



ENERGY PLAN FOR THE MUNICIPALITY OF LUND

2014-2017

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Background

In March 2012, the Lund City Council decided to commission the municipal Executive Board of Lund to produce a comprehensive climate and energy strategy (KS 2012-03-01, § 30). The strategy should be based on existing plans and decisions and coordinated with the revision of LundaEko.

The law on municipal planning (1977:439) states that every municipality should have a current plan for the supply, distribution and use of energy. An energy plan should promote conserving energy, ensuring a secure and sufficient supply of energy and it should be adopted by the City Council.

The main purpose of the document is to coordinate ongoing energy and climate efforts and compose a concrete plan with measures for achieving existing goals and strategies – that is, not to produce new measures. Hence this document is called an Energy Plan; it complies with the decision taken by the City Council and with the legal requirements.

Responsibility

A municipality can delegate a municipal matter to a municipal company. The direct management of the implementation of measures is, however, limited. Identifying a municipal company as responsible for measures in the Energy Plan does not entail an obligation for the company to carry out the measures. It assumes that necessary decisions will be taken by the respective company's boards of directors or at annual general meetings.

Scope, structure and target group

The Energy Plan applies to Lund municipality as a geographical area - to the municipal organization, as well as to local residents, companies, the university, etc. The overarching climate goals cover this geographical area. The measures in the plan of action concern only the municipal organization since that is what the City Council has control over. Several measures, however, are aimed at municipality residents, businesses, etc.

On the basis of the theme meetings that have been held, four sub-areas were isolated, which compose the main sections of the Energy Plan:

Sub-area 1: Energy-efficient vehicles and distribution of renewable fuels

Sub-area 2: Energy-efficient buildings and public works contracts

Sub-area 3: Increasing recovery of residues and waste for energy production and increased degree of self-sufficiency in renewable energy

Sub-area 4: Raising level of knowledge concerning energy questions

Each sub-area is introduced with a description of the situation as of 2012, and an account of substantial implemented measures, ongoing work and the obstacles and challenges that exist in progressing further within energy and climate efforts. The most recent available statistics for each sub-area is presented. This is followed by proposals for measures that aim at achieving comprehensive climate goals. These proposals also show how Lund municipality can circumvent identified obstacles and challenges within the sub-area in question. To make the measures clearer, they have been given a designation that indicates which sub-area the

measure applies to (1-4), what category (A-D) and the number of the measure (1-9). All measures are given a short description, the responsible municipal committee/board and timetable are indicated. With some of the measures, the main responsible agent is indicated when this is considered necessary. For other measures, with several agents, it is expected that in order to fulfill the measure, they work from within their own areas and preconditions.

The target group of the Energy Plan is primarily Lund's municipal organization (its departments and companies), which is charged with implementing the measures. At the same time, the Energy Plan can be used by various expert external actors (organizations that commission the construction of buildings, businesses, branch organizations, regional actors, etc.) who wish to familiarize themselves with the municipal energy and climate efforts and contribute to attaining its climate goals. A short popular version of the Energy Plan, aimed at municipality residents, school pupils, students, etc., shall be produced.

Up-to-date plan and follow-up measures

According to the law on municipal energy planning, every municipality should have an up-to-date Energy Plan. Energy Plan measures refer to the period 2014-2017 and during this period, the Energy Plan is intended as an important tool for Lund municipality to reach its comprehensive climate goals.

The climate goal of the municipality of Lund constitutes the overarching target for the Energy Plan, and it is regularly monitored by the Municipal Executive Board. The Energy Plan measures will be annually followed-up during the period of implementation and will be coordinated with the monitoring of LundaEko and environmental management. During 2017 it is reasonable that a larger follow-up of the Energy Plan's measures will be carried out and reported in the City Council. Then decisions can be taken concerning suitable levels of revision, and in this way, the Plan can continue to be a robust tool for attaining comprehensive climate goals.

How the Energy Plan has been produced

Work with Lund's municipal Energy Plan began in May 2012, when an external project leader was appointed (H-process). The section of the City Office responsible for environmental strategy, public health and security has been the department of the municipality that has led and coordinated work with the Energy Plan. The municipal Executive Committee's environmental health sub-committee has functioned as the steering group.

The first step involved producing a preliminary study, which entailed a survey of existing regulatory documents in the municipality and collecting statistics for various areas such as energy use, renewable energy, eco vehicles, emission of greenhouse gases, etc. On the basis of this preliminary study, a proposal for a work process was prepared. The proposal was presented to the municipal departments and companies at a planning meeting in June 2012. After comments and views, the proposal was revised and a final working plan emerged, with five theme meetings from August to October 2012. These themes included:

1. Energy-efficiency and environmental adaptation
2. Increased self-sufficiency regarding renewable energy
3. Optimized energy use
4. Energy-effective buildings and public works contracts

5. Raised level of knowledge concerning energy questions

Representatives from the relevant municipal departments and companies as well as external actors such as Region Skåne, Biogas Syd, Lund University, Skånska Energi, general contractors, Klimatkommunerna (the climate municipalities) attended the meetings. At the meetings the participants discussed ongoing matters within the theme areas, focusing on identifying where the municipality stood just then and what obstacles and challenges existed as regards working with energy and climate. This was followed by group discussions concerning suitable measures. Parallel with the theme groups, information was presented to the steering group, who contributed comments and views. After the theme meetings, a concluding seminar was held where administrative heads and directors from several municipal administrations and companies worked on the presented proposals for measures and offered views on a further formulation of the Energy Plan.

Links to other regulatory documents and systems of management

The comprehensive climate goals for Lund municipality comprise the basis for its Energy Plan. In parallel with the formulation of this plan, Lund's programme for ecologically sustainable development is being revised. This programme, LundaEko II, is an important regulatory document which links the comprehensive climate goals and the Energy Plan measures. Other municipal regulatory documents such as the strategy for a sustainable transport system, LundaMaTas, and the environmental building programme, SYD, contribute to the overarching climate goals. Checks have been made to reduce overlaps and to avoid contradictions between the Energy Plan and other regulatory documents. The Municipal Comprehensive Plan, like LundaEko, should be seen as a framework for the Energy Plan.

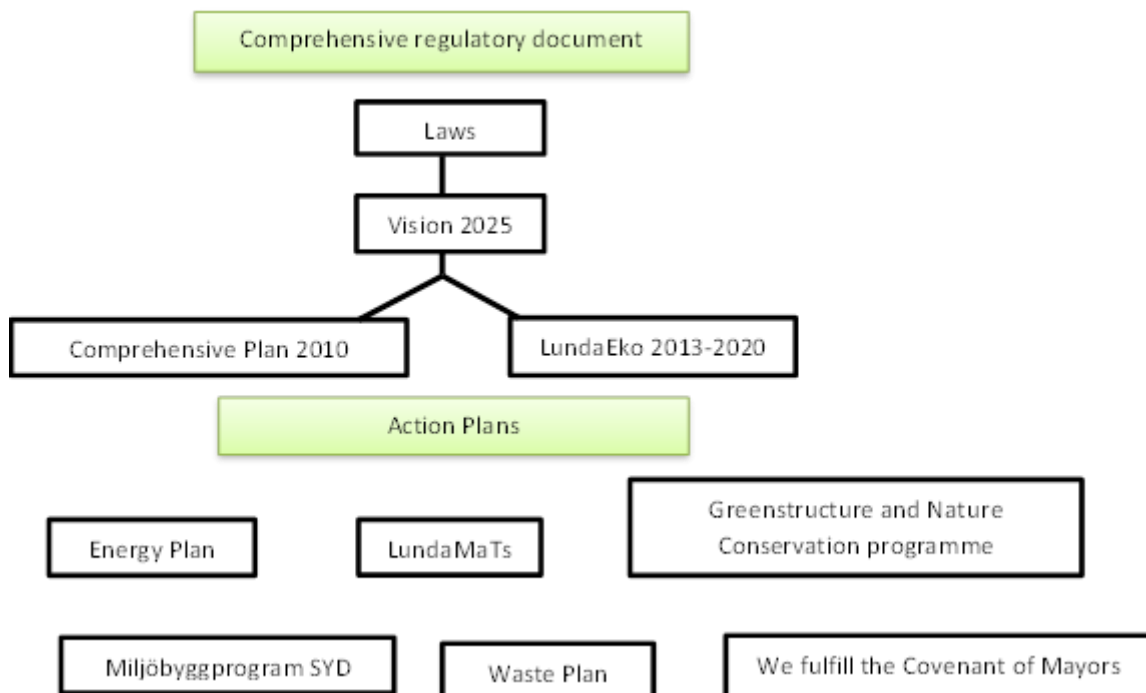


Figure 1. The relationship of the Energy Plan to other regulatory documents related to the environment, energy and climate.

In Lund, the municipal administrations and companies have introduced an environmental management system. Within the framework of this system, the municipality scrutinizes its activities and describes their environmental impact, sets up goals and produces plans of action with concrete measures for achieving these goals. At regular intervals, an external environmental auditor examines work with the environment and gives suggestions for improvement. Already today, extensive energy and climate efforts are being made within the municipality. Against this background, it is of vital importance that the measures and goals of the Energy Plan are on a level that harmonizes with the environmental management system.



Figure 2. *The relationship of the Energy plan to Lund's climate goal, LundaEko and the energy management system.*

Goals

On 26 August 2010, Lund's City Council adopted new climate goals for Lund municipality as a geographical area. These goals constitute the overarching set of goals for the Energy Plan.

- As of 2020, the emission of greenhouse gases in the municipality shall be half of the emissions in 1990.
- As of 2050, these emissions shall be close to zero.

Covenant of Mayors

The municipality of Lund has signed the Covenant of Mayors and the Energy Plan will assist the municipality in living up to the covenant. The Covenant of Mayors is an agreement,

signed by municipalities within EU that aim to go further in their climate efforts than the European goal of 20% reduction of Co2 emissions by 2020.

Reduced energy needs

In order to achieve its comprehensive energy and climate goals, Lund municipality needs first to reduce energy needs. Physical urban planning and life-style and behaviour are important to reducing energy needs in society. The principals of sustainable urban development are thoroughly described in the municipal Comprehensive Plan (CP 2010) and LundaMaTs. Decreasing society's need for energy involves, for example, urban building that reduces the need for transport, constructing buildings so well insulated that the need for heating diminishes, building in smart measurement systems that affect housing and users' energy behaviour, conducting campaigns on life-style issues, etc. One important point of departure in the Energy Plan is therefore that the best kilowatt hour is the one that is saved. This also concerns a primary energy perspective regarding the entire life cycle of fuel.

Primary energy and a system perspective

Within the framework of working with the Energy Plan, the concepts of primary energy and system perspective are central to describing the system of energy.

In the Energy Plan, "system perspective" refers to maintaining an overview of the whole system of energy, not only individual parts or individual properties. Having a comprehensive and broad view enables several aspects of sustainability to be taken into account when there are changes in the energy system. A system perspective facilitates seeing both positive and negative aspects of, for example, local biogas production or recycling residual heat. Such a perspective clarifies closed-loops, fossil fuel replacement and the reduction of primary energy use, the creation of local employment opportunities, the need for expanding transport and drawing new pipelines. When evaluating new or altered energy use in the municipality, a measure's positive and negative sustainability aspects (environmental, social and economic) shall be described from a system perspective.

Primary energy entails viewing the whole life cycle of energy use, which includes extraction, refining, transport and distribution of the energy source utilized. As a numerical value for how much primary energy an energy source uses, the primary energy factor (PEF)¹ is used. Exemplified by fuel, primary energy entails that not only amount of fuel in the vehicle's tank is considered, but also the energy used when the fuel was extracted, produced, transported and distributed to the tanking station. Similarly in the use of electrical energy, the primary energy is determined by the manner of production. Electricity produced in a European coal condensing power plant with low efficiency has a higher primary energy factor than electricity produced in a bio energy-fired Swedish heat and power plant, with high efficiency and combined electricity and heat production. Thus it is important to consider not only purchased energy but also how that energy is produced. When evaluating new or altered energy use in the municipality, primary energy use should always be calculated and measures taken that lead to lower use of primary energy.

¹ In the context it is important to point out the primary energy factor used can vary from year to year and is a standard factor, determined and created to make an assessment of reality.

Environmental valuation of electricity

As regards the use of electricity, it is common to begin with various system perspectives – Swedish, Nordic and European production of electricity. According to figures from Svensk Energi (Swedish Energy), published in *Svensk Fjärrvärme* (Swedish District Heating), the emissions from Nordic production of electricity were ca 100 g CO₂/kWh in 2010 and the renewable portion was 60%. This can be compared with corresponding figures for the whole of Europe – ca 400 g CO₂/kWh. The system boundary that Swedish Energy and Swedish District Heating have chosen when a consumer wishes to monitor the environmental effects of their use of electricity, is the well-integrated Nordic electricity market. Swedish Energy provides an annual guide for origin labelling of electricity in which the Nordic carbon dioxide emissions and portion of renewable electricity are reported and where a Nordic so-called residual mix has been computed, where the production of electricity has been corrected with the trade in production-specific electricity. It is important that, with each project involving increased use of electricity, Lund municipality takes into account the environmental impact of electricity production.

It is, in this context, important to point out that the primary energy factor that is used can vary from year to year and it is a standard factor, created and determined in order to make an assessment of reality.

System boundary ²

By law, the main focus of the Energy Plan is the description of the production, use and distribution of energy within the municipality as a geographical area. Krafringen's (local energy company) area extends to a larger geographical area than the city of Lund; it has a district heating network linked with the municipalities of Lomma and Eslöv. Therefore, as a geographical area, the municipality of Lund doesn't fully function as a system boundary since Krafringen runs the district heating network as one unit. The measures that are carried out are aimed at attaining optimal utility in the network as a whole, not focusing on a specific municipality. By implementing measures in neighbouring municipalities, however, even district heating in Lund can be improved – for example, through Örtoftaverket, while at the same time, through Örtoftaverket the use of natural gas in Lund decreases.

The point of departure for describing the present situation has therefore been to produce, with the help of district heating in the municipalities of Lund-Lomma-Eslöv, a distribution key that can be used when allocating the supplied fuel and the amount of district heating and electricity for Lund municipality.

The municipality as an organization also comprises a type of relevant system boundary for the Energy Plan. The municipality only has full control of its own activities and operations,

² System boundaries can be geographical, organizational or time boundaries. The geographical system boundary is the municipality as a geographical area; the organizational concentrates on the municipality as an organization. Time system boundaries can, for example, entail that data prior to 1995 is not used. It is most common when working with energy and climate strategies to view the municipality (and the equivalent on the county level) as a geographical area. The law governing municipal energy planning (1977:439) also refers to the municipality as a geographical area. Several municipalities inventory also energy use and emissions for the municipality as an organization. In IVL's report B1822 system boundaries and method choices at an altered use of energy are discussed.

Source: Swedish Energy Agency

and the measures in the plan of action encompass only measures managed or controlled by Lund’s municipal departments and companies. At the same time, in several instances, these measures entail reducing climate impact on the part of other – or several – activities than the municipal, residents, transport, commerce, etc. Finally, it is important to note that even if the municipality, as an organization and geographical area, comprises system boundaries, a system perspective shall permeate the Energy Plan.

Energy ladder

In the formulation of the Energy Plan, politicians and public officials requested a common approach as regards how the municipality can work with the use and production of energy from a primary energy perspective. Figure 3 presents the so-called Energy Ladder, which is to be a guide for Lund municipality in all production and use of energy.

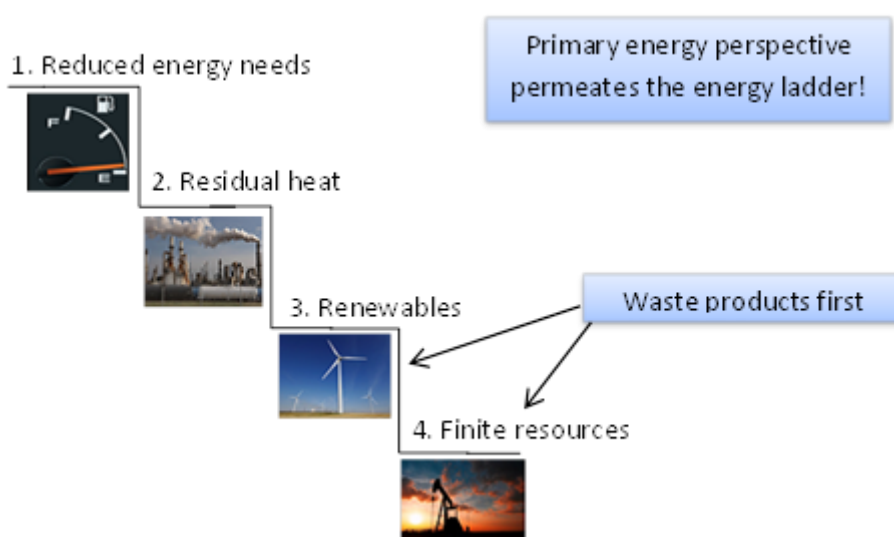


Figure 3. *The Energy Ladder: The Energy Ladder describes the approach that should guide municipal administrations and companies.*

Step one: Decreased energy needs

Step one should always be to decrease energy needs. The point of departure is that all energy use has negative effects on the environment and the best kilowatt hour is that which is not used. The top step of the ladder has a clear connection to sub-areas 1, 2 and 4 of the Energy Plan. This can relate to making cities denser, making the use of vehicles more efficient, choosing energy-effective vehicles or building energy-efficient buildings with intelligent energy solutions that reduce energy needs. When making measures more effective, it is also important to reduce energy use from a life cycle perspective – that is, primary energy. The primary energy perspective means that the number of kilowatt hours reported on electricity bills do not give the whole picture: consideration must be taken to loss and energy expenditure during production and distribution – see the section on “Environmental valuation of electricity”. According to this perspective, if priorities must be made, for example, when renovating buildings, it is more important to reduce the use of electricity than to use district heating produced from renewable sources.

Step two: Residual heat

The next step on the Energy Ladder is to utilize residual heat. The alternative to using residual heat is to release it into the surrounding environment via water or air – that is, “let the fire go up the chimneys.” Residual heat should therefore always be utilized before any new heat production is begun. In certain cases, residual heat can even reach such high temperatures that it can be an alternative for transforming into electricity. On this basis, residual heat has a primary energy factor of “0” and the entire environmental load is laid instead on the original energy use in the source of the residual heat. Even if residual heat has a low primary energy factor, reducing energy needs (step one in the Energy Ladder) should always be aimed at first.

Step three: Renewables

Renewable energy such as solar energy, wind power, bio fuels, biogas, geothermal energy etc. emit low levels of fossil greenhouse gases. Renewable energy should therefore be chosen over finite resources. From a life cycle perspective, renewable energy sometimes has a high primary energy factor – that is, it requires a great deal of energy to produce renewable energy. To reduce primary energy use, waste and residue products should always be prioritized before virgin raw materials when producing renewable energy.

Step four: Finite or non-renewable resources

Finite resources include coal, oil, natural gas and petroleum which emit fossil carbon dioxide. Nuclear power is also based on finite resources and in addition has a very high primary energy factor. Whenever possible, non-renewable resources should be completely avoided, but when they are necessary, they should be chosen on the basis of low emission of greenhouse gases and low primary energy factors. This means that waste and residue products should be used in the first instance.

The situation in 2012

Below is a description of general energy and climate statistics for Lund municipality and the municipality’s efforts to ensure secure and sufficient delivery of energy. Energy and climate statistics aim at giving a picture of the situation within the municipality as a geographical area and refer to either 2010 or 2011, which were the most recent available statistics in 2012, when the then current analysis was produced. Statistics covering heating are degree day corrected; for more detailed statistics, see the respective sub-areas.

Emission of carbon dioxide

As is evident in Figure 4, the emission of greenhouse gases in Lund municipality in 1990 was 408,000 ton expressed as carbon dioxide equivalents. By 2010, emissions had decreased to 394,000 tons, which is a 3.2% reduction. The dominating sectors are energy supply and transport. While emissions from energy supply have diminished between 1990 and 2010, emissions from the transport sector have risen. Even if the total reduction is a step in the right direction, there is much left to do to achieve the Lund’s climate goal of a 50% reduction by 2010 (in comparison with 1990 values).

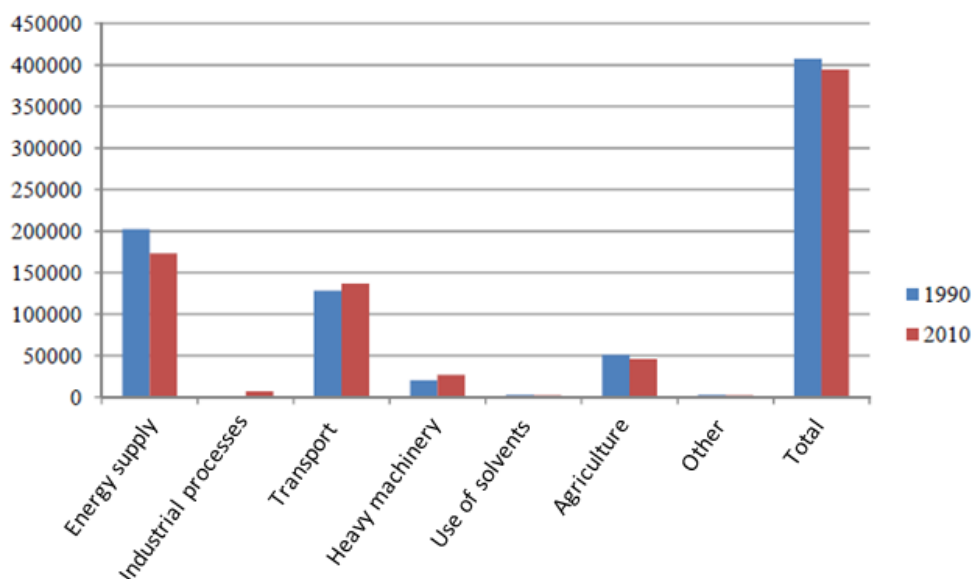


Figure 4. Emissions of greenhouse gases in Lund municipality distributed according to sector (ton carbon dioxide equivalents), in 1990 compared to 2010. Source: SMED

Supplied energy

Within Lund municipality, in 2011 (see Figure 5), 2682 GWh energy was supplied, divided into different fuel and energy sources. Fuels - primarily gas and diesel, together with ethanol, FAME³, RME and vehicle petrol - comprised more than a quarter of the total energy use in the municipality. Twenty-eight percent of the total supply of energy consisted of imported electricity - that is, the sum of the electricity which was distributed in the municipality excluding the electricity that was produced. The natural gas distributed to various end users within the municipality corresponded to ca 20% of the total energy supplied in the municipality. Of this total supply, more than one quarter consisted of renewable energy, a total of 660 GWh, including residual heating and heating from heat pumps.

³ FAME is the abbreviation for Fatty Acid Methyl Ester, which can be based on various oil seed plants. The most common raw material is rape oil, which is esterified to rape methyl ester, RME. From 1 August 2006 it has been possible to mix up to 5% FAME in eco class 1 diesel fuel. The FAME that is used must fulfill the quality requirements in SS-EN 14 214. Source: Petroleum Institute

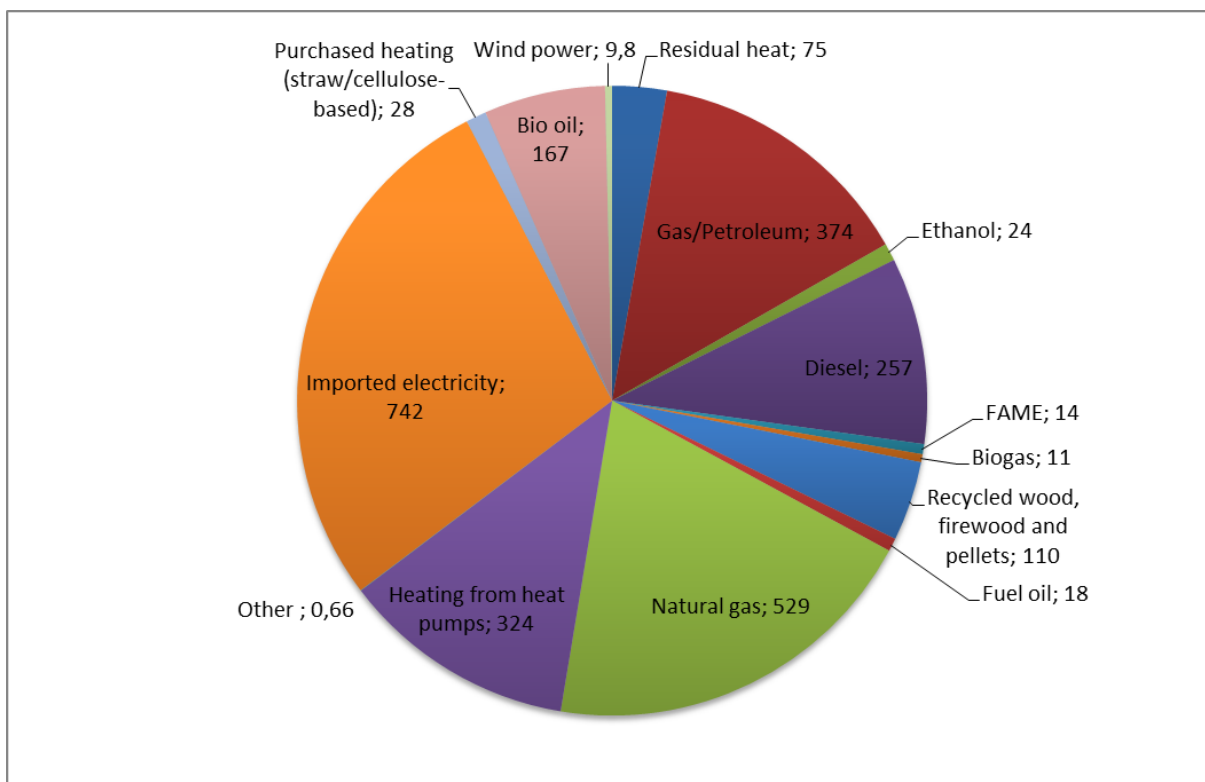


Figure 5. Energy supplied to Lund municipality in 2011 (GWh). The category “other” corresponds to RME (0.18) GWh, heating from photovoltaics (0.27 GWh) and electricity from photovoltaics (0.21 GWh). “Imported electricity” refers to the total distributed electricity within the municipality borders, excluding that produced in Lund (e.g. power heating, wind power and photovoltaics). Source: SCB, the Chimney-sweeping department in Lund, Skånska Energi, EON, the County Board in Skåne, Kraftringen and Lund’s City Office.

Conversion

As regards the conversion of supplied fuel to electricity and district heating, Kraftringen has an extensive area with several plants. In Lund there is Gunnesboverket (electricity and district heating), Södra Verket (district heating and district cooling) and Ångkraftverket (district heating and district cooling). Lomma has Återbruket (electricity and district heating) and Panncentral Alnarp (district heating).

In Eslöv there are several hot water centers (Betan, Närke, Laxen, Sallerup districts), all of which are district heating plants. In addition to production in each plant, residual heat is bought in from Nordic Sugar (Örtofta) and district heating from three country estates - Svenstorp, Björnstorp and Ellinge. District heating production also takes place in Dalby and S Sandby (gas boilers). For more information on Kraftringen’s energy system, see Appendix 1.

In total, in 2011, Kraftringen produced 67.8 GWh electricity through combined heat and power (CHP) at two plants – Gunnesboverket (gas turbine) and Återbruket in Lomma (recycled wood). A distribution key has been used, based on district heating use within the Lund-Lomma-Eslöv network in order to distribute the correct amount of electricity (i.e. of

the total production occurring in both municipalities) in Lund municipality.⁴ Electricity is also produced by photovoltaics (0.21 GWh) and wind power (9.75 GWh). Totally, the local electricity production in Lund corresponded to ca 8% of the municipality's total electricity use. In addition, a total of 765 GWh district heating was produced within Lund municipality allocated to different production plants (degree day correction figures corresponding to 804 GWh).

Energy consumption

Figure 6 shows how energy consumption in Lund municipality in 2011 is dispersed within different sectors. The industry sector primarily uses electricity (165 GWh) and natural gas (167 GWh) together with district heating (64 GWh) and diesel (28 GWh). The service sector in the figure consists of various non-municipal bodies and the figure shows the electricity supplied to offices and storehouses, the retail trade, hotels and restaurant, finance and insurance companies, property management, etc. This sector mainly uses electricity (181 GWh) and district heating (113 GWh). The public sector primarily uses electricity (250 GWh) and district heating (161 GWh) and a small portion of natural gas to heat premises (7.9 GWh). The household sector chiefly uses district heating (467 GWh), electricity (218 GWh) and natural gas (66.3 GWh), plus ca 11 GWh firewood and pellets. Heat pumps in single houses are calculated to supply c 29 GWh. Within the transport sector, petroleum (374 GWh), diesel (216 GWh) and natural gas, as part of vehicle gas (37.8 GWh) dominate. Renewable fuels like FAME (low blend), ethanol (E85 and low mix), RME and biogas (7.15 GWh) corresponding a total of 43 GWh and comprised 6.3% of the total fuel use.

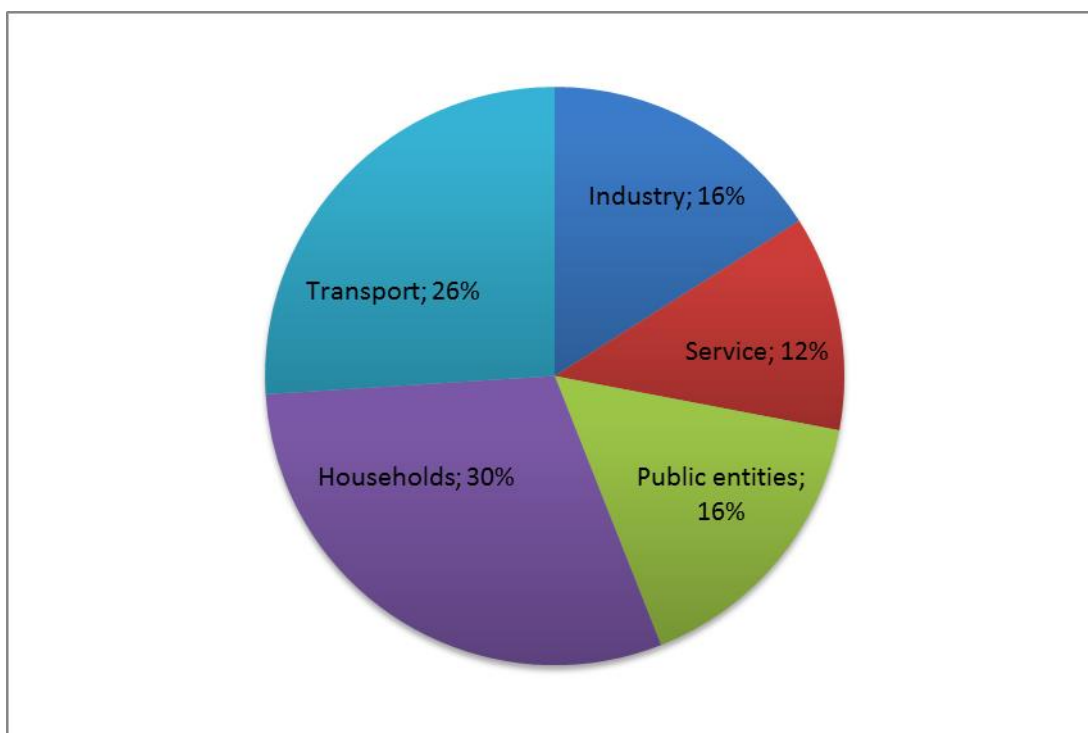


Figure 6. Energy use in Lund municipality in 2011, by sector.

⁴ Cf "System boundary" for more information

Future investments relevant to energy consumption and greenhouse gas emissions

Greenhouse gas emissions from the transport sector (transport and heavy machinery) increased in Lund by almost 10% between 1990 and 2010. Between 2009 and 2010, emissions rose by ca 2%, while at the same time, the highest single value was registered in 2005 and since then the trend has been a slight reduction (Source: SMED). Even if eco-friendly vehicles have been rising in number, it is clear that increased transport per se involves a challenge for diminishing emissions from greenhouse gases from that sector, at a pace allowing climate goals to be achieved. One important measure is the planned biogas plant outside of Dalby, which is to be finished in 2015. The plant should produce enough biogas annually to supply ca 15% of the total number of private automobiles in the municipality as a geographical area. In parallel with this, other important measures are planned, for instance in LundaMaTs, which aim at reducing transport within the municipality. These measures – the biogas plant in Dalby and continuing increase of eco-vehicles - can in the long run contribute to lessening the impact on climate from this sector.

Kraftringen is building a large bio-fuel based combined heat and power plant in Örtofta – Örtoftaverket.⁵ The plant, after starting up in 2014, is to supply half of the district heating requirements, c 500 GWh, in Lund, Lomma and Eslöv. Local bio fuels such as forest residues and recycled wood will here be transformed into both heating and electricity. Örtoftaverket will replace several older plants and thereby increase Kraftringen's portion of renewable fuels. Emissions of carbon dioxide are reckoned to decrease by almost 200,000 tons per year at the same time as ca 220 GWh renewable electricity is produced. This will be an important measure in efforts to achieve the climate goal. Further, district heating in Lund can consist entirely of renewable and recycled heating by 2020 through Örtoftaverket and residual heat from the research facility MAX IV and ESS.⁶

It is important in the context to mention that ESS and MAX IV will demand high effect of electricity. According to calculations made before Lund's application to be host city, ESS should consume ca 350 GWh electricity annually. In the solution which is now being produced, energy consumption has decreased to 250 GWh per year. ESS is investigating possible solutions and a newly-built wind power park, with 40-50 wind power plants, should be able to supply the station's yearly consumption and even generate revenue. Most of the electricity supplied must be cooled off. In collaboration with Kraftringen, ESS plants to recycle a large part of the heating to the district heating network. The goal here is to recycle at least 60% of the residual heat that arises in the plant. According to preliminary figures,

⁵ Örtoftaverket information:

- Outside of Eslöv one of southern Sweden's largest bio fuel combined heat and power plant is being built
- When Örtoftaverket was completed in 2014 it started to produce heating for 50,000 households in Lund, Eslöv and Lomma and electricity corresponding to the total needs of Eslöv.
- The plant is fueled with bio fuel (forest fuels, recycled wood, peat) and so contributes to sustainable energy development and the region's climate goals.
- Through Örtoftaverket, an annual lowering of the region's carbon dioxide emissions by 205,000 tons is calculated.
- Örtoftaverket is Kraftringen's largest commitment ever, with an investment of 1.8 billion Swedish crowns. Source: Kraftringen's home page.

⁶ Together with E.ON and Kraftringen has entered into a cooperative agreement with ESS to develop optimal energy solutions for future research institutes. Source: Kraftringen's homepage.

when the MAX IV plant is fully finished in 2020, it will utilize ca 35 GWh electricity per year. Residual heat will also be recycled from MAX IV.

Secure and sufficient energy supply

According to the law on municipal energy planning, an Energy Plan should contribute to a secure and sufficient delivery of energy. As regards sufficient delivery, it is described how the municipality satisfies that requirement, e.g. under sub-area two, “Increasing self-sufficiency in renewable energy.”

In 2011, about 8% of the electricity used in Lund was produced within the boundaries of the municipality; the rest was imported. The situation is similar in the entire southern electricity area, which means that electricity prices here are higher than in Norrland (Northern Sweden). This is one reason for increasing the local production of renewable electricity. At the same time it is important that the production of renewable energy is consonant with the Energy Ladder (cf. primary energy and system perspective) and that the municipality strives for energy efficiency together with increased production. By reducing the use of energy through increased efficiency while increasing production of renewable energy, Lund municipality can achieve a higher degree of self-sufficiency.⁷

Regarding fuels, the local proportion of self-sufficiency is even less than for electricity, but it is better for heating. This, in combination with the difficulties of converting the transport sector into using renewables, means that Lund municipality, as an organization, prioritizes using biogas as fuel.

Regarding the legal demand for planning for secure delivery of energy, in Lund municipality there are three electricity companies. Krafringen owns Lund’s urban electrical power network; Skånska Energy AB owns the network in most of the eastern part of the municipality; and E.ON owns a small portion of the electricity network in the south east. There is good protection for the electricity network in Lund municipality as regards securing deliveries of energy. All of Krafringen’s cables are buried. Skånska Energy AB has some aerial cables, E.ON and Svenska Kraftnät have high voltage power lines that are still overhead, for example in Väster and at Södra Sandby. There are two supply points from E.ON’s regional network to Krafringen’s electricity grid, one at MAX IV and one in Värpinge, where E.ON has an overhead 130 kV cable to both these points. If there was a break in one of E.ON’s entry points, it would be possible with E.ON’s permission, to feed the entire network from the remaining point. There are no diesel generators that can replace supplies from E.ON, but there are a number of generators which can be connected locally to supply low voltage customers. Skånska Energi AB has their own entry points from E.ON’s regional network which transmit electricity to their local network.

The municipality annually updates risk and vulnerability analyses, which include electricity and heating distribution and access to fuels associated with potential risks. Climate

⁷ Motivation: By reducing the total energy consumption while increasing production of renewable energy we will become more self-sufficient. Consider the following: that we use 900 GWh electricity within Lund municipality in 2011 while producing 72 GWh renewable electricity within the municipality through combined heat and power, photovoltaics and wind power. This means we have ca 8% self-sufficiency ($72/900 = 0.08$). Consider that in 2015 we instead use 700 GWh electricity within Lund municipality (thanks to increased energy efficiency) while producing 80 GWh renewable electricity (within the municipal boundaries), we would then attain c 11.5% self-sufficiency ($80/700 = 0.1142$).

adaptation is also addressed comprehensively and the analyses include certain proposals for measures to reduce risks. Krafringen also carries out annual risk and vulnerability analyses for electricity and district heating. Other laws and regulatory documents within the area of “Secure energy supply” include, for instance, laws on electricity and a plan of action for shortening the periods of disruption – the latter is being produced parallel with the Energy Plan.

As regards district heating, Krafringen has several different plants within Lund municipality: Gunnesboverket, Ångkraftverket and Södra verket. They also have two gas boilers in Södra Sandby and Dalby. They buy in heating from other actors, eg residual heat from Nordic Sugar (Örtofta), straw-based heating from Björnstorp. This dispersed production entails lower risks in conjunction with problems with distribution and production. The risks of operational disruptions in individual production plants affecting users decrease when the district heating networks in Lund, Lomma and Eslöv are connected together.

Sub-area 1: Energy-efficient vehicles and distribution of renewable fuels

The situation in 2012

The following is a description of the situation in 2012 regarding energy effective vehicles and the distribution of renewable fuels in Lund municipality as a geographical area. Examples are taken from discussions held within the framework of the five theme group meetings, and the purpose is to describe what has been done, what is underway, and to take up obstacles and success factors as well as the challenges that form the basis of the proposals for measures included in the plan. Since all statistics for 2012 were not accessible when the Energy Plan was produced, statistics from 2010 and 2011 have been used.

Public procurement of vehicles

During 2010 Lund municipality created a new tendering model and adopted new guidelines for the sub-ordering of vehicles. In this model there are framework agreements with suppliers, who are annually given possibilities to present new vehicle models. In this way, the municipality acquires a broader range and can take advantage of advances in technology. Municipal administrations and companies continually sub-order vehicles on the basis of general guidelines and this approach has in a short time led to a large increase in e. g. gas automobiles in Lund’s fleet of automobiles. As regards specific electric automobiles, there remains substantial uncertainty connected to their second-hand value, which corresponds to about 10% after three years. As regards vehicles running on RME (rape metyl ester), in the spring of 2013 none were tendered. It is important to note the fact that municipalities that place demands on suppliers can influence the market. Lund municipality is a member of Biogas Syd and experiences from that network show that by making tactical decisions and developing correct public procurement and tendering models, the market can be influenced to make eco-friendly and energy-effective vehicles more available. Here the municipality has possibilities to be in the avant-garde and promote development.

The municipality’s own fleet of vehicles

The municipality’s own heavy vehicles, not including the municipal companies’, numbered 72 lorries and 38 tractors as of the turn of the year 2011/2012. Since 1997, the public Waste Disposal Services has worked with converting its vehicle fleet to biogas and of a total of 48

vehicles, 31 are fueled with biogas. In general, using these vehicles has worked well, but one problem that has been identified in certain specific cases is deficiencies in engine power. This problem has been evident when driving heavy loads up steeper inclines; at present therefore, diesel vehicles are used for these purposes. Further, Markentreprenad (land development)⁸, in dialogue with suppliers of heavy vehicles, have been informed that using diesel-gas-hybrid vehicles could entail that a large amount of diesel is utilized when, for example, idling during work with cranes, vehicles that lift e.g. pallets or tow park refuse or waste. It is a challenge to procure alternative vehicles using renewable fuels that can manage these situations. In the context it is important to point out that access to special heavy vehicles with renewable fuels is so far very limited.

Lund municipality (excluding municipal companies) owns a total of 384 automobiles and light trucks. Of these, ca 78.9% use petrol and diesel, 3.4% ethanol, 15.4% CNG and 2.1% electricity/hybrid. Examples of companies and departments working actively with making their fleet of vehicles more eco-friendly are LKF and the Community Care Services. LKF has 47 service vehicles, of which more than half are fueled by CNG and electricity. In 2012 the Community Care Services administration had automobiles, of which 73 were eco-vehicles, and 44 of these run on CNG. Both have made significant changes in line with the new guidelines for procurement of vehicles and they regularly exchange their fossil-fuel driven vehicles, primarily to CNG automobiles. One problem concerns the vehicles used in home help services that travel out into the villages where access to biogas is lacking. At present, the Community Care Services has solved this problem by using diesel cars in these districts, but a biogas filling station would be helpful.

As regards electric vehicles such as automobiles, in spring 2013, there were ten in the whole of Lund municipality, of which Kraftringen owned four. LKF has ten electric vehicles, the so-called Club Car. Electric cars can function in certain municipal activities – for instance, when driving short distances and being able to charge the car overnight. It is more difficult with the cars that must be driven day and night within the home help services since at present it takes 8-12 hours to charge an electric automobile at the municipal supply points. At the rapid charging stations it takes only 10-20 minutes. The cost of purchasing electric cars is at present higher than that of conventional cars. It is thus a challenge for the municipality to find new business models etc. to be able to advance and be part of creating a market for electric vehicles.

In conjunction with the completion of the new local government building, Kristallen, in 2014, a car pool was planned, where most local public employees would have access to the most recent and most energy-effective eco-vehicles on the market for travelling within their jobs. The possibility of also opening up the car pool to private contracts with municipal employees and nearby residents is being considered. This could contribute to reducing the number of cars in Lund.

Distribution of fuels

Kraftringen also works with developing the charging infrastructure for electric vehicles – there are now 15 charging stations in various places in Lund. Regarding RME, in the spring

⁸ Lundafastigheter and Markentreprenad (land development) compose the commercial part of the municipal Services department

of 2013 there was a tanking station on Gastelyckan where a total of 20 m³ (0.18 GWh) was tanked in 2011. However, interest needs to increase if production and use of RME is to become larger. It is worthwhile mentioning in this context that this is a problem for LKF regarding accessible fuels for the vehicles that the company uses for operations and maintenance. LKF has a number of tractors that could be run on RME, but because of long distances to the single tanking station, it is at present not possible to fill these tractors. Kraftringen also strives to increase the proportion of tanking stations for biogas. Today there are three public tanking stations for biogas: Gastelyckan, Gunnesbo and Dalby, and three private stations, of which two are for busses and one for the municipal Waste Disposal Services. The private tanking stations are also located at Gastelyckan and Gunnesbo and with the bus depot near Lund's Railway Station.

Public procurement of transport services and heavy traffic

In April 2013, the municipality of Lund delegated responsibility for city traffic to Skånetrafiken. The ca 50 city busses are fueled by CNG and it is a challenge to change over to pure biogas by 2020, in accordance with Skånetrafiken's vision of being fossil fuel free. Public procurement of school transportation has been carried out and procurement of mobility services commenced in 2013. This involves about 40-50 automobiles and special vehicles for mobility services and 16 school busses, where new types of busses and technology will be tested.

In Lund municipality there is an environmental zone within a circumscribed geographical area where only eco vehicles are allowed to drive. This measure has contributed to the fact that in Lund there are now busses that run on CNG (compressed natural gas). The environmental zone's geographical area encompasses only a small part of the city of Lund. Larger parts of the lorry traffic, for example in industrial areas, are not included in the environmental zone. It remains to work with environmental zone and increase pressure on the users' side, especially within the industrial areas.

The energy use and climate emissions of the fleet of vehicles

Transport and machines comprise a total of 41% of Lund municipality's total emissions of greenhouse gases (figure 4). The internal distribution between different transport sectors (figure 7) indicates that automobiles dominate. In Sweden, between 2011/2012, automobile traffic encompassed 4.4 million automobiles, and of these, 76% were powered by petrol, 17% by diesel, 5% by ethanol and the remaining 2% were hybrid or electric cars. In Lund municipality as a geographical area, at the end of 2011, there were around 55,000 automobiles, of which 63.1 were powered by petrol, 26.2% by diesel, 6.7% by ethanol, 3% by CNG, and 0.9% were electric or hybrid cars, with 9 purely electric cars.

It is important to mention that these statistics only refer to legally owned vehicles and not users, which is a conceivable explanation for why the portion of CNG vehicles is as high as 3%. In concrete terms, this concerns companies with their main offices in Lund, that own vehicles, but lease out these vehicles to other municipalities.

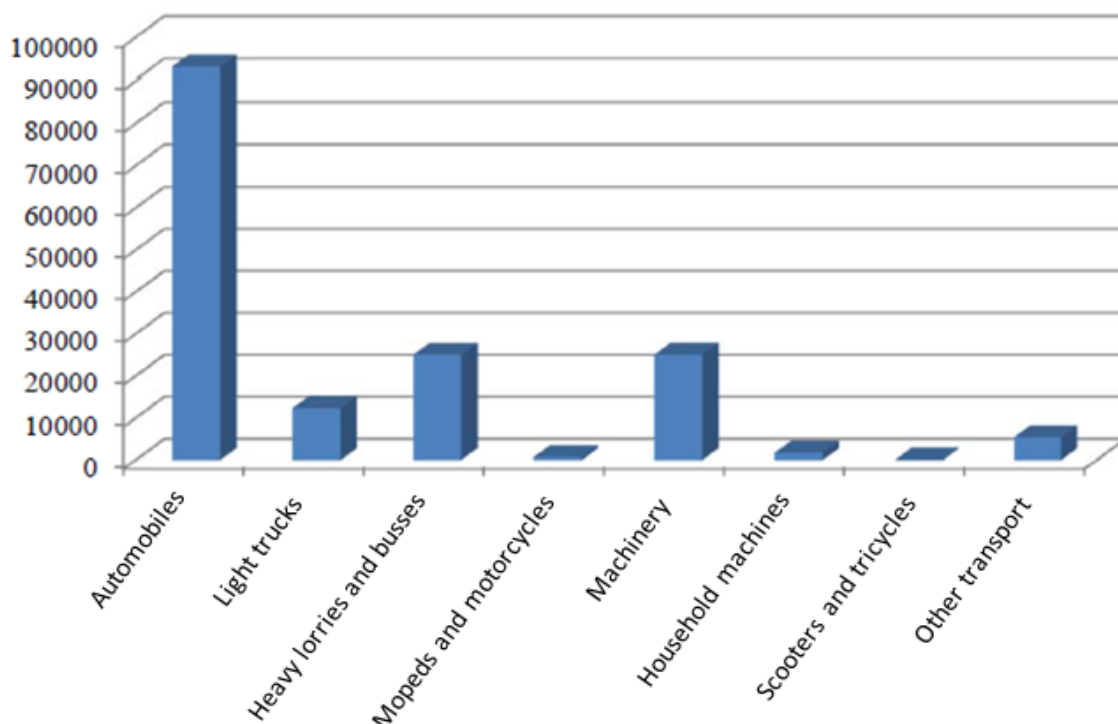


Figure 7. Emissions of greenhouse gasses in 2010 for the transport sector (tons of carbon dioxide equivalent) within Lund municipality as a geographical area by different sub-sectors. Source: SMED

The municipality has an important role in paving the way for new technology and, in its public procurement or tendering, to obtain energy-effective and environmentally-friendly vehicles. In Lund's municipal organization, at the end of 2011, there were 255 automobiles and of these 49% used petrol, 24%, diesel, 5% ethanol, 3% electricity/hybrid and 19 % CNG.

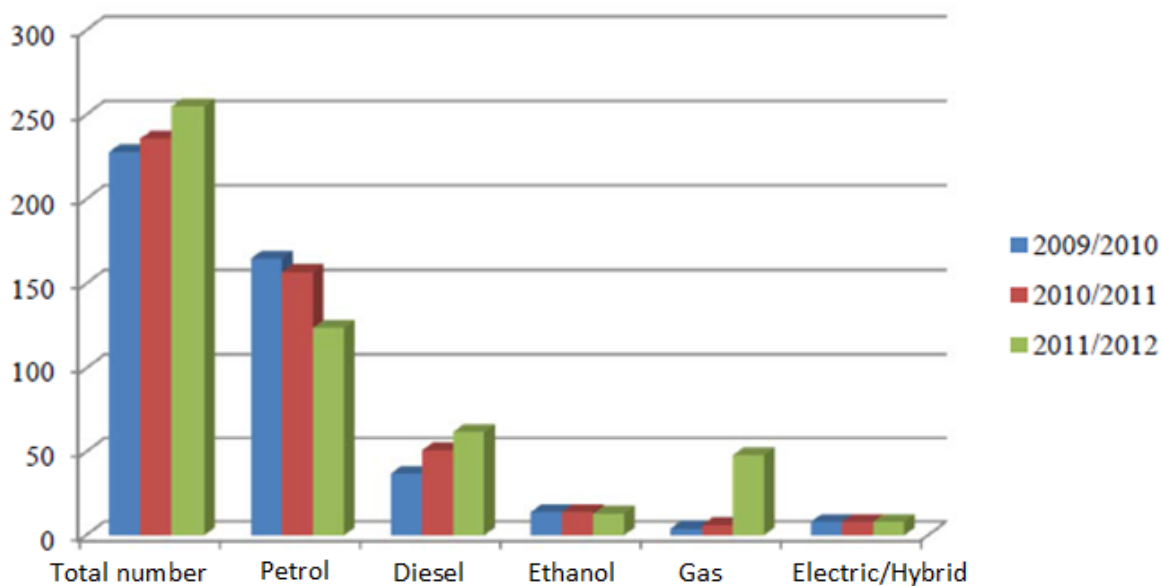


Figure 8. Automobiles in the municipal fleet of vehicles (excluding companies) at the turn of the year 2009/2010, 2010/2011, 2011/2012 on the basis of fuel-use. Source: Miljöfordon Syd.

Measures for sub-area 1

Presented below are the measures that the municipal committees and boards have agreed to carry out. These measures have been formulated during the process of producing the Energy Plan and have been revised after submission for review. These comprehensive measures are intended to build upon successful factors and overcome obstacles and challenges that were discussed in “The present situation, 2012”. The measures should reinforce efforts to increase the proportion of energy-effective, environmentally-friendly vehicles and improve the distribution of renewable fuels.

A. Environmentally-friendly public procurement of vehicles and tenders

Measure 1.A.1

The implementation of the new national definition of environmentally-friendly vehicles is linked to existing guidelines for the purchasing/sub-ordering agreements for automobiles and in conjunction with the formulation of new tendering contracts. Lund municipality formulates environmental requirements for heavy vehicles.

Responsibility: Municipal Executive Board

Timetable: 2015-2016

Measure 1.A.2

Lund municipality formulates a long-term plan for the public procurement of environmentally-friendly and energy-effective machinery. A generous amount of time will be allotted for the conversion to environmentally-friendly machinery and the goal is to cut emissions of greenhouse gases by half.

Responsibility: Municipal Executive Board, the Sanitation Board, the Services Committee, Lunds kommuns fastigets AB, Kraftringen

Timetable: 2014-2015

Measure 1.A.3

When procuring transport tenders, Lund municipality should promote the use of environmentally-friendly and energy-effective heavy vehicles instead of conventional fossil fueled vehicles. As a first step (phase 1), suitable incentives may be used. In the long run (phase 2), the municipality will place clear demands that exclude vehicles with low environmental performance.

Responsibility: Municipal Executive Board, the Services Committee, Technical Committee, Lunds kommuns fastighets AB, Kraftringen

Timetable: 2014-2015 (phase 1), 2016-2017 (phase 2)

Measure 1.A.4

Lund's municipal departments, through the Services Committee (land development), purchase vehicles in accordance with the municipality's guidelines.

Responsibility: All committees

Timetable: Ongoing

Measure 1.A.5

Lund municipality carries out a survey of the municipality's own fleet of vehicles and the replacement rate of these vehicles. An assessment of future needs for renewable fuels (RME, CNG, electricity, etc.) will then be presented, supported by Krafringen, in order to provide the company with necessary information for continued investments in tanking stations.

Responsibility: All relevant committees and boards

Timetable: 2015-2016

B. Distribution of renewable fuels

Measure 1.B.1

More tanking stations for biogas are to be set up within Lund municipality, primarily by Krafringen. In cases when the economic calculations for the tanking station have not been good enough, other forms of ownership than Krafringen have been identified. Examples of such ownership can be the municipality together with local actors.

Responsibility: Krafringen

Timetable: 2014-2017

Measure 1.B.2

Lund municipality works to improve the vehicle charging infrastructure and tests an infrastructure for rapid charging.

Responsibility: Krafringen. Lund Municipal Parking AB, Lunds kommuns fastighets AB, committees that purchase electric vehicles

Timetable: 2014-2017

Measure 1.B.3

More tanking stations for RME are to be set up in order to facilitate tanking for the machinery using RME that are owned by the municipality.

Responsibility: Krafringen (main responsibility), Lunds kommuns fastighets AB

Timetable: 2014-2017

C. Increasing the proportion of environmentally-friendly vehicles used by companies and residents

Measure 1.C.1

Lund municipality actively pursues the target of increasing the proportion of electric and biogas cars amongst both residents and businesses.

Responsibility: Municipal Executive Board, Lund Municipal Parking AB, Lunds kommuns fastighets AB, Krafringen

Timetable: 2014-2017

D. Energy-efficient and environmentally friendly use of vehicles

Measure 1.D.1

Lund municipality makes constant efforts to ensure that the degree of density of the use of municipality's vehicles is satisfactory and that the vehicles are not used unnecessarily.

Responsibility: All relevant committees and boards
Timetable: Start 2015 and ongoing

Measure 1.D.2

Lund municipality carries out a pilot project on mixed loading.
Responsibility: Municipal Executive Board
Timetable: Start 2014-2017

Sub-area 2: Energy-efficient properties and building/public works contracts

The situation in 2012

The following is a description of the situation in 2012 regarding energy-effective properties and building contracts in Lund municipality, with a focus on the municipal organization. Examples are taken from the discussions held within the framework of the five theme group meetings. The purpose is to describe what has been done, what is underway and to take up obstacles and successful factors and the challenges that form the basis of the proposals for measures included in the plan. Since all statistics for 2012 were not accessible when the Energy Plan was produced, statistics from 2010 and 2011 have been used.

Municipally-owned premises

Lund municipality reserves ca 140-160 million Swedish crowns annually for new construction and rebuilding of premises for municipal activities. An ongoing discussion of total rents, heating, hot water, cooling and electricity and incentive rents is held with Lundafastigheter (Lund Properties).⁹ Incentives have been transferred to the property owner from having previously been with the users, for instance, with school headmasters.

Lundafastigheter has prioritized energy efficiency in their premises and they have high demands on new construction. They see a need to work more with the users of the premises and the importance of behaviour connected to energy consumption. As regards new construction Lundafastigheter place harder demands than those in the building regulations of the National Board of Housing Building and Planning (Boverket). Lundafastigheter's starting point is 45kWh/m² Atemp, heating, hot water and electricity. Lundafastigheter aims at reaching the highest environmental class in the SYD Environmental Construction Programme (Miljöbyggprogram SYD), in all their new construction projects. This can be exemplified by the town hall, Kristallen, which was built in compliance with the highest environmental classifications on the market. Also the new preschools are low-energy buildings. Lundafastigheter also test zero-energy buildings and smart, optimized energy solutions such as thermal storage in the body of the building.

Municipally-owned dwellings

For some time Lunds kommuns fastighets AB (LKF) has worked hard to reduce energy use. The environmental project "Trimma LKF" started already in 1990, when the goal was to reduce all costs and impact on the environment, especially as regards the consumption of heating, water and electricity. When the project started, LKF used an average of 210 kWh per m² Atemp for the heating of dwellings and premises. After this project and a number of other

⁹ Lund Properties and land development comprise the commercial entities within the municipal Services administration.

measures, the company has succeeded in using less than 150kWh per m² on average annually in their entire housing stock (LOA+BOA normal year corrected).

New construction maintains a high level of energy efficiency, which reduces energy use also in the entire housing stock. One important factor behind energy efficiency is that LKF owns and manages the stock. Within the city district of Linero, the residential area of Oden, built by LKF in 2013, contains 60 flats that are the first in LKF's production to fulfill the requirements for certification as passive buildings. Another example of energy-efficient new construction is LKF's extensions within Stångby where calculations show an anticipated annual energy use of 39 kWh/m² Atemp, heating and hot water. A concrete instance where LKF monitored the energy actually used is the block Russet in Veberöd, where the properties use ca 40-45kWh/m² Atemp, heating, hot water and electricity. Through these investments LKF has gathered knowledge of technology that can assist in building draft-proof and well-insulated buildings. LKF introduced during one period a system of comfort heating and uses this system in ca 3000 flats, but due to certain difficulties, has chosen not to install the system in new flats. The system is based on an indoor temperature of 21 degrees, which is included in the rent. The person who wishes a warmer temperature pays more, and the one who is satisfied with a lower temperature gets a refund. Since 2000 LKF has installed meters for individual hot water measurements in all new construction and, when it is technically possible, economically reasonable, and environmentally defensible, LKF has installed them in existing stock.

LKF initiated a comprehensive maintenance programme during 2011. The first stage was started in the district Offerkällan, Norra Fälåden. Totally, 50-74 million Swedish crowns is being invested annually, divided amongst ca 125 flats/per year and the entire project is reckoned to continue for 20-25 years. Improving energy efficiency is an important part of property maintenance and LKF has begun with properties built during the 1960s and thereafter in the order of construction. LKF uses the term "low energy building" and avoids the concept of "passive house". LKF uses established concepts and energy standards and is positive to the energy chapter in the SYD Environmental Construction Programme.

SYD Environmental Construction Programme

Together with the city of Malmö and Lund University, the city of Lund has developed the Environmental Construction Programme SYD. The programme is a tool for ecologically sustainable construction and was adopted by both city councils in the autumn 2009. The programme is divided into a number of core areas, of which one concerns demands for buildings' energy performance. The programme is also divided into three environmental classes, where C is the base requirement and the higher classes B and A are available choices for the builder. The programme shall keep apace with development and be updated later. The Planning and Building Committee has delegated the responsibility for developing and running the programme. Through land use agreements when purchasing municipally-owned land, the municipalities can require that builders follow the environmental programmes' demands – at least environmental class C – in their new construction of dwellings and premises.

A new (second) version of SYD Environmental Construction Programme was adopted in October 2012. This new version is adapted to the new planning and building law and the new regulations set down by the National Board of Housing, Building and Planning, where particularly the energy demands have been sharpened. The energy levels in the new

environmental building programme have also made it possible for builders to choose between two different national standards. In December 2012 the state submitted a report to the Building Requirement Enquiry, which was to investigate whether municipalities should continue to have a right to place “special demands” when selling municipal land. The enquiry suggested that a hindering clause be included in the planning and building law which would make that impossible. If the Parliament decides in favour of the enquiry’s proposal, SYD’s or other demands regarding land use agreements may not be acknowledged. Discussions with builders or general contractors should in these instances be given greater latitude in the municipal planning and technical services departments’ daily work so that discussions about environmentally-adapted construction can continue – this assumes resources are also allocated for this

New construction areas

Krafringen works a great deal with Brunnshög and Solbjer. They have discussions with general contractors – e.g. Skanska, LKF and Lundafastigheter. Lund municipality has ambitious visions for the area and intend for it to include world-class innovation, with high energy demands - class A, according to SYD. The new area should also be self-sufficient in energy and high demands are placed on the built property. This means finding solutions that contribute to fulfilling Lund’s vision and finding solutions for energy systems that benefit residents, builders, property companies, etc.

In areas of new construction it is especially important that the most suitable energy solutions are chosen. District-heating based on renewables and bio fuels is a form of heating with a low primary energy factor and should therefore be the first choice for heating new properties.

For newly-built areas it is important to decide at an early stage if the area can or should be connected to the district heating network. The best arrangement is to place culvert pipes in the ground at the same time as roads are being laid in the area. Coordinated planning should be an objective, as regards infrastructure such as electricity, water, sewage and heating.

Energy services and use of premises

Krafringen works with energy services to property owners, industries and owner-occupier housing associations. Krafringen also undertakes various types of consultant commissions, for instance, energy analyses and electrical use analyses, and act as entrepreneurs in operational safety contracts or agreements. Krafringen optimizes operations in all technical systems and supervise and plan maintenance. The company’s goal and focus is the reduction of energy use with the smallest possible investment. One possible next stage is to offer customers a so-called “comfort agreement”, when a temperature level in the property is offered instead of an energy carrier.

The Culture and Leisure Committee has used Krafringen’s energy services to examine two buildings on the basis of energy analysis, and has added measures based on these analyses to their maintenance plans. The Culture and Leisure Department is an example of a municipal department whose premises are mainly owned by Lundafastigheter – for example, sports facilities, leisure facilities, bathing places, etc. - and the committee’s goal in its environmental management system is energy efficiency. As regards division of responsibility, the Culture and Leisure Department often has responsibility for internal maintenance and Lundafastigheter for the external.

The Children and School committees have now begun to apply a so-called total rent with Lundafastigheter where energy consumption, heating and water are included in the rent. There is a need for continuing discussions with Lundafastigheter about the concept of total rent and a wish for some form of portal is created which would enable e.g. schools to monitor their energy consumption.

Households

Even if Lund municipality is actively working with expanding district heating, a number of detached houses still have their own heating. Figure 9 shows information taken from the chimney cleaning services in Lund AB about the different sorts of heating boilers. This corresponds to existing boilers that the chimney sweeping services have information about, but it says nothing about whether the boilers are in use. As regards oil boilers it is probable that only a small portion is being used; however, it is likely that other boilers cover the entire needs for heating and hot water in the detached houses where they are installed. The trend is a decline in the number of boilers in favour of various heat pump solutions.

As regards domestic heating oil, its use has been phased out a great deal over recent years in tandem with the expansion of district heating and the rise in energy costs. The main users of heating oil remain, however, in the household sector - a total of 5.9 GWh. The corresponding figure for natural gas use in households is ca 55 GWh.

As regards heat pumps it is difficult to indicate exact number or measured electricity use and heating production. Heat pumps must be registered for extracting heat from the land, ground water or surface water, but not for air-air or air-water heat pumps. In the Environmental Services Department’s register 883 applications for heat pump installations have been made since 2000-01-01 in properties within the municipality, and most are less than 20 kW. Air-air and air heat pumps are not required to be registered, and therefore a standard assessment has been done for the amount of heating produced. In total, these heat pumps contribute 29.2 GWh heat for heating and hot water within the municipality – not including large heat pumps such as those Krafringen use for the production of district heating.

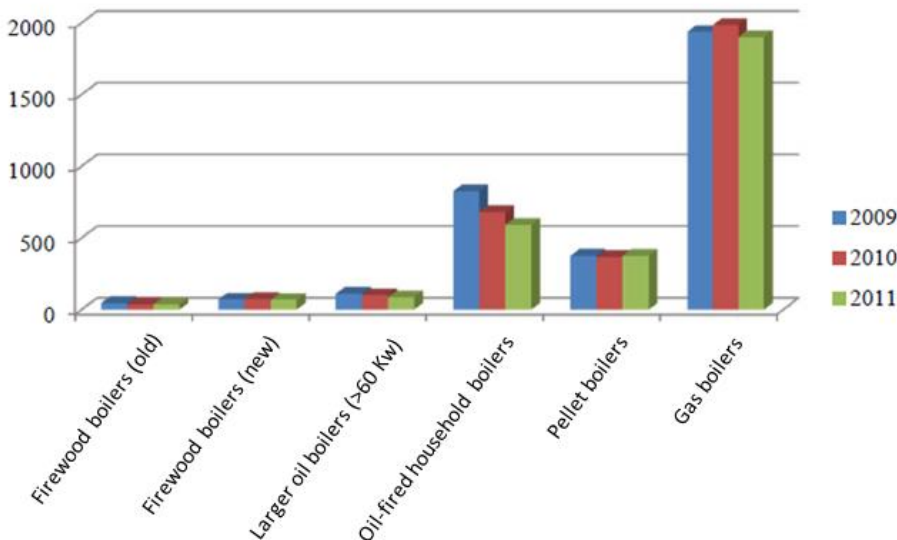


Figure 9. Different types of boilers for heating properties within Lund municipality. Source: Chimney cleaning services in Lund

Measures for sub-area 2

Presented below are the measures that the municipal committees and boards have agreed to carry out. These measures have been formulated during the process of producing the Energy Plan and have been revised after submission for review. These comprehensive measures are intended to build upon successful factors and overcome obstacles and challenges that were discussed in “The present situation, 2012”. The measures should reinforce efforts to increase the proportion of energy-efficient properties and public works contracts in Lund municipality.

A. Energy-efficient renovation of dwellings and premises

Measure 2.A.1

Lund municipality continues to pursue energy efficiency within the framework of renovation and maintenance of municipal properties.

Responsibility: Lunds kommuns fastighets AB, Municipal Services Committee

Timetable: Ongoing

Measure 2.A.2

Energy Advisory Services and Krafringen carry out activities directed towards owner-occupier housing associations and property owners in order to help increase the implementation of measures in the energy declarations.

Responsibility: Municipal Executive Committee, Krafringen

Timetable: Ongoing

Measure 2.A.3

Lund municipality supports activities to raise knowledge within the area of energy-effective property, directed towards various actors such as builders and the general public.

Answer: Municipal Executive Committee, Krafringen

Timetable: Ongoing

B. Energy-efficient new construction of dwellings and premises

Measure 2.B.1

Lund municipality continues to inform builders that they can use the energy advisory services offered by the municipality via the City Office.

Responsibility: Municipal Planning and Building Committee

Timetable: Ongoing

Measure 2.B.2

Lund municipality continues to keep itself updated on what other municipalities are doing regarding energy-effective new construction.

Responsibility: Municipal Planning and Building Committee

Timetable: Ongoing

Measure 2.B.3

When selling municipal land, to ensure that the City Council’s goals for its energy system according to the current version of SYD Environmental Construction Programme and

decisions by the City Council are upheld. In those cases where the municipality does not own the land, discussions with the builders leading to an optimizing of the energy system on the basis of environmental, economic and social aspects should be held.

Responsibility: Municipal Technical Committee

Timetable: Ongoing

Measure 2.B.4

Lund municipality installs intelligent energy solutions in the new production of municipally-owned dwellings and premises.

Responsibility: Municipal Services Committee, Lunds kommuns fastighets AB, Krafringen

Timetable: Ongoing

C. Energy-efficient use of dwellings and premises

Measure 2.C.1

Lund municipality continues to install individual warm hot meters in existing housing stock and in new construction.¹⁰

Responsibility: Lunds kommuns fastighets AB

Timetable: Ongoing

Measure 2.C.2

Continue to develop the exchange of experiences between landlords and users. For instance, to receive points of view and complaints at the same time as customers are informed about energy-smart behaviour. Develop incitement models to engage tenants in their own energy use.

Responsibility: Lunds kommuns fastighets AB. Municipal Services Committee, Krafringen

Timetable: Ongoing

D. Other

Measure 2.D1

In choosing an energy source for heating premises, the point of departure should be a primary energy perspective¹¹, which entails an assessment of the environmental impact of the entire life cycle of the energy used.¹²

Responsibility: Municipal Services Committee, Lunds kommuns fastighets AB

Timetable: Ongoing

¹⁰ This applies in cases where it is technically possible, financial reasonable and proportional in relation to potential energy-saving. In new construction and substantial renovations, the hot water meters should always be installed (according to current EU directives).

¹¹ For more information, see "Primary energy and system perspective" and "The Energy Ladder" above.

¹² This measure is linked with measure 3.C.5 which concerns encouraging the extension of district heating as the possibility of connecting to district heating is central for the implementation of measure 2.D.1. For economic reasons it may sometimes not be possible to choose the energy source that is best from a primary energy perspective, which is why exceptions may need to be made.

Sub-area 3: Increased recovery of waste products for the production of energy

Increased self-sufficiency in renewable energy

The situation in 2012

The following is a description of the situation in 2012 as regards self-sufficiency in renewable energy in Lund municipality, with a focus on the municipal organization. Examples are taken from the discussions held within the framework of the five theme group meetings. The purpose is to describe what has been done, what is underway and to take up obstacles and successful factors and the challenges that form the basis of the proposals for the measures included in the plan. Since all statistics for 2012 were not accessible when the Energy Plan was produced, statistics from 2010 and 2011 have been used.

Solar energy

There are several completed solar energy projects and several projects in preparation in Lund municipality. When LKF builds new dwellings, solar thermal collectors are often installed on the roofs, and LKF also owns two large solar heating plants, Jöns Ols and in Dalby, with a combined production of 150 MWh heating per year. A new photovoltaics plant, which is calculated to produce 30 MWh per year, has been set up in Norra Fäladen. Since LKF's stock has many flat roofs facing south, a project for installing solar power plants on these would be appropriate.

The Municipal Services Department has solar thermal collectors in operation in three of their public baths and intends to place solar thermal collectors in others that lack them today. The department is working with a pilot photovoltaics installation that is expected to generate 12 MWh per year. The plant is located on Råbyvägen, where the Service Department has its premises which are adjacent to Krafringen's property. In addition, there are plans to invest in a larger plant in the same area, which is calculated to produce 80 MWh per year. The Service Department allocates two million Swedish crowns annually to investments in renewable energy sources such as photovoltaics or solar thermal collectors. However, one problem with solar collectors is that many activities and enterprises are shut over the summer months, when solar production is at its best; therefore there is now more focus on photovoltaics.

Krafringen has many important renewable energy projects on the way: for instance, together with Lund municipality, Solar Region Skåne and LTH, they have produced a map of potential solar power, partly financed by the environmental management fund of Region Skåne, with the aim of furthering production of renewable electrical power. The project has developed a method for producing a solar map and making it accessible to the public, for instance, by publishing it on Krafringen's homepage. The purpose of the map is to create an easily accessible instrument for both small and large property-owners who wonder whether their properties are suitable for the production of solar power. The map shows which properties are appropriate for the installation of photovoltaics, considering the property's location and design. The method used for the map will also be described and made available for other actors within the energy sector and other municipalities that are interested in augmenting their solar power production.

Approximately ten photovoltaics plants were connected to Krafringen's grid in the spring of 2013. Krafringen has offered their customers the opportunity to buy surplus electricity from

photovoltaics for 1 Swedish crown per kWh and have received responses especially from the owners of detached houses who wish to connect their photovoltaics. Krafringen now has plans to make a technical map of the grid to see where connections are possible. They are also preparing a solar cell product which will enable companies, organizations and private persons to obtain help in the whole process of establishing photovoltaics – this includes installation and selling surplus electricity.

The municipal parking company presently uses a large amount of electricity – lighting, ventilation, electrically-heated ramps in multi-storey car parks comprise the main part of energy use. The company's goal is to cut its energy use in half and cover 25% of the remaining electricity needs – one fourth of the total use – with electricity from photovoltaics. Today the company has one photovoltaics plant with an output of 13kW at the multi-storey car park at Arenan, and it will be a challenge to increase production in order to achieve its goals.

Within the municipality of Lund in 2012 there were photovoltaics and solar thermal collectors with a capacity corresponding to 205 MWh electricity from photovoltaics and 271 MWh heating from solar thermal collectors.

Wind power

In 2012 there were 13 wind power turbines in Lund municipality, with a capacity of between 0.15-2 MW; annually they produce about 10 GWh. LKF works with wind power and is the largest shareholder in Lundavind, with shares corresponding to 90MWh wind power-produced electricity per year. LKF plans to increase investments in wind power on the basis of possible pilot projects. Krafringen has a number of wind power turbines in Värpinge and is considering more wind power projects. The Municipal Services Committee is investigating the possibility of installing small-scale wind turbines on suitable properties.

Renewable energy in buildings

Major changes have taken place as regards heating in LKF stock of buildings, where oil for heating was phased out entirely in 2010. Some natural gas is still used for heating, both in LKF and Lund's properties - ca 18 GWh total for both. The electricity for the whole of LKF stock corresponds to 12GWh annually and LKF has a contract for Bra Miljöval (Good Environment Choice) electricity. Its own production of renewable electrical energy from photovoltaics and wind power constitutes 2.5% of the total electricity within LKF's stock of buildings. LKF aims to increase production of renewable electricity – a challenge for the company.

Smart grid and micro production of electricity

The next generation's electricity grid, the so-called smart grid, gives users greater control and more information about their own energy use. Altering users' (residents') behaviour benefits both the economy and the environment. The next generation's smart grid will also give better preconditions for a larger proportion of micro production in Lund municipality and possibilities for creating locally-produced electricity. Electricity that is produced close to the consumers has less wastage and is thus better for the environment. Micro producers can sell the surplus they themselves do not use to an energy company. A natural next step is to store energy locally when there is a surplus; for example, the share of electric vehicles can be

increased. On the occasions when individual use is low, energy can be stored in the vehicle's batteries to be used later. These are ways to create new possibilities for a self-sufficient society.

Optimized production and use of district heating

Kraftringen's district heating network today extends 300 kilometers. The district heating system makes it possible to recover and recycle waste products from the city and the surroundings, for example, residue heating from industry and sanitation plants, recycled wood and woodchips. In Lund 765 GWh district heating was used in 2011; with degree day correction, this corresponds to 804 GWh. Kraftringen aims at reaching an optimal energy efficiency and eco-friendly district heating. Coordinated planning as regards establishing infrastructure such as electricity, water/sewage and heating supply should be an objective. One good example is Brunnshög's first building phase, Solbjer, where general contractors were employed at an early stage, which facilitated discussions about heating and other energy solutions before any other infrastructure provided. Kraftringen and LTH cooperate in a project on adaptive networks, self-regulating networks, where the district heating temperatures are lowered when requirement is low. Kraftringen is also investigating possibilities for new culvert techniques in order to cut heating losses. One task for Kraftringen is to examine what heating output they should be building for so that the network is expanded in an optimal way. The company is also interested in receiving the residual heating that is expected to come from ESS and MAX IV. Calculations indicate that ESS and MAX IV will regularly deliver residual heating, therefore storage during the summer when heating needs are slight is suitable. Kraftringen has a geothermal system in the western districts of Lund, at Gunnesboverket, where residual heating from ESS and MAX IV should be able to be stored during part of the year. ESS aims at using residual heating in the district heating network instead of installing a cooling tower.

Kraftringen is building a large biomass power plant, Örtoftaverket, which will commence operation in 2014 (see the section, Present situation). As the plant produces both electricity and heating and is also equipped with flue gas condensation, it achieves high operating efficiency. The plant will provide the region, which at present does not produce sufficient electricity of its own, with locally-produced, renewable electricity. This will be produced very effectively as the plant is connected to the district heating network, with customers who use residual heating.

District cooling

Kraftringen also has a district cooling network in Lund, where production is divided into two "islands", often called the "southern" and the "northern" district cooling network. The northern network is much larger in extent and includes at present some forty customer facilities. Production is carried out with heating pumps in the production plant Ångkraftverket (steam power plant), ÅKV. In 2011, Kraftringen delivered a total of 66 GWh district cooling. The heating that was cooled off with the district cooling was converted into district heating in the heating pumps. A total, the district cooling heat pumps supplied 95 GWh district heating during 2011, which corresponds to c 10% of the total district heating production in Lund/Lomma/Eslöv.

The energy supplied to the district cooling heat pumps is in the form of electricity; 1 MW electricity can produce c 2 MW district cooling and simultaneously 3 MW district heating. Krafringen plans to expand its production capacity.

Biogas, compressed natural gas (CNG) and natural gas

Within the municipality of Lund, there are gas networks in parts of Lund, Dalby, Södra Sandby and Revinge. Together with local actors in Dalby, Krafringen plans to build a plant for the production of biogas. The purpose of this plant is to recover the energy stored in waste products from livestock farming (manure) and agriculture in the area. It is planned to be located in an industrial area, at Siporex and Sydsten, outside of Dalby.

If the plant starts operating and the anticipated production becomes accessible as vehicle fuel, 8000 automobiles per year should be able to be driven with biogas, which corresponds to about 15% of the total number of automobiles in the municipality. This is an important investment which should increase the municipality’s chances of achieving its climate goals. Krafringen is investigating the possibilities of transforming some of the gas network into a biogas network, with biogas from the Dalby plant. Biogas has a somewhat lower heating value compared with natural gas. To obtain the same heating value as natural gas, therefore the gas network is “spiked” with propane (fossil gas). If a lower heating value would be permitted, the addition of propane in biogas could be avoided.

A total of 45 GWh compressed natural gas (CNG) was tanked in Lund municipality in 2011, of which 7.15 GWh consisted of biogas that was produced at Källby sewage treatment plant. At present, most of the biogas is used by the sewage treatment plant’s vehicles. Thus what remains is to increase production so that more of, e. g. the fleet of automobiles can also use biogas.

Statistics are uncertain regarding the amount of natural gas used in Lund municipality, within different sectors. The natural gas market is de-regulated and there are several gas suppliers selling gas to customers in the municipality, and the gas sold may be natural gas, biogas or a mix of the two. What is certain is how much natural gas Krafringen has distributed to customers in the municipality - in 2011, it was 529 GWh, with the following distribution:

Sector	Use of natural gas (percent)
Electricity and heating production	47
Industry/process	32
Compressed Natural Gas (excluding biogas)	7
Households	13
Public works	1

Table 1. Sector use of natural gas within Lund municipality, 2011. Source: Krafringen.

Measures for sub-area 3

Presented below are the measures that committees and boards have agreed to carry out. These measures have been formulated during the process of producing the Energy Plan and have been revised after submission for review. These comprehensive measures are intended to build upon successful factors and overcome obstacles and challenges that were discussed in “The present situation, 2012”. The measures serve therefore to reinforce efforts to increase the recovery of waste products for energy production and increase self-sufficiency in renewable energy within Lund municipality.

A. Increasing the amount of renewable fuels

Measure 3.A.1

Lund municipality undertakes an investigation of the technical and economic preconditions for producing biogas from appropriate parts of park and garden waste (phase 1). If the outcome of the investigation is positive, all parts of this waste shall be used for energy purposes – firewood for heating power production and compost waste to produce biogas (phase 2). Potential obstacles such as location and mode of operation should be scrutinized at an early stage.

Responsibility: Municipal Sanitation Board

Timetable: 2014-2015 (phase 1), 2015-2017 (phase 2)

Measure 3.A.2

Lund municipality tests new solutions for the recovery of more of the waste products in the municipality for biogas production and second generation bio fuels,¹³ in cooperation with VA Syd and Lund University. By testing new solutions in Lund, the municipality can also support new companies and will have started up at least one pilot project before 2017.

Responsibility: Municipal Executive Committee

Timetable: 2014-2017

Measure 3.A.3

Kraftringen builds the planned biogas plant outside Dalby. A part of the natural gas network in Lund municipality is changed into a biogas network.

Responsibility: Kraftringen

Timetable: 2014-2017

Measure 3.A.4

Lund municipality works to stimulate the establishment of more biogas plants, in collaboration with Kraftringen, farmers and others.

Responsibility: Municipal Executive Committee, Kraftringen

Timetable: 2014-2017

Measure 3.A.5

Lund municipality collaborates with branch organizations and networks such as Klimatkommunerna (Climate Municipalities) in order to influence national energy and

¹³ Methanol, bio diesel (DME), gaseous hydrogen, fluid biogas, etc.

climate policy, with the aim of stimulating biogas production.

Responsibility: Municipal Executive Committee

Timetable: Ongoing

Measure 3.A.6

In dialogue with researchers at Lund University and Lund Technical College, the municipality seeks new knowledge about how bio fertilizer can be made attractive enough to sell. Information directed towards the relevant actors is conveyed together with branch organizations.

Responsibility: Municipal Executive Committee

Timetable: 2014-2017

Measure 3.A.7

On a regular basis, Lund municipality undertakes to increase standardization, simplification, common methods of payment, tanking systems etc. as regards renewable fuels. This concerns making renewable fuels simpler for producers and consumers and influencing energy and climate policy.

Responsibility: Municipal Executive Committee, Krafringen

Timetable: Ongoing

B. Increasing production of renewable electricity and heating

Measure 3.B.1

Lund municipality actively undertakes to influence national energy and climate policy in order to facilitate offsetting the electricity it produces itself with that produced by electrical network companies – so-called net debiting.

Responsibility: Municipal Executive Committee

Timetable: Ongoing

Measure 3.B.2

The solar energy potential map, produced for the whole municipality, shall be used as a basis for investments in solar energy, in collaboration with branch organizations and property owners.

Responsibility: Krafringen, the Municipal Planning and Building Committee, Municipal Executive Committee

Timetable: 2014-2017

Measure 3.B.3

Lund municipality carries out activities that contribute to greater knowledge about small-scale renewable energy and that help property owners to sell electricity from small-scale production – so-called micro-production – from e. g. photovoltaics and wind power.

Responsibility: Krafringen, Municipal Executive Committee

Timetable: Ongoing

Measure 3.B.4

Lund municipality continues to phase out natural gas as a source of heating in properties and to replace it with sources in accordance with the Energy Ladder (cf “Energy Ladder”).

Responsibility: Lunds kommuns fastighets AB, the Municipal Services Committee

Timetable: Ongoing

Measure 3.B.5

Lund municipal government departments and municipal companies collaborate in societal planning in order to identify possibilities of stimulating small-scale production of electricity when new city districts are being formed.

Responsibility: Municipal Planning and Building Committee (main responsibility), and relevant committees and boards.

Timetable: Ongoing

C. Optimized use of district heating, residual heat and district cooling

Measure 3.C.1

Small-scale heating production is not recommended in areas where residual heat is available, and in this way, an optimal use of residual heat is furthered. In the areas in question the municipality provides various kinds of information clearly recommending district heating based on available residual heat.

Responsibility: Municipal Executive Committee

Timetable: Ongoing

Measure 3.C.2

Kraftringen completes the building of a bio –power plant in Örtofta.

Responsibility: Kraftringen

Timetable 2014

Measure 3.C.3

A preliminary study in order to inventory interest in and the need for heat-driven cooling – ie “comfort cooling” and cooling for lower temperatures, for instance in refrigerated or cooled rooms in the municipality.

Responsibility: Kraftringen (main responsibility), Lunds kommuns fastighets AB, Municipal Services Committee

Timetable: start 2016

Measure 3.C.4

Kraftringen develops concepts for promoting district heating-driven household and industrial kitchen equipment. Collaboration with Lunds kommuns fastighets AB and the Municipal Service Committee. Evaluation is made of commenced projects.

Responsibility: Kraftringen koncernen AB (main responsibility), Lunds kommuns fastighets AB, Municipal Services Committee

Timetable: 2015-2017

Measure 3.C.5

Lund municipality produces a strategy concerning the possibilities to promote being connected to district heating in new communities and areas of expansion; this includes even land that is not owned by the municipality, and entails increasing density within the district heating area.

Responsibility: Municipal Executive Committee (main responsibility), Municipal Technical Services Committee, Krafringen

Timetable: 2015-2016

Measure 3.C.6

Increasing coordination and review to recover accessible residual heating within Lund municipality.

Responsibility: Krafringen (main responsibility), Municipal Planning and Building Committee

Timetable: Ongoing

Measure 3.C.7

Carrying out a survey to ascertain the needs for district cooling in the municipality. The district cooling network can then be extended to cover needs.

Responsibility: Krafringen

Timetable: Start 2015

D. Other

Measure 3.D.1

The municipality should have an ongoing dialogue on renewable energy with residents and businesses in Lund. The dialogue aims at lowering the risk that local opinion will defeat renewable energy projects.

Responsibility: Municipal Executive Committee (main responsibility), relevant committees and boards

Timetable: Ongoing

Measure 3.D.2

Lund municipality is a pilot municipality for new technology where clear links are made between environmental efforts and economic growth. Brunnshög is in this context a good example that shows the way and that harmonises with Region Skåne's energy and climate goals.

Responsibility: Municipal Executive Committee

Timetable: Ongoing

Sub-area 4: Raising the level of knowledge concerning energy issues

The situation in 2012

The following is a description of how Lund municipality worked with raising the level of knowledge of energy questions, directed at various target groups. Examples are taken from the discussions held within the framework of the five theme group meetings. The purpose is

to describe what has been done, what is underway and take up obstacles and successful factors and the challenges that form the basis of the proposals for the measures included in the Energy Plan.

Efforts aimed at residents and within the municipal organization

The state energy authority gives economic assistance for energy and climate advice to municipalities in Sweden. In Lund, the City Office has responsibility for energy and climate advice, with an adviser who offers free and impartial advice to private persons and businesses. This includes, in addition to advice about properties and renewable energy, also advice about transport. Private persons usually ring, write emails or visit the adviser, and the adviser may also visit businesses. One important question is how energy advice should be used, when according to legislation, it may not be directed towards municipal organizations, but it can be aimed at students in school. At present it is unclear how long-term the financing of this advisory service will be as the decision about state financing applies for only one year at a time. Thus solutions must be found for augmenting the municipal energy advisory service and keeping a long-term perspective in disseminating energy advice.

The City Office organizes public lecture series on energy and the environment. It coordinates environmental networks within the municipality as well as the municipal departments' environment management systems, where various energy issues are handled.

The Culture and Leisure Services Department's work with energy is based on the goals included in the environmental management system. The department's goal is to provide a good example, for instance, they exchange conventional lighting with LED in the City Hall, which gives the right signals to the public. The department also tries to make the people using their premises more aware of environmental factors. There is an idea to insert a clause in rental contracts to the effect that the department's energy goals should be followed by those hiring the premises. To gather new ideas a so-called "users' council" is arranged, and this also increases participation.

The Culture and Leisure Services Committee is responsible for sports facilities whereas Lundafastigheter owns the facilities. According to the Committee, it is not entirely clear who has responsibility for sports facilities' energy performance, as energy savings are not returned to those using the sports arenas today and therefore they will be less interested in taking energy-saving measures. It is therefore important to clarify the division of responsibility between the Culture and Leisure Services Department, Lundafastigheter and the clubs and associations that hire the premises. Important questions to investigate include how to induce the associations that hire municipal sports arenas to be more economical with energy. Who should sign agreements with clubs or associations that rent sports facilities?

Energy education in schools

The Municipal Services Department has produced films on energy aimed at school children. Krafringen has initiated an energy competition, "Spänningsökarna" (lit. "Voltage-seekers") that is aimed at 8th year pupils. Young people can brainstorm freely on energy and environmental solutions. When the competition was organized in 2012, twenty-five 8th year classes participated and the competition's homepage had 11,500 visitors.

Raising the level of knowledge within business and industry

The Environmental Services Department, in collaboration with the municipal energy and climate advisor, is initiating cooperative visits to businesses with the aim of informing the business sector about their energy use.

Communicating energy efforts

Information on municipal departments' and companies' comprehensive energy measures has lacked internal coordination. Coordinated communication of the municipality's energy and climate efforts would be desirable and worthwhile.

Measures for sub-area 4

Presented below are the measures that the municipal committees and boards have agreed to carry out. These measures have been formulated during the process of producing the Energy Plan and have been revised after submission for review. These comprehensive measures are intended to build upon successful factors and overcome obstacles and challenges that were discussed in "The present situation, 2012". The measures should reinforce efforts to increase knowledge of energy questions within the municipal organization, among school children, local residents and businesses.

A. Raising knowledge within the municipal organization

Measure 4.A.1

An internal municipal "energy strategist" is to be employed and will be a key person in the energy efficiency efforts within the municipalities' own activities. Special efforts to advance knowledge about energy amongst users of municipally-owned/hired premises' will be carried out with the support of the municipal energy strategist.

Responsibility: Municipal Services Committee

Timetable: Start 2014

Measure 4.A.2

A recurrent internal education concerning life cycle costs, aimed at decision-makers and other relevant target groups (e.g. contractors, economists, caretakers) will be organized.

Responsibility: Municipal Executive Committee

Timetable: Start 2014 and ongoing

B. Raising knowledge amongst school children, local residents and businesses

Measure 4.B.1

In cooperation with the energy strategist (cf measure 4.A.1) and the energy advisor, Kraftringen offers energy information in schools, for example, study visits and "spänningssökarna" competitions.

Responsibility: Kraftringen (main responsibility), Municipal Executive Committee, Municipal Services Committee

Timetable: Ongoing

Measure 4.B.2

Production of a collective strategy for how Lund municipality within the municipal organization (departments and companies) can communicate to local residents the municipality's progress with energy use.

Responsibility: Municipal Executive Committee

Timetable: 2015

Measure 4.B.3

Lund municipality works to increase clubs' and associations' knowledge of energy use, e. g. through a users' council.

Responsibility: Municipal Culture and Leisure Committee

Timetable: Start 2014 and ongoing

Measure 4.B.4

Lund municipality tests visualizing energy use in schools and public premises. Collaboration with Lund Technical College.

Responsibility: Municipal Services Committee

Timetable: 2014-2017

Measure 4.B.5

Undertake energy campaigns directed towards residents of the municipality. This measure concerns responding to residents' interests, helping them to make active decisions about energy (e g photovoltaics, smart houses, energy saving tips, etc.) and thereby contributes to carrying out the measures in the Energy Plan.

Responsibility: Municipal Executive Committee, Krafringen, Lunds kommuns fastighets AB

Timetable: Ongoing

Measure 4.B.6

A conference on energy issues, for the public, businesses, researchers and municipal officials to be held annually, where exchanges of experience, annual reports of monitoring are important features and greater collaboration is encouraged.

Responsibility: Municipal Executive Committee

Timetable: Start 2014 and ongoing

Measure 4.B.7¹⁴

Dissemination of information with the purpose of raising the level of knowledge about environmental vehicles, renewable fuels and shared use of vehicles, aimed at residents and businesses.

Responsibility: Municipal Technical Services Committee (main responsibility), Municipal Executive Committee

Timetable: Ongoing

¹⁴ This measure goes together with measure 1.C.1

Measure 4.B.8

Lund municipality investigates the possibilities of ensuring that external users of municipal premises, e.g. clubs and associations that hire premises from the municipality are obliged to follow the municipality's energy goals.

Responsibility: Municipal Culture and Leisure Services Committee, Municipal Services Committee

Timetable: 2014-2015

Appendix 1: Krafringen's energy system

