears on the map). Besides these municipal plants, Eskilstuna Energy and Environment also operates small heating plants in Sundbyholm, Kjula, Skogstorp, Hållsta and Tumbo (red circles) on behalf of external owners.

### 6.5.2 District heating and urban infrastructure

The combined heat and power plant is situated close to the center of Eskilstuna. A relocation of the plant is currently being considered in order to respond to two challenges: the need for a technical renewal of a 28 year old district heating boiler and the need to reduce the heavy transport of wood chips into the city.

Eskilstuna Energy & Environment enterprise is planning to build a new, combined heating and power plant 10 km east of the city in a new logistical park (called “Eskilstuna Logistik Park” – ELP) just south of Kjula, between the Svealand Railway and the E20 motorway.

The Eskilstuna combined heat and power plant consumes about 900,000 MWh biofuels per year. The biofuel (wood chips) is delivered by 8,182 lorries per year, with varying seasonal intensity. In the cold winters, about 80 lorries pass through the town each day. With the new combined heating and power plant in operation, the annual number of transports to the city will decrease to about 3,500 lorries, while 30- 50% of the wood chips will be delivered by rail to the new plant, thus reducing the number of lorries by 2,800-4,600.

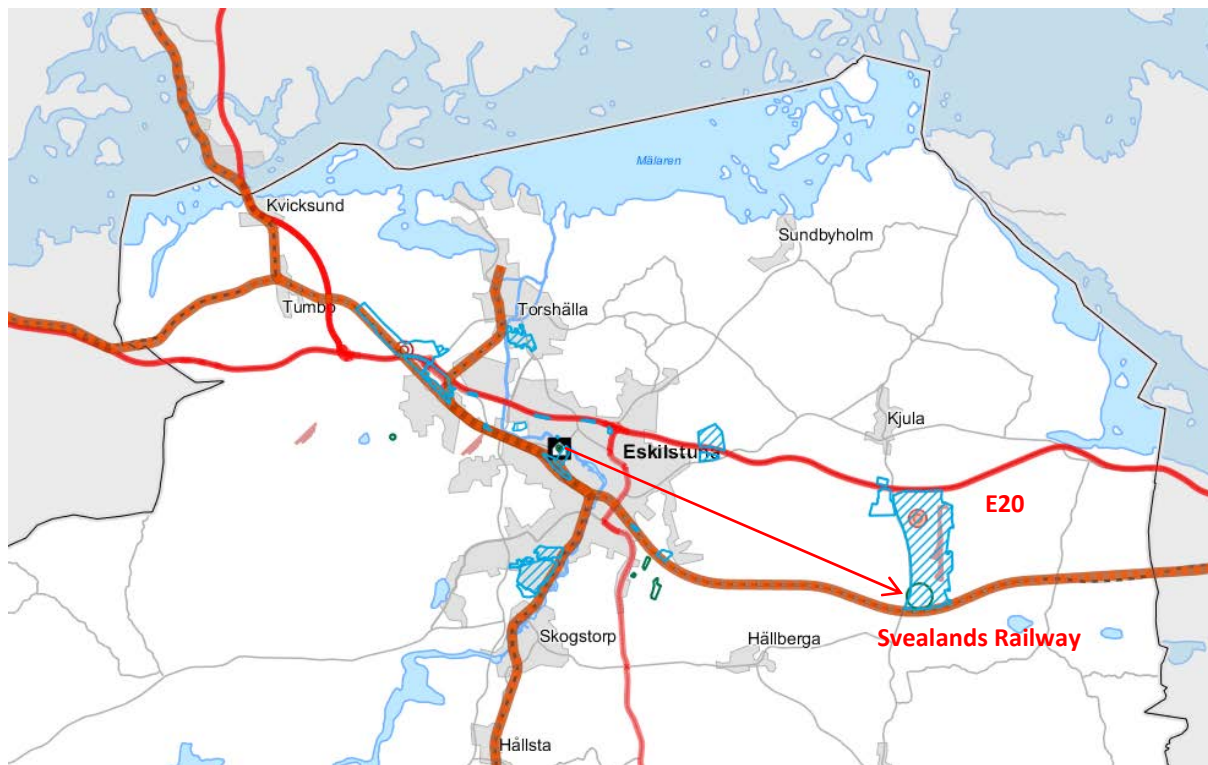


Figure 30. Eskilstuna Logistik Park. The park is situated 10 km east of Eskilstuna between the E20 motorway and the Svealand Railway. The arrow indicates the relocation of the district heating plant from the city to the logistic park – close to the railway, providing the possibility to transport wood chips by rail as well as by road. At the eastern part of the park is an airfield (the long vertical thin figure). Hence, the logistic park offers intermodal shifts between road, rail and air transport (as indicated by the small red circles).

In sum, transportation to the old and new premises will decrease to 4,800 – 6,500 lorries per year, although there is a projected increase in bio fuel consumption by 130,000 MWh.

### 6.5.3 District heating and spatial planning

More recently, the means to implement an integrative planning of district heating and spatial planning has been reduced due to a national deregulation of planning powers. Formerly, urban districts could be legally assigned for district heating. In these districts, it was compulsory for developers to connect with the district heating grid. This kind of assignment is no longer permitted. Citizens' choice of heating system has been liberalized, and the municipal planning monopoly has been cut back. Thus, homeowners are now free to choose the heating system they prefer. As a consequence, the comprehensive plan only reveals the current state of district heating and no intentional future assigned districts. The lay-out of areas intended for future housing, however, is still legal. Thus, Figure 36 shows these two kinds of areas, as well as the lack of future intended district heating areas. The municipal enterprise, Eskilstuna Energi och Miljö ('Eskilstuna Energy and Environment') has plans for the future, but realizing these plans depends on future negotiations with private developers.



Figure 31. District heating and housing. After deregulation of the planning system, it is no longer possible to assign districts for district heating. The map shows the urban areas currently provided with district heating (grey hatched) and areas planned for housing by the Eskilstuna Comprehensive plan 2013/2030 (brown hatched). No information is available regarding the future energy supply of the assigned housing areas outside the district heating areas. With the deregulation of the municipal planning monopoly, the future heating in these districts will be decided by agreements between the developer and the Eskilstuna Energy & Environment enterprise. Whether district heating will be an option for the developer depends on decisions made by Eskilstuna Energy & Environment as to the profitability of including new districts in the heating system.

### 6.5.4 Biogas from waste water

Close to the city centre, the central waste water treatment plant is situated. The pipelines and the plant were established with substantial national subsidies. In the water treatment process, biogas has been a bi-product since the 1960s. Formerly, biogas it was used for electricity production. Today, it is used as fuel for busses and municipal vehicles, not least because of the branding value.

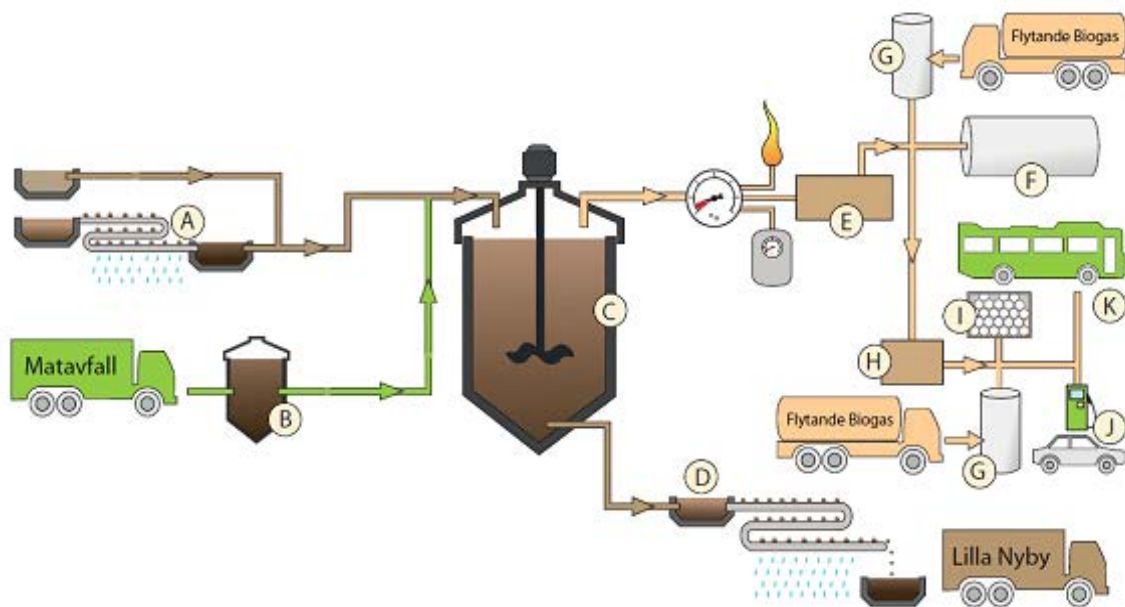


Figure 32. Biogas production in Eskilstuna.

A: Sludge from the wastewater, B: Waste from food, C: Rot chamber, D: Drainage of remaining sludge, E: Purification of Gas i.e. upgrading from 65 % to 97% methane, F: Tank for storage of biogas, G: Imported liquid methane (for back-up), H: High pressure compressor (300 bar), I: Storage in gas cylinders (300 bar), J: Public gas station, K: Gas station for busses.

## 7 Regional initiatives

The Eskilstuna sustainable planning relates as earlier emphasised to national planning. But also at the regional level, initiatives are taken.

### 7.1 Sörmland Region on commuting

The Sörmland Region (see § 3.3) elaborated a few documents revealing the regional context of the Eskilstuna climate planning. These documents include an 'outside-world' analysis, a comprehensive regional development strategy, a climate and energy strategy - and a report on commuting.

The previously mentioned regional enlargement is further documented in the report on commuting in the Södermanland County (WSP Sverige AB, 2008).

From 1993 to 2006 commuting across municipal borders increased by 45%. About two-thirds of the commuting included crossing the regional border, most of which commuted to Stockholm County.

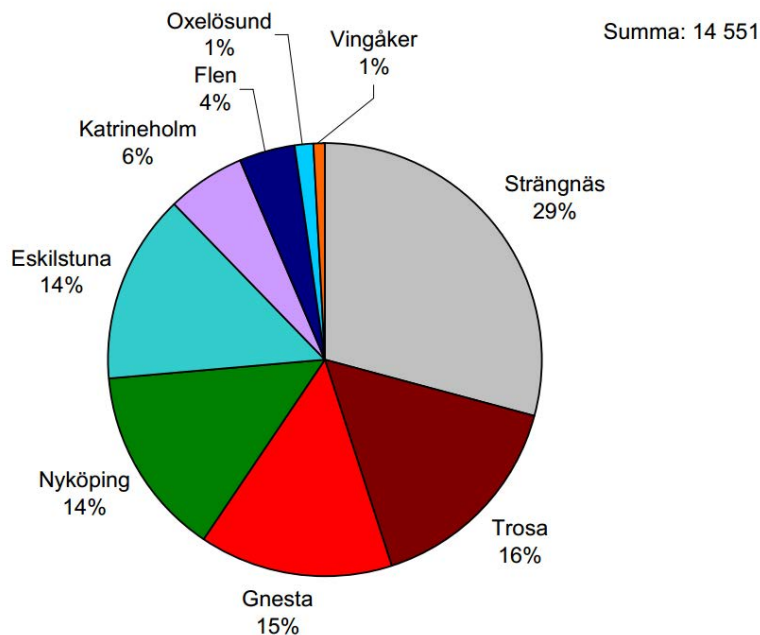


Figure 33. Out-commuting from Södermanland County to Stockholm County (WSP Sverige AB, 2008).

As shown in Figure 38, commuting generally involves the municipalities of the region, hence justifying the conception of an ongoing regional enlargement process. Out-commuting is dominated by Stockholm as the major driver of the regional enlargement process, whereas in-commuting comprises a little less than half of commuting and is more evenly distributed among three of the neighbouring counties.

As mentioned earlier, regional enlargement is seen as a driver of development by Eskilstuna municipality. In line with this, the Sörmland Regional Cooperation includes regional enlargement as a prospective in the 'outside-world analysis'. Thus, the final SWOT analysis includes as strengths: proximity to Stockholm, the position in the Stockholm-Mälars Region, and train-connection with Stockholm. Regional enlargement provides access to

competencies in an enlarged Stockholm-Mälars Region and opportunities for increased specialization. To meet these opportunities, the threats of decreasing quality of life and extended pressure on the environment following from extended travelling is, however, foreseen together with the risk of increased gasoline prices.

## 7.2 The regional county on climate

The County Administrative Boards (“Länsstyrelsen”) are responsible for mediating the implementation of the national climate policies at the regional level. The key tools of the mediator are soft ones: a vision and an agenda to provide an overview of goals and tasks to be fulfilled – mostly by agents other than the County Administrative Board.

The strategy set up a picture of the present situation and potentials for the future.... It is not the climate and energy strategy as such that reduces the emissions and changes the energy system – it is the initiatives by the *private and municipal enterprises* and – not least – the decisions *we* take every day. It is *all of us* together that are able to realize the vision until 2050 by setting up more wind turbines, making the use of energy more efficient and by setting up sustainable towns and efficient transport solutions (Länsstyrelsen Södermanlands län, 2012b, p. 4).

The strategy is accompanied by proposals for actions addressed to the relevant stakeholders, cf. 7.2.2. Hence, it is not restricted to regional stakeholders (Länsstyrelsen Södermanlands län, 2012a). It includes huge investments in advanced technology and infrastructure down to public procurement and tendering of daily necessities. The climate strategy is supposed to be a common obligation for all members of society; thus, information and education are seen as means, along with investments.

### 7.2.1 Total flows: sources of energy and sectors of consumption

The total flow of energy in Södermanland County is shown in Figure 39. The input in 2008 was 16.3 TWh needed for the consumption of 15.0 TWh and transmission and conversion losses. In the diagram, the enormous consumption of the Steelworks SSAB, located in Oxelösund, is about 7 TWh and excluded from the diagram. Transport is the largest consumer of energy, followed closely by household consumption. As with Eskilstuna, we find the most diverse consumption in the households, who use electricity as well as bio fuels and district heating. The use of electricity is omnipresent (unless with transport), due to its use for both appliances and heating.

The arrow showing electricity input does not include locally produced electricity; e.g., from combined heat-and-power plants. It is emphasized that the electricity is ‘imported’ from the national energy grid based upon nuclear power and water turbines, backed up by the Nordic energy grid in which marginal energy production is based on fossil fuels. Thus, energy consumption in the region has an impact on emissions outside the region. This is why Eskilstuna and five more municipalities in the county only purchase electricity produced from renewables.

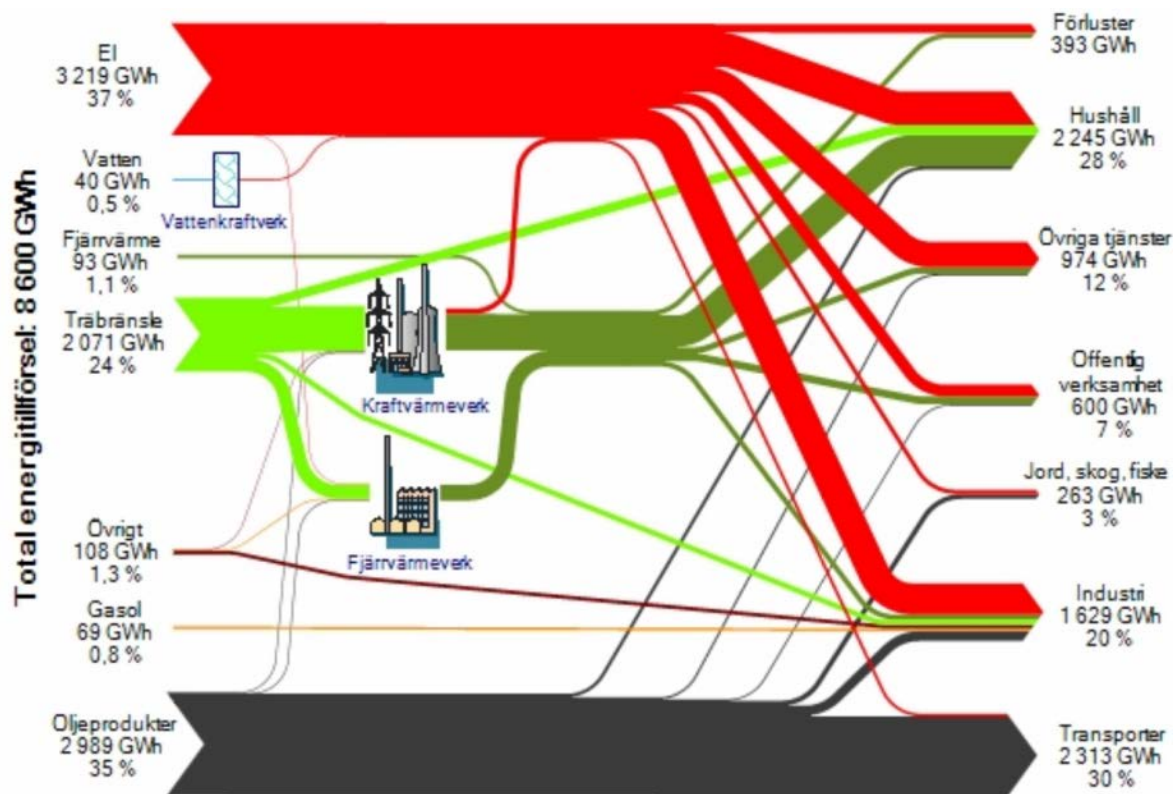


Figure 39. Diagram of energy supply and consumption in Södermanland County (the huge company SSAB not included) (Länsstyrelsen Södermanlands län, 2012b, p. 15).

The left column from top: Electricity, energy from water turbines, district heating, energy from wood, other sources, gasoline, oil products. Right column from top: Energy loss, households, other services, public enterprises, farming-forestry-fishery, industry, transport.

### 7.2.2 Fields of action

Six fields of actions are included in the plan:

1. Energy friendly housing and premises
2. Sustainable societal planning
3. Renewable energy
4. Energy efficiency and new business ideas
5. Sustainable transport systems
6. Sustainable consumption.

Of special relevance to the PLEEC WP4 is the second field of action, societal planning. As with the Eskilstuna climate plan, the structure of the built environment is stressed as highly responsible for transport needs and energy consumption. However, no further advice is given as to how to develop the structure and patterns of the built environment. The scattered urban structure and the lack of a single, large urban centre are taken as points of departure, as is the increased commuting to the Stockholm region. Special attention is given to the fact that the share of public transport in daily commuting is low. Hence, concerns are raised about the low frequencies of trains, high prices and capacity problems on single railway lines lacking double passing lines.

## 8 Pilot projects

This section illustrates how climate perspectives have been integrated into projects and development schemes. It was prepared by Vanessa Scheffler, Magdalena Lindfeldt, Per Nyzell and Sheraz Iqbal, Eskilstuna Municipality.

### 8.1 Väster – transforming an industrial area

One of the densification strategies in the Comprehensive plan is to re-use already built-up areas for industries (brownfields) and to transform them to integrated, more diversified city districts (“blandstad”).

At the same time the municipality is taking advantage of existing infrastructures (such as technical infrastructure, e.g. district heating) and the possibility of reshaping the existing infrastructure for new needs and priorities (such as traffic structure, e.g. walkability).



#### 8.1.1 Background

The first step was already taken in the 90ties when a former industrial area next to the city district Väster became Munktelstaden with new functions in existing buildings such as City Art Museum, hotel, conference centre, science centre, offices, educational establishments and leisure centre.



Figure 40. Väster in relation to the city center and Munktell. The future Väster Illustration: Andrea McNicholas

The next industrial area to be transformed is called Väster. The area is situated 10 walking minutes from the city centre and the railway station. The detailed program for the area (“Fördjupning av programmet”) comprises a vision as well as the main development guidelines and strategies with a planning perspective until 2030.

#### 8.1.2 Structure driven energy efficiency

Due to planning level and current legislation, the detailed program addresses among others following strategies and measures when it comes to energy related issues:

- Better preconditions for sustainable transports  
Urban planning is based on prioritizing pedestrians, bicycles and public transportation before cars. Walkability first! Thus energy efficient behaviour is facilitated in order to shorten the energy consumption for transportation.
- Enhancements in sustainable traffic structure/grid and more quality/comfort



Traffic simulations and space syntax analyses for public transport, bicycle and pedestrians were done showing among others missing links and consequences of different grid structures. They build the base for reshaping existing traffic structures to the needs of sustainable transports today (such as gene, attractive and secure strings/paths).

- Diversity and a mixture of different functions  
Strengthening diversity by densification and re-use within and nearby the area helps to minimize the need of cars and is part of various built environment
- Re-use of former industrial buildings for other functions  
Cultural heritage, identity, energy-efficiency, walkability

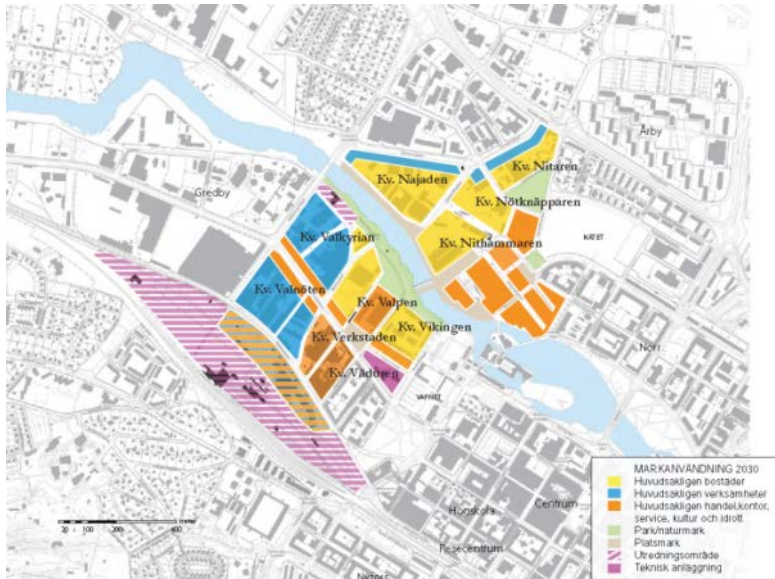


Figure 41. Proposal for a transformed, diverse city district.

### 8.1.3 Success factors

- High political ambition and leadership  
The city of Eskilstuna has taken a holistic attitude to sustainability and development of the city. Political ambition and leadership is strong, with goals set at a high level.
- Participation and co-operation for long-term commitments

The planning process was based on a holistic approach and broad participation and cooperation. Both the city departments and the public were involved including such as organizations, enterprises and the property owners. Through workshops and dialog the commitment to the development has been discussed and agreed upon. To develop a sustainable city is a team task - all actors taking responsibility for this are winners. The Swedish Energy Agency's program for a Sustainable Municipality (“Uthållig kommun”) has given the planning progress experiences and knowledge from other municipalities. It has provided support and good examples of the work done by the participating municipalities.

### 8.1.4 A sneak preview of ongoing projects

Now the established co-work with the property owners is going into a new stage. From vision to reality the next step is to put detailed development plans, building permits and projects into reality. Some ongoing projects are:

- A new bridge for bicycle and pedestrians over Eskilstuna river – a missing link in the bicycle/pedestrian network is built

- The swimming hall is just under construction – the new energy efficient building is under construction and certified as environmental building – grade gold (“miljöbyggnad - guld”)
- One of the first detailed development plan for 400 bostäder is under preparation, the detailed plan for an arena has been approved 2013.

## 8.2 Lagersberg – transforming a ‘million program area’

Lagersberg is situated about 3 km south of the city centre and one of the housing areas in Eskilstuna from the so called million program with potential for more efficient energy use. The housing area is also characterized by former traffic planning ideals with traffic separation and over-sized streets.

### 8.2.1 Background

The rental apartments are owned by the municipal housing company “Eskilstuna Kommunfastigheter AB” (Kfast). The company has initiated the project “Green and beautiful Lagersberg” (“Gröna sköna Lagersberg”). The project consists of three parts: Renovation of the 430 apartments for more energy efficiency, inspiring and secure common green spaces as well as residents and others being more aware about environmental and energy issues. The project is implemented between 2012 and 2015, and split into four implementation periods. The costs are about 300 mio SEK and financed by decreased energy costs, directed services and a low rent increase.

The housing area is also part of other projects of the municipality such as the so called urban integration project (“Stadsläkningsprojektet”) . Analyses have among others investigated the possibilities for two densification strategies from the Comprehensive plan: On the one hand to link together existing city districts by new buildings and on the other hand - within 3 km from the city centre - to build dense housing structures along oversized streets.

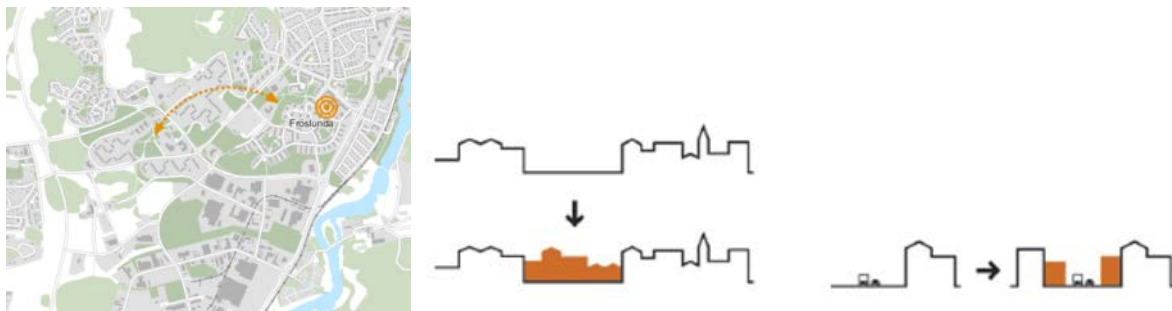


Figure 42. Strategic links between city districts and some of the densification strategies in the comprehensive plan 2030

### 8.2.2 Structure driven energy efficiency

The aim of the renovation project is to decrease the energy use from 180 kWh/m<sup>2</sup> to about 90 kWh/m<sup>2</sup>. The tenants stay and live in their flats during the renovation.

As a first step, a so called testing house was renovated being a reference for investments later on. Together with contractors and engineers a range of measures has assessed being most energy efficient in the existing buildings. Some of the energy efficiency measures are: Better isolation of the facade and loft/roof, replacement of plumbing, replacement of windows, new bathrooms, installation of solar panels for the production of warm water, installation of solar cells for the production of electricity (ca 750 m<sup>2</sup>) and presence

monitored lighting. Evaluating the results of phase 1 showed that the energy use had decreased to 101 kWh/m<sup>2</sup>. The rent increase was about 330 SEK per month.



Figure 43. The four phases

The urban integration project (Stadsläkningsprojektet) and its aims:

1. Better structural links between city districts (e.g. for pedestrians and cyclists)
2. Create more attractive built environments
3. Strengthen possibilities for companies and densification of housing

Space syntax analyses have been done to see the integration level for different existing paths and streets as well as where to develop new links in the grid and to surrounding areas. At the moment different densification areas and designs are under discussion.



Figure 34. Analyse space syntax and how to strengthen links, nya GC-vägar, ny vägnät



Figure 35. Some parts in the existing city structure under discussion for densification

### 8.2.3 Success factors

- Different implementation phases  
Evaluation of measures and their performance in reality before the next implementation phase.
- Energy efficiency measures in housing constructions linked with behavioural measures  
Some new technical solutions, such as individual measuring of warm water are requiring behavioural changes in order to show full effect. Energy efficiency measures are embedded in a broader context of energy and sustainability issues.
- Co-operation is central  
During construction: so called partnering, in other parts by participation of tenants and others. Some of the co-operation partners are Lagersbergsbor, Eskilstuna Kommuns förvaltningar (LaRSprojektet), Lagersbergsskolan and Fritidsgården. Eskilstuna Energi & Miljö, Hyresgästföreningen, Eskilstuna Folkhögskola, Interactive Institute Swedish ICT, Energimyndigheten, SABO, Eskilstuna Friidrott, Nätverket Din Idé, NCC, Maskinringen.

### 8.2.4 A sneak preview of ongoing projects

- Starting phase three and four
- Further discussions of the densification proposals of the Stadsläkningsprojektet  
The areas proposed for further densification are now discussed in different contexts and forums.

## 8.3 Sustainable transport: “Take the bus when you can, take the car when you have to”

As a result of former urban and transport planning with the car as norm, Eskilstuna had a low share of public transport for many years – even compared to other cities at the same size.

### 8.3.1 Background

Due to rationalization in industries, public transportation decreased dramatically between 1999 and 2002. In 2002 the pupil card (“elevkort”) was introduced and as a result the amount of travelers in the local busses (“stadstrafiken”) increased. But between 2007 and 2011, travelling in local busses stagnated again. 2010, the town planning board/committee (“Stadsbyggnadsnämnden”) approved a declaration of intent for public transport. It said that the car no longer was the norm for urban and transport planning in Eskilstuna, and three overall aims were set:

- 1) To double the travels by public transport from 2006 until 2020
- 2) All buses use renewable fuel, latest by 2020
- 3) Accessibility to public transport to be increase until 2020

### 8.3.2 Structure driven energy efficiency

In 2011 Eskilstuna municipality and the regional transport authority (Länstrafiken Sörmland) introduced new bus routes with shorter travel times and intervals. There are more biogas buses, countryside routes directly to the city centre (without change to inner city busses) and subsidised fees. Today, there are 14 radial local bus routes, most of which are connected with the central market place – ‘Fristadstorget’. There are also 10 regional routes (“landsbygdslinjer”) with varying departure intervalls.

Route 1 and 2 are main routes with most of the users and departures every 10 minutes. Route 3 and 4 depart every 15 minutes. The remaining routes depart once or twice an hour. The main function of some routes is feeding in to the main routes 1 and 2.

There are three bigger travel nodes:

- the central market place Fristadstorget in Eskilstuna where inner city and regional busses meets
- the central station as an intermodal node between trains and some inner city and regional busses
- the central market place Östra torget in Torshälla as a node for buss changes to Mälardalen and Mälby.

However, a cohesive and easy accessible bus terminal is still lacking.

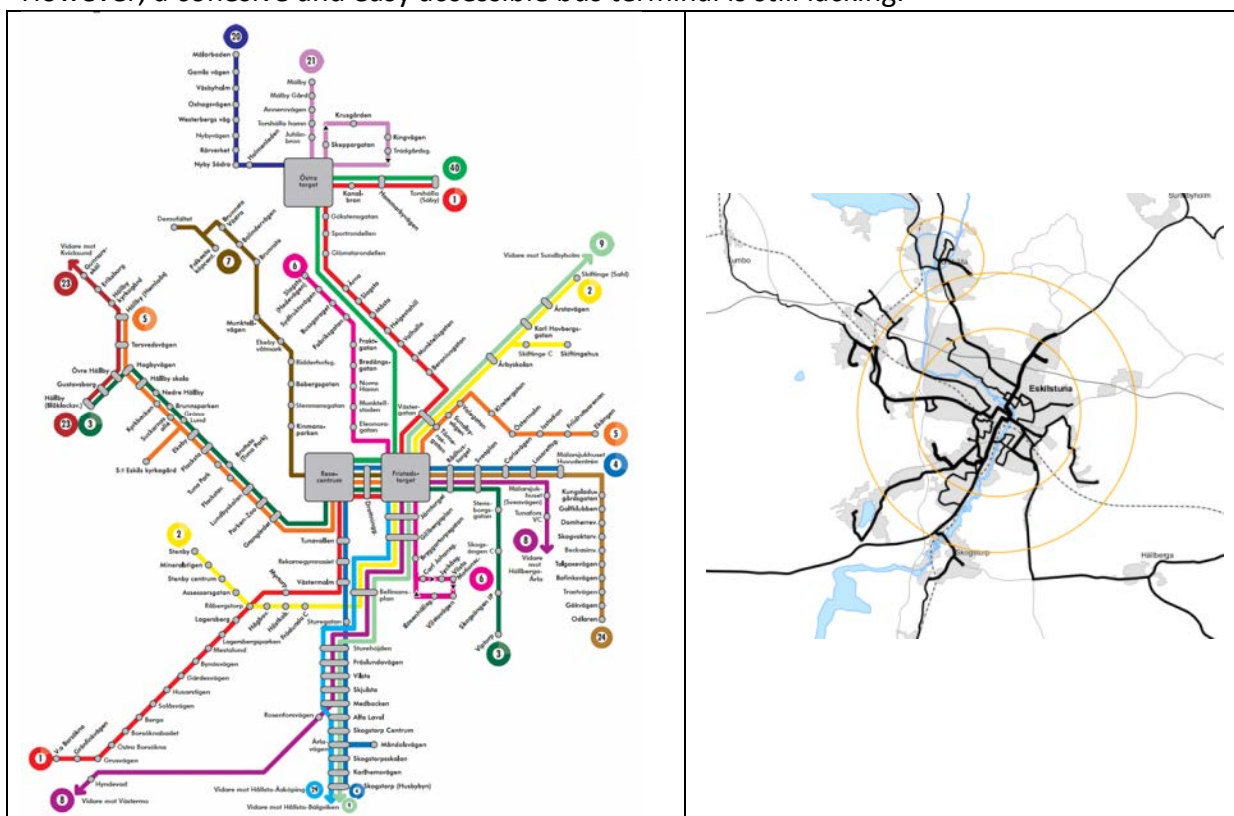


Figure 36. Public transport network (left) and frequency of buses per hour and bus lines (right).

From December 2011 until September 2012, the total amount of travels has increased with 6 % and still continues increasing for both – pupils and paying travellers.

### 8.3.3 Success factors

- Corporation and participation between three partners: Eskilstuna Municipality – Regional transport authority (Länstrafiken) - Veolia
- Improved accessibility: Prioritizing traffic light for busses – separate bus lanes – more direct bus routes
- Information to passengers: real time system

- Accessibility accommodation: 70% of bus stops in the central part of the city are accessible for disabled persons
- Tax: Eskilstuna municipality favours tax subsidies for travellers



Figure 37. Buss designed by pupils, foto: Göran Jonsson

#### 8.3.4 A sneak preview of ongoing projects

- New residential developments will be planned close to existing public transport routes to increase the number of users.
- New travel centre ("resecentrum" at central station)

With the increasing amount of travellers by train the future development of the central train station to a modern travel node and more integrated part of the city is under discussion. It strengthens also Eskilstunas role as a regional node. At the same time it increases also the accessibility and attractiveness of the area for both – business and citizens

## 9 Summary of urban energy planning in the city

These years, the concern for energy efficiency and climate is made an omnipresent issue in Eskilstuna. Hence, the concern is revealed not only by planning documents but also by e.g. the operation of municipal supply and services and the daily management of public enterprises.

*The climate plan* introduces a clear distinction between the municipality as an enterprise and as an agent. As an enterprise, the municipality is capable of carrying through projects and setting up milestones for its own activities. As an agent, the municipality is negotiating with private companies, organisations, private persons, interest groups and the general public in order to promote a positive attitude and involvement in energy efficient projects.

The climate plan provides an analytical overview of energy consumption and supply as well as an overview of current initiatives and the most relevant tools for a municipal energy policy. Thus, the climate plan is a key instrument for formulation of the climate and energy issues.

One of the most important organisations to cope with energy is the municipal enterprise, Eskilstuna Energy & Environment. The enterprise is responsible for running the combined power and district heating plant, including the former conversion of the plant to bio-fuels. Also, the enterprise has introduced biogas production from wastewater, now being used locally as fuel for public busses.

One of the most pressing issues for the *comprehensive spatial planning* is guiding future urban development into dense development in or close to existing urban centres and along public transport connections between such centres. Surprisingly, a deregulation of former

planning powers for the zoning of energy districts with compulsory supply of district heating has taken place, leaving the issue to negotiations between the supplier and the consumer.

*The traffic plan* is an integral part of the municipal set up of planning. The plan provides analytical overviews, two of which are related to urban structure, i.e. a ‘thinning out’ process of the urban tissue, caused by the excessive land use demands and a dispersion of urban functions, notably retail. Goals are formulated for future composition of traffic modes, bicycle networks and public transportation.

*Municipal buildings and projects* are set up, aiming at energy efficiency along with general planning principles. In this report three such initiatives are reported in detail. All of them are contributing to the afore-mentioned principle of concentrating urban development in the existing urban environments and the connection between them: transformation and integration of a former industrial area into the urban environment, refurbishing and integration of one of Eskilstuna’s large scale residential neighbourhoods of the 1960s and initiatives to improve peoples’ use of public transport.

## 10 Perspectives for thematic report

For the thematic report several findings of the Eskilstuna case may be considered in relation with the other cases.

### 10.1 Planning and monitoring

#### 10.1.1 Effectiveness and potentials

One of the primary lessons from Eskilstuna concerns the distinction between climate plans and projects run by the municipal concern and the climate strategies to be developed in cooperation with the wider municipal community. The municipal climate plans and projects are carried out with high level of efficiency by the Eskilstuna municipal concern, which is in charge of all decisions concerning municipal planning, services and infrastructure.

As compared to the municipal climate plans and projects, the climate strategies concerning the entire municipality have much larger potentials for e.g. CO<sub>2</sub> savings, but the development and implementation of such strategies relies upon partnerships to be formed between the Eskilstuna municipal concern and e.g. private companies, organizations and the public, all of which operate outside the direct control of the municipality.

The distinction between these two policy areas is very relevant and operational for the preparation of plans, projects and strategies.

#### 10.1.2 Spatial planning and other kinds of planning

In Eskilstuna, comprehensive spatial planning is emphasized a key instrument of sustainable development, but the idea of sustainable development has not been left to a single kind of planning or policy. To a very high degree, sustainability has become omnipresent, integrated across sectors and between levels in the municipal organization. Thus, we are not dealing with a sectorial responsibility but with more general commitments. Comparing Eskilstuna and other municipalities it is, thus, needed to take into account the extent into which planning is operating on the backcloth of a general culture or commitments of sustainability.

### 10.1.3 Spatial planning – periodical understanding

To understand the contribution of spatial planning to the agenda of sustainability, it is important to acknowledge the interplay between elements decisive to spatial planning:

- *Legal setup* of planning duties and competencies
- Shifting *challenges from the outside world*, e.g. economic conjunctures
- Shifting *political agendas*, will and commitment

This setup varies over time and makes it suitable to identify periods of planning characterized by certain specific efforts, successes, failures or dependencies in the developing from the outside.

### 10.1.4 Strong trends and mild answers

Climate and energy planning is faced with strong societal development trends the impact of which are related to higher energy consumption (e.g. excessive consumption of land, regional enlargement and the scattering of urban functions, strong traditions for open settlement structure and increasing car ownership). Policies matching these trends by equally strong tools are not realistic. Therefore, climate and energy planning opt for what is feasible: to introduce second order principles of sustainability.

The Eskilstuna case, thus, demonstrates that climate policies are to be developed subordinate to the basic drivers of economic development. In Eskilstuna, regional enlargement offered the municipality a way out of a long economic downturn from the mid-1970s to the late 1990s. Regional enlargement is facilitated by increased commuting, i.e. an increase of one of the three key drivers of CO<sub>2</sub> emissions. This process of development of the regional urban system is not questioned. It is taken as the background for initiatives aimed at compensating for the effects of commuting, such as policies for enhancing commuting by train rather than car and the development of a dense urban structure in hub-and-spoke patterns adjacent to public transport lines. Strictly speaking, the refurbishment of urban structure is probably a second order policy compensating for the development of regional urban systems.

### 10.1.5 Strategic planning

Two kinds of strategic planning are at play: (1) matching trends in the outside world (e.g. ‘threats’ and ‘opportunities’) and (2) setting up hierarchies of visions (strategy) and goals (plans and projects).

“Mild answers to strong trends” are part of the ‘strategy 2’ vocabulary: setting up directions to follow rather than milestones to be met. At the strategic level, everything is correct, but at the operational level tools are too soft to really follow-up.

## 10.2 Urban structure and morphology

### 10.2.1 Urban structure: hubs of savings and consumption?

Energy consumption corresponds with urban development. Accordingly, principles of urban development, notably urban structure, are supposed crucial for energy consumption. To deal with urban structure is typically a second order planning issue. Not the entire urban structure is at play in existing cities. Only marginal changes or enhancement of existing potentials are possible. In Eskilstuna, a radical decision was taken to abandon former planning in the attractive coastal area of the Mälaren. Further, it was decided to concentrate



future urban development within or close to the existing urban cores as well as in connection with public transport links between these cores.

## 10.3 Energy

### 10.3.1 Combined district heating and power

95% of the city of Eskilstuna is service by district heating, produced at a combined power and heating plant. Only 25% of the electricity consumption is provided by the plant. Thus, the remaining 75% of electricity consumption has to be imported from the national grid.

### 10.3.2 District heating

District heating is best suited for dense urban areas. In rural and scattered urban areas district heating is not feasible and must be supplemented by other sources, notably heat-pumps.

A tool for improving district heating in future urban development is the zoning of energy districts for compulsory energy supply. This tool has been widely used. In Sweden a deregulation of planning has taken place. Therefore, the provision of district heating in residential as well as industrial areas is a subject of negotiations.

### 10.3.3 The three 'sinners'

The largest amount of energy consumption is in the sectors of transport, households and industry. They are the 'sinners', but they have different potentials for reduction of CO<sub>2</sub> emissions. Households and transport are the largest consumers, almost even. But they differ in potentials for reducing the CO<sub>2</sub> emissions. With few exemptions transportation depends on fossil fuels, whereas energy for households is composed by a number of energy sources, including an increasing amount of renewables operated by large district heating plants as well as individual house owners.

Thus, national measures are efficiently introduced in the conversion of district heating into renewables as well as conversion of the heating of single family dwellings using heat pumps and solar cells. Designing incentives to reduce fossil fuels in transport remains the key challenge, exacerbated as it is by strong structural development trends that have increased transport both internationally and regionally. Worth noticing is that recent figures reveal a stand-still or even decrease of car-use as measured by personal kilometres per year.

At municipal level the consumption of electricity is of special concern. Only about 25% it is possible to produce by local combined power and district heating plants. Some small additional power may be provided locally by e.g. solar cells. But for the remaining part consumers are dependent upon national grids, i.e. power produced by energy sources that are beyond the control of the municipality.

## 11 Lessons and links to other PLEEC work packages

Is to follow after Delft

## 12 Annex 1. Spatial planning: system and plans

Prepared by Vanessa by Vanessa Scheffler, Eskilstuna Municipality.

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The municipal planning monopol („kommunalt planmonopol“) has a long tradition in the Swedish spatial planning. Thus it is up to the municipality to make spatial plans showing how to use the land and water. Spatial planning at the local level is mostly done by two instruments - the comprehensive plan and detailed development plans.

The control of land use and development within the municipality takes place through the detailed development plan („detaljplan“), which is the implementation instrument of the municipality.

### 12.1 Comprehensive plan – one of the local instruments for spatial planning

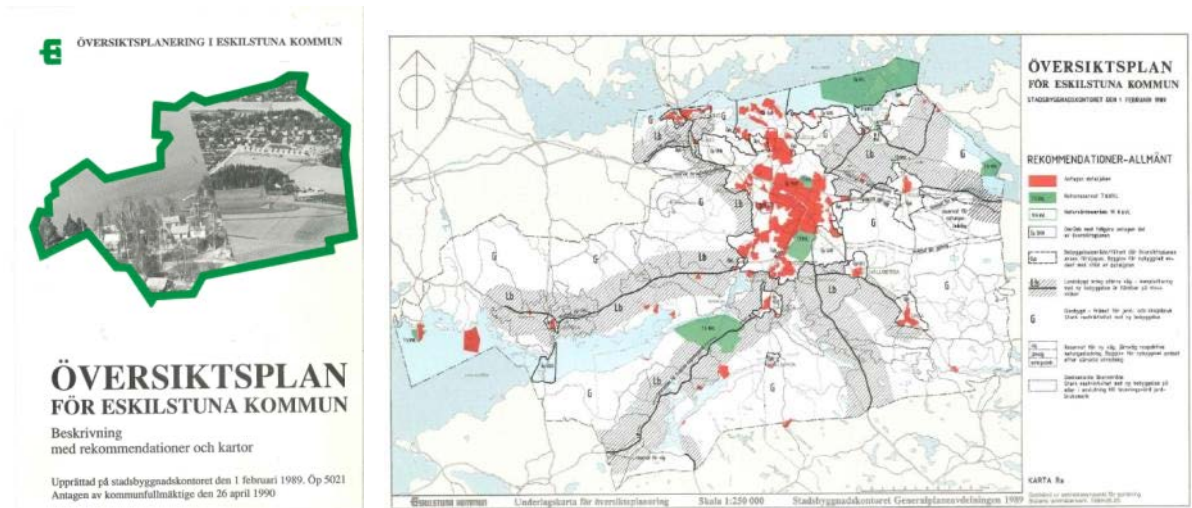
Since the introducing of the Planning and Building Act („Plan- och bygglagen“ – PBL) in 1987 municipalities are required to have an up-to-date comprehensive plan for the whole municipality. The comprehensive plan shows the long-term development of the physical environment, the future use of land and water, how to accommodate national interests („riksintressen“) and general interests („allmänna intressen“) such as natural resources. The plan is legally non-binding but a steering document within the municipal concern and has a guiding function for detailed development plans and building permits. Thus the comprehensive plan is both – strategic and guiding. At least once each legislative period (four years) the city council is supposed to prove if the plan is still up-to-date or needs to be revised.

The reason that municipalities follow these non-binding plans is the consensus-based process where among others private organizations, public agencies, and citizens are involved. Thus the plan reflects an integration of various perspectives.

There is a possibility to deepen the comprehensive plan thematically for the whole area of the municipality (e.g. wind power) or geographically for parts of the municipality (e.g. city center) (so called detailed comprehensive plan – „fördjupad översiktsplan“).

### 12.2 The comprehensive plan 1990 (“Översiktsplan 1990“)

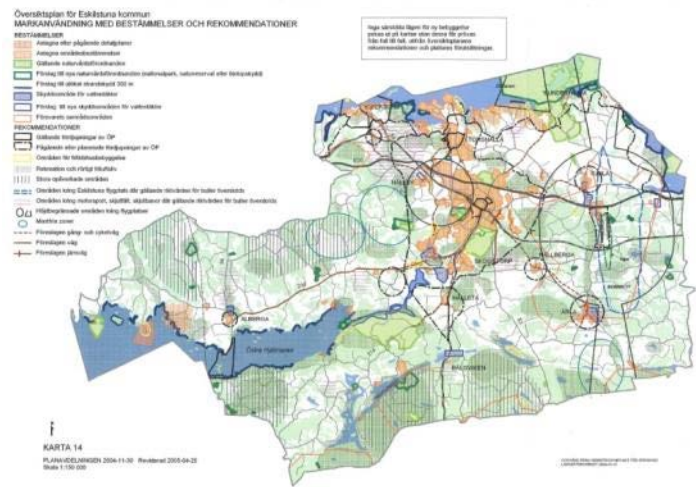
The new Planning and Building Act 1987 („Plan- och bygglagen“ – PBL) made comprehensive planning compulsory for municipalities. The act aimed among others to hushållning with resources and a general feasibility study for new built-up areas (“lämplighetsprövning“).



The comprehensive plan 1990 shows mostly the future use of land and water and how to treat different interests such as national interests („Riksdirektivet“). There is no strategic part.

**12.3 The comprehensive plan 2005 (“Översiktsplan 2005”)**

In 1996 the role of the comprehensive plan was strengthened: The up-to-date status had to be proven each legislative period. The plan should show environmental and risk factors, how to develop and preserve the built environment and consequences of the comprehensive plan should be described.



Framsida ÖP 2005

Figur 48. Markanvändning med bestämmelser – översiktsplan 2005

During the 1990’s the municipality was still quite strict with building permits at the countryside. However, this attitude was weakened up. In the late 90ties, Svealandsbanan (1997) and the motorway (2004) were built strengthening the regional enlargement. The traveltime to Stockholm went about one hour by train. At the same time the water and sewage water network was build-out along the Mälaren coast in order to prevent lake Mälaren from eutrophication. Thus summer cottages were turning into permanent housing (often including houses getting bigger). In the beginning of 2000, the municipality even had a marketing campaign at the central station in Stockholm in order to attract people to

Eskilstuna. The pattern of settlement had changed to urban sprawl and car-dependency (difficult with public transport in that areas).

As a consequence, the comprehensive plan 2005 (“Översiktsplan 2005”) started a discussion about issues like compact city and sustainability as well as the future development along the coast Mälaren. In order to meet the new tendencies and questions of urban planning, two detailed comprehensive plans were made parallel to the new comprehensive plan 2005 – one for the city (“FÖP Stadsbygden 2005”) the other for the coast Mälaren (“FÖP Mälärstranden 2005”).

However, it was difficult to change the ongoing tendencies of development from one to another day and the discussion about compact city and the future development along the Mälaren was started again with the comprehensive plan 2030 (“Översiktsplan 2030”).

## 12.4 The comprehensive plan 2030 (“Översiktsplan 2030”)

2011 the Planning and Building Act was revised. The strategic function was further strengthened (long-term development of the built environment, national/regional aims with bearing for sustainable development such as environmental quality objectives, regional climate and energy strategies, county plans for transport infrastructure and transport policy objectives). Under the new Act municipalities are to take account of environmental and climate aspects which includes both reduced climate impact and adaptation to climate change. Inter-municipal and regional circumstances were encouraged. The demand for control of up-to date status each legislative period was strengthened.



Figure 49. The comprehensive plan 2030 (“Översiktsplan 2030”) – One of the maps showing the future use of land and water areas

The Stockholm-Mälaren Region continues its development as a functional region with Eskilstuna as a part of it. Comprehensive planning in a sustainable way has to be seen even in its regional context (such as functional region, traffic and technical infrastructure, national goals and interests on a regional/local level). Co-operation with other cities in the functional region, such as Västerås becomes more and more important and comprises more and more issues (see “Samhällskontraktet”). Despite former tendencies of urban sprawl, there are still good preconditions for a dense urban structure (see densification principles) and about 2/3 of the population is still living in a comfortable bicycle distance - about 3 km from the city centre. The development within the city center is starting again with new buildings on former demolition properties. Until 2030, Eskilstuna needs to build about 5000 bostäder.

By emphasizing the planning horizon in the name – the year 2030 – the title indicates the change to a more strategic document, a long-term development and a common vision for 2030 shared by the municipal concern. Regional aspects are pointed out stronger.

Another aspect strengthening the strategic approach is part of the planning process. Parallel to the comprehensive plan two other steering documents were started – the traffic plan and the climate plan. Together they built a strong set of well-synchronized strategic documents. There is also a strong political backing for the idea of a compact and diverse city.

During the planning process, the idea of a compact city and how to develop along the coast Mälaren were part of the discussions again, e.g. by four scenarios. In the end, the comprehensive plan 2030 replaced the former detailed comprehensive plan for Mälärstranden.



Figure 50. Left: 4 scenarios discussed during the process with the comprehensive plan 2030. Right: Development schemes showing the future linkage between urban and traffic structure as well as the green fingers.

Some targets related to energy issues in the comprehensive plan 2030:

- Strengthen regional links
- Growth with dense urban structure, development along public transport strings, resource efficiency and accessibility
- Create diversity of the built environment

Karta 1

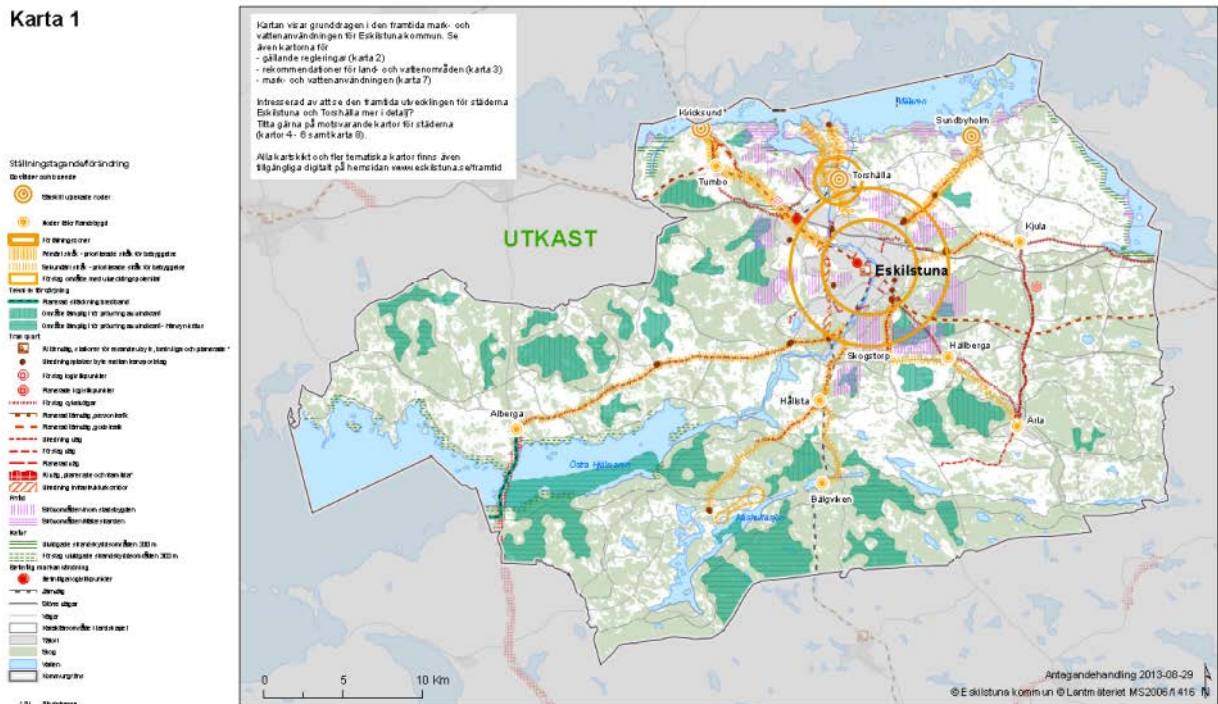


Figure 51. Main principles in the future development.

Legend: 1. densification inwards in order to strengthen compact and diverse cities (larger circles around the cities Eskilstuna and Torshälla). 2. growth with complementary single buildings along public transport lanes and water/sewage water infrastructure (hatched lines). This is done like in a necklace of pearls to three main nodes (bold double-circles Kvikksund, Torshälla and Sundbyholm). 3. completion in smaller nodes/villages (small circles around Alberga, Bålgviken, Hållsta, Ärla, Hållberga, Kjula) and existing housing in rural areas.

Some important planning principles and discussed issues related to energy aspects:

- Densification and diversification - Different densification strategies (see figure 52, such as F: transformation of industrial areas in order to create more mixed-used areas)

- A. Möjliggöra vertikal förtätning i stadscentrum inom vissa ramar vad avser boende kvaliteter som tillgång till p-platser och grönytor
- B. Utnyttja obebyggd impedimentmark och lucktomter
- C. Bygga ihop stadsdelar
- D. Inom zonen 3 km från centrum byggs stadsmässigt kring idag överbredda gator.
- E. Utnyttja parkeringsytor som inte nyttjas fullt ut
- F. Vissa industriområden och annan exploaterad mark omvandlas till blandstad med bostadsområden, handel och verksamheter – ex Väster.
- G. Bygga ut med enkelsidigt utnyttjade gator
- H. Utnyttja bullerstörda lägen längs trafikleder för verksamheter
- I. Förtätning sker där potential finns med hänsyn till tillgång och kvalitet på grönområden och andra friarealer.

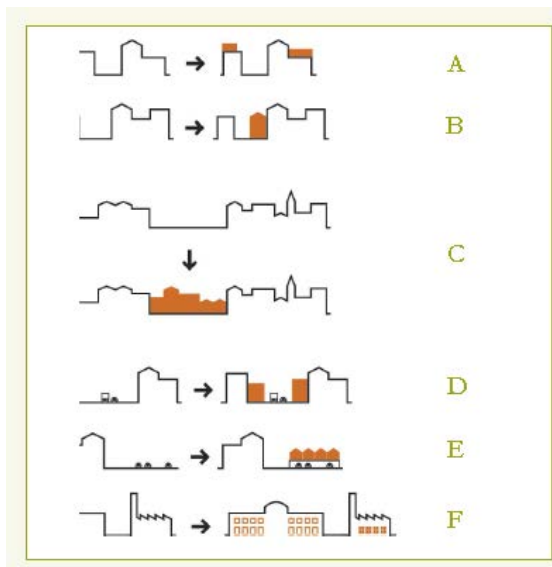


Figure 52. Densification principles

- Sustainable transportation – the car is no longer the norm but pedestrians (see also traffic plan)
- Transport intermodality - the comprehensive plan supposes locations where to examine intermodality between different traffic parts
- Location of housing within bicycle-distance from the city centres or in proximity to public transportation
- Logistics - a new logistic centre called ELP in the south-east of the municipality (Kjula)
- National interest wind power

For the first time, Eskilstuna municipality shows where to adapt the national interest at the local level.

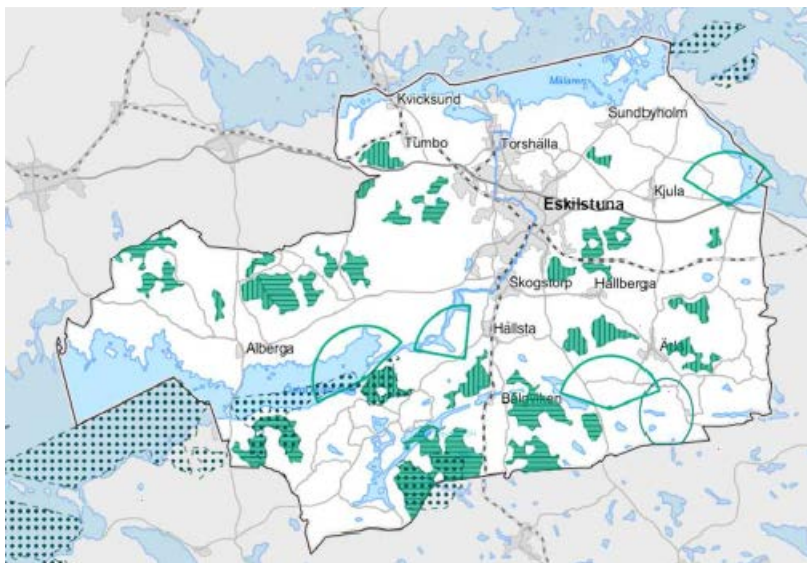


Figure 53. National interest of wind power in a local perspective (The national areas are dotted, suitable areas from a local point of view green with lines in different directions)

The comprehensive plan 2030 is seen as the first experience towards more rolling, flexible comprehensive planning and urban development process in Eskilstuna. The aim is to act as a long-term urban development program that provides support for priorities in the shorter term. However, flexible implementation is important, with planning able to adapt to new conditions and changes in the world around us.

Thus, other forms than detailed comprehensive plans are used to concretize the intentions of comprehensive plan 2030. More flexible forms, so called “visions” and “strategies”, are used, such as Vision of the city center - “stadsvisionen”, and strategy to built-out - “utbyggnadsstrategi”.

Another aspect is the continually follow-up of the comprehensive plan to reflect new situations and adapt to current issues. The monitoring system shows for example where building permissions are given and thereby if the aim of densification instead of urban sprawl is reached or not.

## 13 Annex 2. Regional transport

Prepared by Vanessa by Vanessa Scheffler and colleagues, Eskilstuna Municipality.

Eight of ten travels by train start or end in Stockholm. Today the capacity of the railway system south of Stockholm is not sufficient and leads to delays and congestions within the railway traffic.

Therefore, there will be some important changes in the regional transportation structure, such as the citybanan in Stockholm 2017 and the double line to Strängnäs/Härad for the Svealandsbanan. Those investments will improve train connections within the Lake Mälaren region as well as Sweden and increase the capacity on the Svealandsbanan as well as the use of new trains.

### 13.1 Citybanan 2017

Today, all types of railway traffic are supposed to use only two lines south of Stockholm: commuter trains, regional trains, long-distance trains and goods train.

The citybanan-project is about a 6 km long tunnel in Stockholm exclusively for commuter trains. All the other types of trains continue using the existing two lines. By that, the capacity of the line is doubled in Stockholm and all trains can go more dense and more in time. The project is supposed to be finished in the year 2017.

### 13.2 Future changes for the Svealandsbanan

The Svealandsbanan from 1997 replaced the former railway between Södertälje and Eskilstuna. Svealandsbanan was built for one-hour-traffic on that line. Since then, commuting has increased intensively. Therefore, Trafikverket plans for more meeting points along the line as well as double lines at some parts of the Svealandsbanan. The aim is to make it possible for have-an-hour-traffic with extra-trains during rush hour.

### 13.3 Stockholm-Mälaren Regional commuting.

During the period 1990-2012, commuting has increased in the Stockholm-Mälaren region. The regional train traffic allows longer commuting distances within acceptable travel time. Due to Svealandsbanan the interaction of the labour markets between the cities south of Mälaren and Stockholm has increased strongly. Even the motorway has been important for commuting within the shorter relations in the strings.

Regional fast trains allow shorter travel times. A lot of people accept longer commuting times by train compared to other traffic issues, due to the better possibility to work or study during the travel.

The regional traffic co-operation within Mälaren, Bergslagen and Uppland simplifies regional enlargement by offering effective transport of persons.



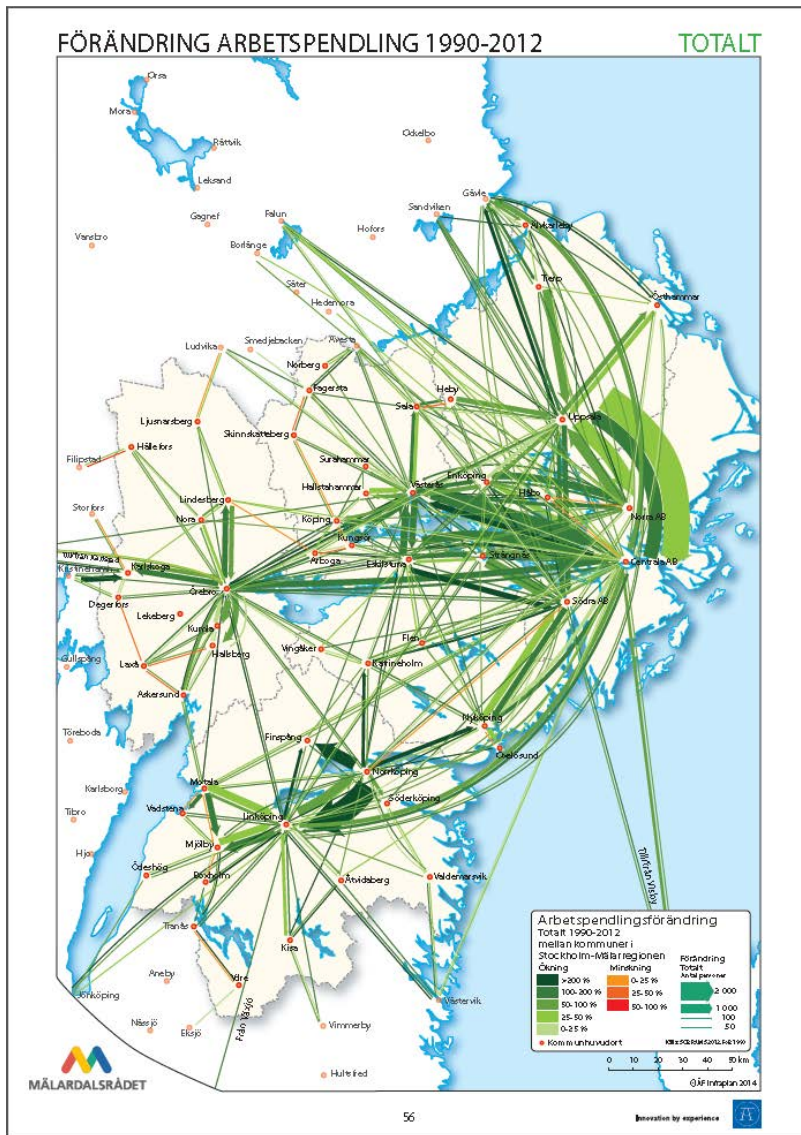


Figure 54. Förändring i arbetspendlingen i Stockholm-Mälardalen Region between 1990 and 2012



Figure 55. Commuting between biggest cities 2012

Source: Mälardalsrådet – Arbetspendling i Stockholm-Mälardalensregionen 2012 (2014-03-18)  
[http://www.infraplan.se/pendlingskartor\\_2012/Start.html](http://www.infraplan.se/pendlingskartor_2012/Start.html)

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