The scope of municipal energy plans in a Swedish region
A review of energy and environmental issues in the plans

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Abstract

Swedish legislation requires municipalities to produce an energy plan. Each municipal government is required to prepare and maintain a plan for the supply, distribution, and use of energy. Legislation also requires an assessment of the environmental impacts of any activities before implementation.

Whether municipal energy plans have contributed to or preferably controlled the development of local energy systems has been a subject for debate. In the research project “Strategic Environmental Assessment of Local Energy Systems”, financed by the Swedish Energy Agency, the municipal energy plan as a tool for developing local energy systems is studied. In this study, twelve municipal energy plans from Östergötland County in southern Sweden have been analysed. Different kinds of municipalities are represented in this county.

The analysis has been based on a number of questions in different categories assessing energy system characteristics, environmental impact assessment and aims, the planning process, and goals for the plans. This report reviews the contents of all the energy plans in this first study.
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1. Introduction

**1.1 Municipal energy planning**

Municipalities\(^1\) play an important role in the Swedish energy system, mainly as the dominating local energy distributor but also as owner of a large number of public buildings. In addition, the municipality provides energy-related information and advice to its citizens. Much of the responsibility for the development of the municipal energy system lies with local authorities, which must abide by Swedish legislation. One of the means for the municipal government to manage and develop their municipal energy systems is the municipal energy plan.

In 1977, the Swedish government passed an act that required municipalities to develop energy plans (SFS 1977:439). The act addressed supply and distribution issues, although it was not compulsory. That is, municipalities were encouraged rather than required to develop an energy plan. No national agency was appointed to approve or control the municipal energy plans (National Energy Administration, 1986). The requirements in the act were vague and therefore lead to uncertainty about the obligations the municipalities had concerning municipal energy planning (Swedish National Audit Office, 1991).

The role of municipal energy planning has been debated since 1977 primarily because of the lack of strict direction or sanctions. One other subject for debate is the participation from national government agencies in the local energy planning processes (National Energy Administration, 1986). Many municipalities have chosen not to prioritise energy planning despite the act on municipal energy planning that requires an up-to-date plan (Lundqvist, 2002). The act has also been criticised by the Swedish National Audit Office (1991) because the effects of this national governance of municipal planning have been uncertain. According to the National Audit Office, the legislation is an ineffective way to accomplish municipal energy planning. This weakness is mainly due to its vague conditions and lack of incentives, normative as well as economic. The National Audit Office also concludes that it is doubtful that the act on municipal energy planning has influenced the development of Swedish municipal energy systems.

The act on municipal energy planning, however, has persisted. Moreover, strengths of municipal energy planning have been emphasised. The

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\(^1\) The Swedish word *kommun* is translated as municipality, and it refers to a political and administrative organisation as well as a geographical area. To avoid confusion, the word municipality is here used for the administrative/political organisation (including civil servants). When the political organisation (*kommunfullmäktige*) is denoted, the term municipal council is used. Furthermore, is the term local authority used when the municipality as an authority is referred to (see glossary).
Swedish National Audit Office (1991) states that there indeed is a need for municipal energy planning even if legislation on the subject might not be necessary. Olerup (2000) believes that the strength of energy planning lies with the possibility to generate alternatives regardless of changing national energy policies or subsidies. The value of energy planning in connection to waste management or expansion of district heating has also been stressed (Johansson, 2001).

1.2 Aim of the study

This study reviews municipal energy plans. The study has been conducted in the context of the “Strategic Environmental Assessment of Local Energy Systems” research project, which in turn is a part of the research program Emissions and Air Quality. The research in the project is focused on municipal energy plans as a tool for controlling the development of a local energy system.

The aim of the study presented in this report is two-fold. First, it aims to analyse the scope of municipal energy plans concerning energy related issues and environmentally related issues. Secondly, the scope of the energy plans is analysed in relation to Swedish energy and environmental policy as well as to spatial planning, decentralisation, and deregulation of the electricity market. In addition, the energy plans are studied in relation to international initiatives such as Agenda 21 (LA21).

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2 A research program financed by the Swedish National Energy Administration.
2. Background – Policies and other factors influencing municipal energy systems

A number of factors influence municipal energy systems and hence municipal energy planning. This section focuses on national policies and trends. In addition, some international trends that might affect local energy planning are also examined.

2.1 Energy policy

Swedish energy policy has gone through four major stages after the introduction of the act on municipal energy planning in 1977 which is due to have influenced the municipal energy systems. This overview starts in 1975 (right after the first world-wide oil crisis) and explores the politics behind the 1977 act on municipal energy planning. Vedung (2001) describes the development of the Swedish energy policy from 1975 to 1997.

1975-1984 Nuclear energy and conservation

According to Vedung, the expression “energy policy” was rarely used in Swedish politics before 1975. Until then, energy concerns had been entirely supply oriented, but by 1975 a rather strong energy conservation program was launched. However, the main overall goals in the 1975 energy policy included a 2% annual growth in energy demand and 13 new nuclear reactors. Vedung believes that the strong push for nuclear power was due to the desire to reduce oil dependency. After a referendum in 1980, the decision was made to double the installed capacity of nuclear power and then to phase it out before 2010.

1985-1991 Increased dependence on nuclear energy

According to Vedung, the main outline in the energy policy from 1975 was maintained in the 1985 energy policy. The last two (of the planned 13) nuclear reactors were about to be started when the government proclaimed that more general and diffuse goals had to be adopted. Although the beginning of the phase-out of nuclear power could not be determined, energy policy should prepare the phase-out by using energy conservation measures and replacing electricity with alternative energy sources.

Following the Chernobyl accident in 1986, it was decided that two reactors should be shut down by 1995. This decision, however, was reconsidered in 1990.

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3 Before 1975, the annual growth in energy demand had been more than 5%, so a modest annual growth of 2% was regarded as energy conservation (National Industry Board, 1975)
1991-1996: Secure energy supply for economic growth

Vedung notes that a new national energy policy was agreed on in 1991, and the 1988 phase-out agreement regarding nuclear energy was abandoned. Again, electricity was an important issue. The Government Bill states that it is important to “secure the supply of electricity and other energy”, and to maintain competitive prices to promote economic growth. There was no longer a fixed date for the phase-out of nuclear energy.

1997-Building a sustainable energy system

In June 1997, the Swedish government delivered yet another energy policy. Vedung describes objectives of this policy as a way to create a sustainable energy system. Secure supply of energy at competitive prices was still important and should be based on renewable energy sources. Finally, Vedung notes that the government also returned to fixed dates for decommissioning of two nuclear reactors during this time.

With this policy (Government Bill 1996/97:84), a financial program was launched. Support was given for connecting buildings to district heating systems, and new electricity production from renewable energy sources was subsidised. Priority was also given to research programs that would address keeping the cost of renewable energy low in order to make it competitive with nuclear and fossil energy (Government Bill 1996/97:84). The financial program following the 1997 energy policy included possibilities to develop local district heating systems and wind power. Municipalities could participate in Local Investment Program (LIP), which provided potential funding for alternative energy sources.

The act on municipal energy planning

The act on municipal energy planning was established in 1977; the act has been revised and completed with additional legislation several times. For example, to emphasise the reduction of oil dependency, a further requirement for a complementary municipal oil reduction plan was presented to municipalities in 1981 (National Energy Administration, 1986). This complementary legislation addressed the conversion of local energy systems from oil-based systems to alternative energy sources and more efficient energy technologies.

After the 1985 energy policy, the separate oil reduction plan was removed (National Energy Administration, 1986). Municipal energy planning was revised and the role of energy users as an important part of the energy system was acknowledged. Municipalities were encouraged to plan for supply, distribution, and use of energy (Swedish National Audit Office, 1991). Another goal following the policy was to integrate energy into municipalities’ overall planning process.
In 1991, a requirement for environmental impact assessment (EIA) for the energy plan was added to the act on municipal energy planning. This requirement was replaced in 1997 with a weaker statement that required only a general environmental assessment of the energy plan.

### 2.2 Environmental policy

The Environmental Protection Act (SFS 1969:387) was presented in 1969 and is seen as an important mark when it comes to environmental legislation in Sweden. With the Act, the government wished to address the reduction of all types of pollution—air, water, and noise pollution—to improve the health and comfort of the populace (Government Bill 1969:28). In 1981, legal demands on the assessment of the environmental effects were introduced in the Environmental Protection Act.

In 1972, a new Government Bill was presented regarding spatial planning and the management of land and water (Government Bill 1972:111). This provided the conditions for the placement of environmentally hazardous industries. These parameters were presented to ameliorate the conflict between industrial uses of natural resources (land and water) and society’s use of land and water. By legally assessing an activity, the government aimed for a comprehensive perspective on environmental, political, and other societal goals (Linderström, 2002).

In 1984 the Swedish Government presented a new bill (Government Bill 1984/85: 127) that aimed to present a program for air pollution and acidification.

In 1988, the environmental policy for the next decade was presented in a Government Bill (Government Bill 1987/88:85). According to Anselm (1995), the basis for the environmental policy should be a comprehensive view with long-term objectives. The policy should aim at making sure that all human activities consider the vulnerability of nature. The aim could be reached by means of an efficient legislation and control but also through education and fees. Furthermore, the environmental politics would also focus on the international level to accelerate a change in lifestyle and consumption patterns. Acidification, water pollution, and the depletion of the ozone layer were the environmental issues that the bill addressed. Nature conservation is another key word in the bill; that is, genetic diversity and endangered species and habitats should be protected. Finally, the bill calls for a long-term and effective use of resources.

In 1991, a bill was presented that declared that the natural environment, employment, welfare, social care, and equity formed the basis for the politics of government (Government Bill 1990/91:90, Linderström, 2002). All areas in the society should be imbued with the responsibility for the
environment and for the management of resources. All activities in society would be adjusted to ecologically sound practices to combine a living environment with welfare and employment. The connection between economy and nature was hence important. The 1988 Government Bill focused on the environmental risks and the demands of a comprehensive environmental policy. This bill, however, focused on the global environmental problems caused by diffuse sources. The bill further aimed at striving for an environmentally adapted energy system.

One dominant perspective in the Government Bill of 1991 was that prevention is better than cure. Therefore, an important part of the bill was the introduction of a general call for environmental impact assessment (EIA). The call for EIA in the 1991 bill was on a more general level in order to make clear when and how project developers should perform an EIA. In some Acts that already included calls for EIA, such as the Environmental Protection Act, the call for EIA was somewhat sharpened. A number of other acts were introduced to the EIA call as well such as the Act on municipal Energy Planning (SFS 1977:439).

Another of the areas pointed out as important in the 1991 bill was waste management such as recycling. In 1993, the Swedish Government presented a new bill on “Kretsloppsanpassning” (Government Bill 1992/93:180). With this bill the government aimed towards an ecologically sustainable development and one way to accomplish this was to close the material cycles. A good resource economy would be one of the key words for the Swedish society, another was to stimulate reuse of materials and to minimise the environmental impacts from materials and products. These measures would minimise the generation of wastes and emissions to the environment. In addition, the use of renewable natural resources (instead of non-renewable ones) was stressed. The bill also emphasised how industrial material and energy flows should imitate nature’s closed material cycles to minimise the use of resources (Roth, 2001).

In 1998, Swedish environmental goals were presented (Government Bill 1997/98:145). This bill presented the government’s ambition that the next generation would be able to “hand over” a society to future generations where most of the environmental problems were solved. The proposals in the bill cover many areas in the society such as energy, transportation, employment, agriculture, design, and architecture. One important proposition is a new environmental code that co-ordinates, sharpens, and broadens environmental legislation. The bill further proposes that a number of environmental quality goals would be established by the parliament to set the environmental conditions that will be accomplished within one generation. The use of resources also needs to be efficient from a global perspective. Furthermore, it is considered vital that the environmentally
adapted businesses and environmentally adapted societal planning be preconditions for a sustainable development.

The environmental code that the Swedish government proposed was presented in more detail in Government Bill 1997/98:45. The reasons for this new code were many. Firstly, the code aimed to co-ordinate the existing central environmental acts. Hitherto, the environmental legislation had been difficult to grasp. Secondly, many of the environmentally hazardous activities had insufficient regulations; the new code would provide all activities the same basic regulation. Thirdly, the aim was to come to terms with the diffuse sources of pollution. In the code, all activities that contribute to the deterioration of the environment should be controlled. The development of Swedish environmental policy is shown in Table 1.

Table 1. Development of the Swedish environmental policies and legislation

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>The Environmental Protection Act is introduced to reduce emissions, pollutions and noise</td>
</tr>
<tr>
<td>1972</td>
<td>A policy on spatial planning and the management of land and water is presented</td>
</tr>
<tr>
<td>1984</td>
<td>A program for reducing air pollution and acidification is presented by the Swedish government</td>
</tr>
<tr>
<td>1987</td>
<td>The Planning and Building Act is introduced&lt;br&gt;The Act on the management of the natural resources is introduced&lt;br&gt;The WCED report on sustainable development is presented</td>
</tr>
<tr>
<td>1988</td>
<td>A new long-term and comprehensive environmental policy is presented</td>
</tr>
<tr>
<td>1991</td>
<td>An environmental policy is presented which states that a living environment should be the basis for all Swedish policy</td>
</tr>
<tr>
<td>1992</td>
<td>The Rio-conference on sustainable development</td>
</tr>
<tr>
<td>1993</td>
<td>A report on “kretsloppsanpassning” is presented and a new policy on waste management is introduced</td>
</tr>
<tr>
<td>1998</td>
<td>New environmental goals are presented, aiming to promote ecological sustainable development</td>
</tr>
<tr>
<td>1999</td>
<td>A new environmental code is introduced</td>
</tr>
</tbody>
</table>

2.3 Other policies, trends, and legislation

Except for national energy and environmental policy, there are a number of other trends, policies, and legislation, both national and international, which have influenced the development of local energy systems in Sweden. Some of these that are likely to have influenced the development of local energy systems are reviewed below.
Decentralisation

Sweden has a long tradition of local self-governance where decisions are made at the local level of government. Since the 1960s, Sweden has experienced strong opinions for decentralisation, which have resulted in new legislation for local authorities (Gustavsson, 1999). The first complete act on local self-governance was issued in 1977 (SFS 1977:179). In 1991, this legislation was replaced by a new Municipal Act (SFS 1991:900). The 1991 Municipal Act stressed the market economy by viewing municipalities as businesses that were allowed to generate profit. The demand for transparency, however, in the municipal companies was strengthened and the principle of public access to official documents (offentlighetsprincipen in Swedish) was emphasised (Gustavsson, 1999).

The Municipal Act was revised in 1994 and a self-cost principle (självkostnadsprincipen) was introduced: that is, fees for municipal services must not exceed the cost of to provide the service. This principle was meant to prevent municipalities from using one activity to finance another. For example, profit from a municipal energy company should not finance schools or health care.

Deregulation of the electricity market

After the oil crises in the 1970s, municipal energy companies played an important role for supplying electricity. Local electricity suppliers, often the municipal energy company, have traditionally been responsible for secure and sufficient electricity supply and legal use has made the electricity supply a municipal concern (Linquist, 1993). In 1996, the Swedish electricity market was deregulated. The deregulation has led to some exceptions in the Municipal Act (Gustavsson, 1999): municipal energy companies are free to pursue customers outside their municipality, and they are free to set prices at market level.

The deregulation has led to many municipalities either selling or privatising their local energy companies (Swedish National Energy Administration, 2002). How this has affected municipal energy planning is uncertain, but it might lead to limited control over the development of the local energy systems. It could also lead to more attention being paid to energy concerns.

Spatial planning

According to Lamm (1990), spatial planning has been conducted in Sweden since 1947 when a general plan was issued for how land was to be used for different purposes. During the 1950s and 1960s, general plans were dominated by large scale re-structuring of industry and a large
housing program. A more extensive program for spatial planning was issued in 1972 because the need for developed spatial planning was recognised. Lamm notes that a new generation of spatial plans were issued between 1972 and 1986, but that energy was usually not part of municipal planning issues.

In 1987, the Planning and Building Act was introduced (SFS 1987:10, see also Government Bill 1985/86:1). According to Bengtsson (1992), this act regulated all land use. Private interests should not be able to stop a development and/or land use that society considers important. In the Planning and Building Act, there is also a call for a municipal comprehensive plan and a detailed development plan. A municipal comprehensive plan should state public interests that should be taken into consideration when decisions are made regarding the use of municipal land and water. The plan should also deal with how the natural environment and built environment in the municipality should be developed or preserved. Furthermore, the municipal comprehensive plan should show how the municipality would consider national interests in accordance to the legislation on the management of natural resources (SFS 1987: 10). The link to national interest makes the municipal comprehensive plan a link between national policy as expressed in legislation and the local objectives. The plan may be seen as an agreement between national and local interests, which allows further planning relatively free from state involvement. According to the act, the consequences of the plan should be stated clearly. If the municipal comprehensive plan indicates where development is suitable, the detailed development plan determines the type of building in areas where it is required. The plan should include a plan report and an implementation report. In addition, a program should be included that shows the starting points and the objectives of the plan. In many cases, an EIA has to be included as well.

Following the 1987 Planning and Building Act, this third generation of spatial plans had great potential to address energy issues. However, in the municipalities studied, energy issues have not been integrated in the municipal comprehensive plans to a large extent.

The Act of Management of Natural Resources

The Act of Management of Natural resources (SFS 1987:12) was also introduced in 1987 as a part of the new planning legislation. According to Bengtsson (1992), the act aimed to give guidance for decision-making when land use conflicts arose. The act expressed intentions for comprehensive decision-making where long-term effects of any action were taken into account as well as social and ecological aspects were more carefully considered. When solving a conflict, the act emphasises the use of
certain areas (a geographical focus in other words), but it does not regard the assessment of different environmental risks or the values of different environments.

**International environmental initiatives**

In 1987, the World Commission on Environment and Development presented a report (WCED, 1987) on sustainable development that considered how to integrate economic development, environmental quality, and a sustainable use of the world’s resources.

In 1992, the United Nation’s Conference on environment and development took place in Rio. One of the results from the conference was the acceptance of the action program Agenda 21 (LA21). The program included goals and guidance on sustainable development by eliminating poverty and environmental risks under the declaration “Think globally–act locally”. Although the program was not legally binding, it was considered politically and morally motivated. The Swedish government also wrote a letter of intent to the parliament to show how Sweden planned to fulfil the aims of the UN conference. In 2001, about 70% of the Swedish municipalities had adopted a plan for LA21 projects in the municipal council, but the work following the adoption of these plans have varied (Edström and Eckerberg, 2002).
3. Method – The review

Thirteen municipalities in Östergötland County in southern Sweden were chosen for the study. The municipalities represent different sizes, business profiles, and energy systems. This made it possible to generalise the results at a national level. Table 2 presents the municipalities distributed according to the categorisation of the Swedish association of local authorities (Swedish Association of Local Authorities, 2002) (see also Appendix 1).

Table 2. The studied municipalities. Classification is made according to the Swedish association’s categorisation of local authorities.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Åtvidaberg</td>
<td>Other minor municipality</td>
</tr>
<tr>
<td>Boxholm</td>
<td>Industrial municipality</td>
</tr>
<tr>
<td>Finspång</td>
<td>Industrial municipality</td>
</tr>
<tr>
<td>Kinda</td>
<td>Rural municipality</td>
</tr>
<tr>
<td>Linköping</td>
<td>Large town</td>
</tr>
<tr>
<td>Mjölby</td>
<td>Medium sized town</td>
</tr>
<tr>
<td>Motala</td>
<td>Medium sized town</td>
</tr>
<tr>
<td>Norrköping</td>
<td>Large town</td>
</tr>
<tr>
<td>Ödeshög</td>
<td>Rural municipality</td>
</tr>
<tr>
<td>Söderköping</td>
<td>Other minor municipality</td>
</tr>
<tr>
<td>Vadstena</td>
<td>Other minor municipality</td>
</tr>
<tr>
<td>Valdemarsvik</td>
<td>Rural municipality</td>
</tr>
<tr>
<td>Ydre</td>
<td>Rural municipality</td>
</tr>
</tbody>
</table>

3.2 Structure of the analysis

Twelve of the thirteen municipalities have a municipal energy plan. The energy plans have been examined using a large number of questions with respect to the following categories:

1. the municipal energy plan and its context;
2. analysis of the energy system;
3. environmental assessment in the energy plan;
4. and the planning process.

The questions are listed in Appendix 2.

The analysis in the first category aims to analyse what aspects on the context of the energy plan are included in the municipal plan. This aims to form the basis for a further analysis of the relationships between the energy
plan and other municipal planning as well as energy related projects in the municipality.

The second category analyses the systems approach of the energy plan: the system perspectives; plans for the development of local energy systems, whether the energy plan is plant oriented, and what ambitions the municipality has for future energy use.

The analysis of the third category, environmental assessments in the energy plan, analyses how the plan relates to national, regional, and local environmental goals, environmental impacts, and resource management issues. The fourth category, the planning process, provides an overall picture of the layout of the plan, who has worked with it, how the work has been conducted, what different scenarios and/or visions of the future energy system are described, and how the municipality plans to realise the future energy system. The questions were formulated with the act on municipal energy planning (SFS 1977:439) in mind. Formulation of the review questions was also inspired by a number of books and reports on the subject as well as earlier research (see Appendix 3).

During the analysis of each energy plan, the review questions were answered with F, S, or N: Full description of the issue; Some description of the issue; and No description of the issue. This simplified rating has been adapted to each question. In some cases, for example, when analysing descriptive issues such as contemporary heating systems, F is achieved if two or more heating systems are described. When analysing issues such as the perspectives in the energy plan, an additional analysis to the description has been required for an “F”. This simplified rating has the advantage of making the judgements less subjective and facilitates a visualisation of the results. The results of the analysis are presented with shaded dots in Tables 4 through 16 in the result section of this report.

3.3 Categorisation

The results in this report have been categorised into different periods. This has been done because the plans cover a time span that involves some shifts of focus in Swedish politics regarding issues on energy as well as environmental issues. This categorisation was made to aid the analysis of the relationship between the energy plans and national policy. The energy related results have been categorised into four periods, which relate to Vedung’s summary of Swedish energy policy: 1977-1984, 1985-1991, 1992-1996, and 1997-present (Chapter 2.1).

As regards to the environmental issues, the results are distributed in three periods inspired Linderström’s division (2002): 1970-1982, 1983-1991, 1992-present. The first period covers when the environmental issues began
to be considered but were still considered insignificant. During the second period, the environmental issues became frequent issues present in both the political and the public agenda. Issues such as air pollution and its effects on the environment were heavily discussed. In 1992, the UN conference in Rio brought sustainable development into the political agenda and posited a new approach to environmental issues. Emissions from known sources were still on the agenda, although there were also calls for a more comprehensive perspective on environmental issues. Diffuse and global environmental problems and risks became part of the political and environmental agenda.
4. Results – Scope of the energy plans

The status of the energy plans varies widely between the municipalities. In one case, no plan has been issued at all. In other municipalities, the plan has been regularly updated and revised. The organisation of the planning processes also differs. In some municipalities, civil servants have administrated the planning process. In others, external consultants have been responsible for the production of the energy plan. The valid plans in the 12 municipalities have been issued between 1979 and 1999 and are produced by different kinds of authors (Table 3). The contents of the plans are also largely different because the plans are written at different times and are therefore based on different national energy policy contexts. The level of ambition the municipalities demonstrate in their plans also varies. In some municipalities, in particular the larger ones, the plans contain scenarios and analyses of environmental impacts. In others, mainly the older ones, the plans are descriptive rather than analytical and contain a large amount of information summarised in charts and tables. Newer plans often contain less data and use a qualitative approach.

Table 3. Status of and authors of municipal energy plans in Östergötland County.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Plan issued year</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boxholm</td>
<td>1979</td>
<td>Work group¹</td>
</tr>
<tr>
<td>Kinda</td>
<td>1980</td>
<td>Consultant²</td>
</tr>
<tr>
<td>Finspång</td>
<td>1982</td>
<td>Work group¹</td>
</tr>
<tr>
<td>Åtvidaberg</td>
<td>1986</td>
<td>Consultant³</td>
</tr>
<tr>
<td>Ydre</td>
<td>1986</td>
<td>Consultant²</td>
</tr>
<tr>
<td>Linköping</td>
<td>1991</td>
<td>Not indicated</td>
</tr>
<tr>
<td>Motala</td>
<td>1991</td>
<td>Consultant⁴</td>
</tr>
<tr>
<td>Söderköping</td>
<td>1992</td>
<td>Consultant⁵</td>
</tr>
<tr>
<td>Norrköping</td>
<td>1996</td>
<td>Civil servants and politicians</td>
</tr>
<tr>
<td>Valdermarsvik</td>
<td>1998</td>
<td>Civil servants</td>
</tr>
<tr>
<td>Mjölby</td>
<td>1999</td>
<td>Work group⁶</td>
</tr>
<tr>
<td>Ödeshög</td>
<td>1999</td>
<td>Consultant⁷</td>
</tr>
<tr>
<td>Vadstena</td>
<td>No plan</td>
<td>-</td>
</tr>
</tbody>
</table>

¹Representatives from the municipal government, local industry, and the local power supplier
² Scandiaconsult AB, Linköping
³ VBB AB, Linköping
⁴ VBB VIAK AB, Malmö
⁵ Miljöinvest AB
⁶ Representatives not indicated
⁷ Tellus Ekoteknik AB, Linköping
4.1. Municipal energy plans and their context

This section describes how different issues related to energy are described in the plans. The aim is to draw a picture of what background information has been taken into account as the plan was developed. Table 4 summarises how the background information in the energy plans varies over time.

Goals described in the plans

Most plans describe goals for the municipal energy system. Three plans develop general goals, are more visionary on reduced energy use, and encourage environmental friendly energy sources rather than developing specific goals. Regional goals are also described in most plans, but these goals are not related to the municipality’s concerns. Most municipalities commented that there are national goals for the energy sector and their contents. Only one municipality has analysed what implementing these goals would mean for the local energy system.

Economic issues

The older plans address the discount rate and its impact on energy prices; the newer plans address the possibility to decrease energy costs in public buildings. In one case the advantage of having low fixed energy price to encourage savings is highlighted. Two of the newer plans relate employment to energy issues. In addition, employment has been mentioned in connection to financial funds to create “green” employment within the Local Investment Programs (see section 2.1).

Generally, possibilities to receive national subsidies are described, but how these may be used to improve the local energy systems are not analysed. Two plans comment on how new taxation would affect the energy situation in the municipality.

Two plans discuss how local authorities can influence the energy system. One of the plans discusses how to influence local energy companies, local regulations, and how to provide competent advisement. This plan also recognises that the national government has greater means to implement change than the municipal government. The other plan addresses how consumers can measure their energy use and costs to influence their energy use.

Relation to other municipal concerns

Descriptions on how energy issues relate to spatial and other planning within the municipalities have varied. Older plans provide more detail. One plan carefully describes energy aspects in spatial planning. Three of the
newer plans comment on the connection to other planning because new power plants are discussed. Two plans relate to LA21 work. In one of these two plans, the Swedish national curriculum for LA21 is attached. The other plan is issued as a part of the municipality’s LA21 activities.

Plans issued in the late 1980s and early 1990s relate to the current discussion about an extended natural gas grid in southern Sweden. (This natural gas grid extension was a contemporary issue in the region during these years). Only one of these plans discusses what this new energy source would mean to the local energy system. Table 4 shows to what extent issues regarding the municipal energy plan context are described.

Table 4. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and made the years of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes general goals for the energy sector</td>
<td>● ● ○</td>
</tr>
<tr>
<td>Relates to regional goals for the energy sector</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Relates to national goals for the energy sector and to national energy policy</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Relates the content of the energy plan to economical aspects, both municipal and national</td>
<td>● ○ ○</td>
</tr>
<tr>
<td>Includes economical aspects regarding employment</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Includes the means for the municipality to influence on the energy system</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Includes national means of control</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Relates municipal energy planning to other municipal planning</td>
<td>● ● ○</td>
</tr>
<tr>
<td>Relates the energy plan and local Agenda 21</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Includes the position on national solutions (such as a natural gas grid)</td>
<td>○ ○ ○</td>
</tr>
</tbody>
</table>
4.2 Analysis of the energy system

This section analyses on which basis the energy plans are issued, i.e. relations to, and interactions with, the surrounding world, and from which perspectives issues are raised. The aim is to analyse whether the energy plans have a systems approach and if so which system perspectives are applied. Visions regarding the development of local energy systems are also analysed.

Perspectives described in the energy plans

The plans addressed the perspectives of the local energy systems. Table 5 lists a summary of these plans. Co-operation between the local authority and industry are described in three plans. However, none of them describe these interactions in detail. Two plans note that municipal responsibility to provide electricity for heating is not valid if district heating is present or planned in the area. One plan points out that district heating has to have a competitive price, and another comments on many of the local authority’s responsibilities regarding energy. This plan is the only one that identifies transportation as an important energy related issue. Two of the newer plans contain additional perspectives on their energy systems. One of the plans discusses the municipal energy system from a national perspective. The other plan discusses regional, national, and global perspectives.

Four plans address transportation issues. One refers to a separate transportation plan, and one describes a need for efficient transportation and alternative fuels. Incentives for the development of public transportation and bicycle lanes are also described. Two newer plans outline the possibilities for decreased energy use in the transport sector. One argues for more public rail transportation. The other states that use of locally produced fuel would decrease transportation costs. No plan discusses costs for energy or the energy system.
Table 5 shows to what extent energy plans include different issues that explain perspectives in the energy plan. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and time of development</th>
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</thead>
<tbody>
<tr>
<td>Relations to, or interactions with, different actors in the municipality are described.</td>
<td>● ○ ○</td>
</tr>
<tr>
<td>Energy services that the municipality should provide is described</td>
<td>● ○ ○</td>
</tr>
<tr>
<td>The municipal, local energy system is described from a local, regional, national or global perspective</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Transport issues are discussed</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Costs for the energy systems are analysed</td>
<td>○ ○ ○</td>
</tr>
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Possibilities to generate electricity from renewable energy sources

Possibilities to generate electricity from renewable energy sources have been discussed in almost all plans (Table 6). Most plans contain some information about local possibilities for electricity generation. The most common electricity sources described are wind power, hydropower, and cogeneration of heat and electricity with biomass fuels. One plan also addresses solar power. Generally, newer plans mention wind power and cogeneration, and older plans focus on hydropower. Different alternatives, however, usually are not compared. One plan mentions fossil fuels for cogeneration because the most economically favourable fuel should be used. The same plan also suggests waste as a favourable fuel for cogeneration.

Future possibilities for electricity generation are not as commonly discussed. The same pattern for possible sources can be seen: older plans discuss hydropower and newer plans discuss wind power or cogeneration. One plan discusses future electricity production with natural gas as an option.

No plan describes if purchase of electricity should be undertaken, but two plans mention that if new equipment or appliances are bought, they should be energy efficient to save electricity. Table 6 shows to what extent energy plans include issues regarding electricity generation.
Table 6 shows to what extent energy plans include issues regarding electricity generation. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and time of development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present opportunities for local electricity production from renewable sources</td>
<td>● ● ●</td>
</tr>
<tr>
<td>Future conditions for electricity production from renewable sources are described</td>
<td>● ● ●</td>
</tr>
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**Contemporary heat supply**

Most plans describe contemporary heating in the municipality. Descriptions of heating systems are generally quantitative in the older plans and qualitative in the newer plans. Two plans contain much information about conditions for district heating. These plans origin from municipalities that are about to expand their district heating system. District heating are the first choice for heating in all plans. Local district heating is mainly discussed in the older plans. Older plans describe small-scale solid fuel combustion as a potential way to reduce oil dependence. Newer plans, however, focus on problems associated with small-scale combustion of solid fuels. Wood pellets are described as an alternative in one plan.

Heat pumps are mentioned in the older plans, and in two from the middle periods. The technology is described shortly, and focus is on usage in one family houses. Oil is described as an important part of the energy system in the older plans. Almost all plans mention oil without going into detail. In one of the newer plans, it is stated that the decreased use of oil has lead to an increased use of electricity. There has been only a slight decrease in total energy use.

Only one plan discusses possibilities and disadvantages with solar heat. In another plan, there are comments on environmental advantages of electrical heating. One plan describes transformation to electrical heating, and two plans discuss waste as a possible fuel for heating. One plan discusses the use of waste heat from industry. In one energy plan, residues from the agricultural sector are identified as a potential energy source. Table 7 shows to what extent energy plans include issues concerning contemporary heat supply.
Table 7 shows to what extent energy plans include issues concerning contemporary heat supply. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and time of development</th>
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</thead>
<tbody>
<tr>
<td>Description of the current conditions for local district heating.</td>
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</tr>
<tr>
<td>Description of the current small-scale solid fuel heating.</td>
<td>●●● ○ ○</td>
</tr>
<tr>
<td>Description of heating with heat pumps.</td>
<td>○ ● ● ○ ○</td>
</tr>
<tr>
<td>Description of heating with oil.</td>
<td>● ● ● ○ ○</td>
</tr>
<tr>
<td>Description of heating with solar heat</td>
<td>○ ○ ○ ○</td>
</tr>
<tr>
<td>Description of heating with electricity</td>
<td>○ ○ ○ ○</td>
</tr>
<tr>
<td>Description of heating with other sources</td>
<td>● ● ● ○ ○</td>
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Visions for future heat supply

Most plans describe visions for the development of the heating systems in the municipality. Table 8 summarises the results regarding the plans’ visions for the future heat supply.

Visions for future district heating systems often focus on the issue of fuel choice and flexibility. One plan mentions that the future system should be environmentally friendly. Two newer plans describe local district heating as a good alternative for smaller towns and villages. One plan states that local district heating should be a local initiative and something that the local authority can encourage rather than require. Two newer plans describe how small-scale solid fuel combustion should be dealt with in the future for a more environmentally friendly heating system. One plan mentions pellet combustion as an alternative small scale heating technique. Heat pumps get most attention in the older plans and are described as potentially important heat sources in district heating systems. The newer plans that mention heat pumps discuss economic aspects and the importance of providing information and advice to its citizens. Three older plans describe visions to decrease the use of oil. Two plans describe the
prognosis for decreasing oil use. One plan describes different ways to decrease oil use.

Possibilities to use solar heat are described in two older plans. Emphasis is given to passive solar heat in new residential areas, and the heat storage problems are addressed. Two newer plans briefly mention solar heat. One plan describes the potential and extent of existing solar heat systems.

Two plans contain prognoses for increased use of electricity for heating. One plan states that households should convert their heating system to electricity, but keep options open for safety reasons. In one plan, no opinion for or against heating with electricity is expressed, but district heating is regarded as a better choice.

The following future energy sources for heating are mentioned in one or two plans: waste, waste heat, coal, biogas, biomass, and peat. Table 8 shows to what extent energy plans address visions for future heat supply.

Table 8 shows to what extent energy plans address visions for future heat supply. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or that deeper and plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and time of development</th>
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<tbody>
<tr>
<td>Includes visions for district heating.</td>
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</tr>
<tr>
<td>Includes visions for local district heating.</td>
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</tr>
<tr>
<td>Includes visions for small-scale solid fuel heating.</td>
<td>○ ○ ○</td>
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<tr>
<td>Description of heating with heat pumps.</td>
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<tr>
<td>Includes visions for heating with oil.</td>
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<tr>
<td>Includes visions for heating with solar heat.</td>
<td>● ● ○</td>
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<tr>
<td>Includes visions for heating with electricity.</td>
<td>● ● ○</td>
</tr>
<tr>
<td>Includes visions for heating with other sources</td>
<td>● ● ○</td>
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</table>

Contemporary energy carriers in the energy systems

Some energy plans describe the energy sources that dominate the energy systems. For municipally owned estates including housing, the plans describe energy systems containing a large share of fossil fuels (6),
electricity (3), district heat (3), and solid fuels (1). Electricity and solid fuels are represented in the newer plans to a large extent.

For privately owned estates, the plans describe energy systems containing a large share of fossil fuels (6), electricity (3), district heating (2), and solid fuels (4). Older plans focus on oil and solid fuels, and the newer plans address a larger share of electricity and district heating.

For the industry, energy plans describe energy systems containing a large share of fossil fuels (6), electricity (6), and solid fuels (4). No plan mentions district heating for industrial use. The energy plans have generally not included extensive information about fuel used in the industry. In Norrköping, the paper mills use a large amount of biomass although the paper mills demand large amounts of electricity. Table 9 shows the extent dominating energy carriers are described in the plans.

Table 9 shows the extent dominating energy carriers are described in the plans. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and time of development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of energy carriers in municipally owned estates (including housing).</td>
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</tr>
<tr>
<td>Description of energy carriers in privately owned estates (including housing)</td>
<td><img src="image" alt="dots" /></td>
</tr>
<tr>
<td>Description of energy carriers in industry</td>
<td><img src="image" alt="dots" /></td>
</tr>
<tr>
<td>Description of energy carriers used in district heating plants.</td>
<td><img src="image" alt="dots" /></td>
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</table>

The fuel mix used in district heating plants is described in the plans as using a large share of fossil fuels (3), electricity (1), waste (1), and biomass (2). In all of the district heating systems described in the plans, a significant share of the energy comes from fossil fuels.

**Visions for future energy carriers in the energy system**

A few plans describe the energy sources and carriers municipalities wish to dominate the energy systems in the future. For municipally owned estates including housing, renewable energy sources are emphasised in two
plans. District heating is the primary choice in one plan. One plan emphasises the importance of flexibility for the future.

Two plans contain visions for the future fuel mix in the private sector. One newer plan describes a desire to decrease the use of oil and electricity for heating and to restrict small-scale solid fuel combustion. The other, an older plan describes a desire to decrease the use of oil and increase the use of electricity and solid fuels. One plan describes a desire to decrease the use of oil in industry and to increase the use of electricity and solid fuels. One energy plan comments on the differences in quality of energy, but a thorough analysis is not made. Table 10 shows to what extent energy carriers are described in the energy plans.

Table 10. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

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<tr>
<th>Reviewed issue</th>
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**Energy plant projects in the local energy system**

In one plan, the area required for a future plant is specified as 150 x 150 m. Another plan states that land that can be used for energy utilization should be protected from other exploitation. One plan notes that a project group should investigate if a new plant is the best solution and how it should be constructed. Five other plans describe already existing projects.

**4.3 Use of energy**

Most energy plans describe contemporary energy use, but the plans represent different ambitions for these descriptions. The older plans contain quantitative descriptions; two of the plans written in the early 1990s are
qualitative. The newest plans contain both qualitative and quantitative descriptions of energy use.

Visions for future energy use in the municipality are closely related to goals for the energy sector, so this issue will not be discussed under this section. One plan, however, mentions the role the local authority can play in setting good examples for energy use, for example by choosing energy efficient appliances. Table 11 shows to what extent energy plans include issues on energy use.

Table 11 shows to what extent energy plans include issues on energy use. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and time of development</th>
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</table>
| Visions for future energy use are described | ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●
a potential to be at a more general and strategic level and that the assessments could include regional and global environmental issues.

This assumption is based on an earlier study (Bruhn-Tysk, 2001) of what environmental issues environmental impact assessments for energy plant projects include. That study showed that the environmental assessments often are very local in scale regarding only to the energy plant itself. This means that the environmental effects from the entire energy system are often excluded even if they, from a life-cycle perspective, are relevant for the energy plant where the electricity and/or heat production takes place. Seldom are the perspectives of the environmental assessments for the energy plant projects stretched over the regional perspective. Perhaps regional and global environmental issues should be considered at a strategic level rather than for each specific project. If so, the energy plan could be useful because it should be a strategic document. If tiering is possible between environmental assessments for energy plants and strategic environmental assessments (SEAs) for local energy plans, perhaps the scope and perspectives of the environmental assessments could be widened. In a SEA for an energy plan, larger systemic issues can be covered as well, which is something that a single project developer may not have the competence or resources to do.

**The scope of environmental aspects in the reviewed energy plans**

Regarding the environmental aspects of the current municipal energy system that the plans cover, some findings seem to be apparent in the studied plans. As shown in Tables 12-15, environmental issues are only occasionally included. The plans mainly include environmental impacts on the local level such as resource extraction and emissions from energy plants to air. Environmental impacts at the national and global level are included in only two cases; both examine emissions of carbon dioxide. The impacts, however, are only described in general terms. Two energy plans include resource extraction and management for energy use and include a specification of the regional conditions for resource extraction. Nine plans examine this at the local level. The effects of the emissions and resource extraction are also covered in some cases. The indirect environmental effects of the energy plan are assessed in general terms with no analysis in one energy plan. Four plans include environmental effects at the local level. The assessments mainly specify the effects of emissions within the municipality. Regional effects are included in four plans that deal with emissions causing acidification. The effects are thoroughly specified and analysed in one plan and in general terms in the other three plans.

Global effects were covered in two cases and address global warming issues. The assessments do not specify how the municipal energy systems
themselves contribute to global warming. Furthermore, conditions for resource extraction are specified in seven energy plans, mostly in a detailed way. The direct and indirect effects of resource extraction are assessed in two energy plans, of which one assesses the effects thoroughly. Both the specifications of the conditions and the assessments are limited to the local level. Finally, two of the twelve energy plans refer briefly to national and local environmental goals, which make it difficult to say if the proposed energy plan would conflict with municipal environmental goals. However, three plans include environmental goals for the energy sector in general, which to some extent makes a conflict analysis possible. The results from the study indicate that the potential to cover strategic environmental issues in the energy plans is not fully used since the plans have a local perspective and are plant oriented. Table 12 shows to what extent the studied energy plans include environmental goals and impacts. Table 13 shows to what extent the studied energy plans include direct and indirect environmental effects. Finally, Table 14 indicates to what extent the studied energy plans include environmental goals for the energy sector and direct and indirect environmental effects of energy resource extraction.

Table 12 shows to what extent the studied energy plans include environmental goals and impacts. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including time of development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relates to national environmental goals</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Describes local environmental goals</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related global environmental impacts</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related national environmental impacts</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related regional environmental impacts</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related local environmental impacts</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>
Table 13 shows to what extent the studied energy plans include direct and indirect environmental effects. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including time of development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assesses the current and to the energy sector related global environmental direct effects assessed</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related national environmental direct effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related regional environmental direct effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related local environmental direct effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related global environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related national environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related regional environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the current and to the energy sector related local environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
</tbody>
</table>
Table 14 shows to what extent the studied energy plans include environmental goals for the energy sector and direct and indirect environmental effects of energy resource extraction. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including time of development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifies environmental goals for the energy sector</td>
<td>○ ○ ○     ○○○○     ●●●●</td>
</tr>
<tr>
<td>Specifies conditions for resource extraction for energy use</td>
<td>● ● ○     ●●○○     ●●●○</td>
</tr>
<tr>
<td>Assesses the direct and indirect global effects of resource extraction for energy use</td>
<td>○ ○ ○     ○○○○     ○○○○</td>
</tr>
<tr>
<td>Assesses the direct and indirect national effects of resource extraction for energy use</td>
<td>○ ○ ○     ○○○○     ○○○○</td>
</tr>
<tr>
<td>Assesses the direct and indirect regional effects of resource extraction for energy use</td>
<td>○ ○ ○     ○○○○     ○○○○</td>
</tr>
<tr>
<td>Assesses the direct and indirect local effects of resource extraction for energy use</td>
<td>○ ○ ○     ○○○○     ●●●○</td>
</tr>
<tr>
<td>Specifies the goals for resource management within the municipality</td>
<td>○ ○ ○     ○○○○     ○○○○</td>
</tr>
<tr>
<td>Specifies goals for energy saving within the municipality</td>
<td>● ● ○     ●●○○     ●●●○</td>
</tr>
</tbody>
</table>

In addition, future environmental impacts seem to be addressed. Future environmental impacts at the global level are included in two of the plans, and one plan includes the future environmental impacts at the regional level. However, local impacts are described in eight energy plans. Furthermore, three energy plans briefly assess the future direct effects at the global, regional, and local level. The indirect effects are assessed in three energy plans at the global level and the local level. The effects mainly regard resource extraction, acidification, and global warming. Table 15 shows to what extent the energy plans include future environmental issues.
Table 15 shows to what extent the energy plans include future environmental issues. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including time of development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assesses the future and to the energy sector related global environmental impacts</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related national environmental impacts</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related regional environmental impacts</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related local environmental impacts</td>
<td>● ● ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related global environmental direct effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related national environmental direct effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related regional environmental direct effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related local environmental direct effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related global environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related national environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related regional environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>Assesses the future and to the energy sector related local environmental indirect effects</td>
<td>○ ○ ○</td>
</tr>
</tbody>
</table>

4.5 The planning process

The reviewed energy plans result from various discussions among different municipal actors and they have probably also been preceded by negotiations. As this planning process forms the outcome of the municipal energy planning, some issues concerning the planning process should be included in the energy plan. Hence, this section deals with the scope of the planning process issues and the layout of the plan.

The contents of the plan are summarised in five of the twelve energy plans. Three of them conclude the plan in detail while two of them only concluded the material briefly. References to the material and studies that have been used during the plan process are included in five cases as well. As regards the planning process, the organisation is briefly described in
three cases. This result may be partly explained by the fact that many of the energy plans have been prepared by consultants (Table 3). By using a consultant, the focus may tend to be on the plan as a resulting document rather than focusing on the planning process. The methods and tools used during the planning are described thoroughly in two cases and briefly in one case. Alternative possibilities for development and/or scenarios are described and compared in five cases, which indicates that many of the municipalities already had decided on energy strategies when the plan was made. The alternatives were described in detail in three plans and briefly in two. Furthermore, how to reach the stated goals and an action plan were specified in all twelve energy plans, while routines for following-up the goals and specifying those responsible for reaching goals were only specified in three and six plans respectively. Finally, strategies for managing the energy system were specified in five energy plans, of which three plans did not put much detail in their description. The results are shown in Table 16.
Table 16 shows to what extent the energy plans include issues on the planning process and the energy plan layout. Each dot represents one energy plan. Non-filled dots represent no or insignificant information in the plan, and shaded dots represent some information or more general descriptions. Black dots represent thorough descriptions or plans that include thorough analyses.

<table>
<thead>
<tr>
<th>Reviewed issue</th>
<th>Number of energy plans including the issue and time of development</th>
</tr>
</thead>
<tbody>
<tr>
<td>References are included</td>
<td></td>
</tr>
<tr>
<td>Describes the organisation for the planning process</td>
<td></td>
</tr>
<tr>
<td>Describes the methods and tools used during the planning process</td>
<td></td>
</tr>
<tr>
<td>Describes alternative possibilities for development and/or scenarios</td>
<td></td>
</tr>
<tr>
<td>Compares any included alternatives and/or scenarios</td>
<td></td>
</tr>
<tr>
<td>Specifies measures and action plan</td>
<td></td>
</tr>
<tr>
<td>Specifies strategies for managing the energy system development</td>
<td></td>
</tr>
<tr>
<td>Specifies the routines for following up goals</td>
<td></td>
</tr>
<tr>
<td>Specifies those responsible for reaching the goals</td>
<td></td>
</tr>
</tbody>
</table>

4.6 General assessment of the energy plans

This section summarises contents of typical energy plans in terms of three time periods. Despite Swedish energy and environmental policies, energy plans in the study can be categorised into three major groups: older plans written in the late 1970s or the early 1980s; plans written in the middle or late 1980s or the early 1990s; and newer plans written after 1997. The two energy plans written in the energy policy period 1992-1996 are not similar. The plan written in 1992 has many similarities with plans written in the late 1980s and those from 1991, and the one written in 1996 has more similarities with the plans written after 1997. The description of typical energy plans will therefore be discussed in terms of these of three time periods: older plans (plans written 1977-1985); middle-aged plans (1986-1992); and newer plans (1993-present).
Older plans (1977-1985)

Typical older plans are written by work groups from local authorities. The goals described in the plans are specific, and economic issues are often discussed in a context of discount rate and its effects on energy prices. National means to control the local energy system are described, but their influence on local energy systems is not analysed. The necessity of including energy issues in the overall planning process is often highlighted in these plans.

Facts, figures, and diagrams dominate the parts describing contemporary local energy systems. The plans often resemble a major inventory of existing and potential energy sources. Most plans are supply oriented and the main issues are reduction of oil use and development of a safe and secure energy supply. Energy use is also expected to increase.

Energy systems are often described as highly dependent on fossil fuels. For heating buildings, biomass is also an important energy source. Goals for the energy systems in older plans are often quantified regarding oil reduction, energy efficiency in buildings, and use of heat pumps. Higher energy efficiency and decreased energy use are intended to be reached through optimisation of building heating systems, lower indoor temperature, improved insulation, individual measurement of energy use, and energy advisement.

As regards the layout of the energy plan, a typical older plan is concluded in detail, however references to materials used during the study are missing. Alternative possibilities for development of the municipal energy system are analysed with respect to predicting future energy demand in the municipality. Measures and action plans are specified in detail; however, the strategies for managing the development of an energy system are only vaguely described.

Environmental aspects are not in the immediate focus during this period. Rather the focus is on the energy plants themselves and on energy savings. Partly due to the local orientation environmental aspects mainly concerns local conditions for resource extraction and quantifying emissions from the energy plants.

Middle-aged plans (1986-1992)

Typically, consultants produced the middle-aged plans. The energy plan from this period is more analytical than older plans. Quantitative assessments play central roles, but the goals presented are more visionary than in the older plans. Energy systems are described with electricity and small-scale biomass combustion for heating buildings, heat pumps, and district heating. Fossil fuels still dominate in industry. Energy use is also
now expected to increase and the contemporary national plans on a natural gas grid are often discussed as a potential energy source.

Goals for the energy system generally contain expansion of district heating grids and reduced emissions from the energy sector. To increase energy efficiency, individual measurement of energy use, energy advisement, Energy issues in the over-all planning process are emphasised.

The typical energy plan during this period describes only briefly the organisation and methods used during the planning process. Furthermore, any alternative development for the energy system concerns different fuel in different types of energy plants. A detailed plan for measures and action is included; however, how the energy plan will be implemented is only described in general terms. Finally, those responsible for attaining any goals are specified. There are no guidelines in the plans for how the goals should be audited.

The environmental aspects are still mainly focused on local concerns and energy plant oriented. However, the effects of resource extraction and emissions from the energy plant are now to some extent assessed, both at the local and regional level. Furthermore, there is an indication for a concern for the environmental impacts from other parts of the municipal energy system such as the transportation sector.

Newer plans (1993-)

Newer energy plans are written by work groups with civil servants. The newer plans are much shorter than their predecessors; however, they are analytical in their character and contain much data. The largest difference compared to earlier plans is their overall perspective on energy systems. For example, energy efficiency issues in buildings are no longer the main focus when it comes to saving energy. The newer plans examine energy in relation to employment opportunities and transportation issues.

Energy systems are, as before, described with electricity for heating buildings, biomass for heating small buildings, heat pumps, and district heating. However, all energy systems still involve fossil fuels. The goals, however, are more focused on reduced emissions, optimisation of the entire energy system, renewable energy sources, and decreased industrial energy use.

To reach energy use goals, these plans focus on measuring energy use, energy advisement, and energy issues in the overall planning process. Newer plans include the importance of purchasing energy efficient appliances and the use of indicators to monitor energy efficiency.
The content of the plan is concluded in general terms, and the materials used during the writing of the plan are referred to in detail. The organisation and methods used during the planning process are not included. Moreover, the scenario technique is now a method that is used to describe alternative developments for the entire municipal energy system. The action plan and strategies for accomplishing the plan are described in detail. People responsible for reaching any goals are specified in very general terms. There are detailed descriptions, however, for how the goals will be attained.

In the newer plans, the perspective on the environmental issues has shifted towards a concern for the environment that includes the entire energy system. The focus is still at the municipal level although a wider spatial perspective is apparent. The environmental issues concern environmental goals at the local and national level. Furthermore, there is some concern for global environmental effects mainly in the form of global warming. The global concern may be due to the Rio Conference of 1992; some newer plans refer to the conference and LA21.
5. Discussion

This section discusses energy plans from a legislative and policy context. The three typical plans are related to energy and environmental policy.

5.1 Municipal energy planning and Swedish energy policy

All energy plans contain goals for the local energy sector and most of them refer to national energy goals. One energy plan contains detailed analysis about how implementation of national goals at the local level will affect the municipal energy system. Although national energy policy is not mentioned in all energy plans, traces of contemporary energy policy can be observed.

Older energy plans and the energy policy 1977-1984

Older energy plans describe energy systems highly dependent on fossil fuels and an expected growth in energy demand. This corresponds to the national energy situation.

Energy conservation measures with regard to oil reduction and energy efficiency in buildings were important in the older plans. This also corresponds to the national policy to reduce oil use. As requested by the government in the early 1980s, one of the energy plans includes an oil reduction plan.

The planned nuclear reactors and the supply of electricity are not directly mentioned in the plans. The advantages of electrical heating are mentioned, but future electricity supply mentioned in the plans is related to local hydropower rather than national nuclear power.

Middle-aged energy plans and the energy policy 1985-1991

The diffuse goals of the national energy policy are illustrated in the diffuse goals in the energy plans from this period. The large amount of available electricity can also be recognised in the energy plans: many plans describe how the municipality should prepare for extended heating with electricity.

Results from the national goals for a more comprehensive planning, with energy issues discussed in relation to spatial planning can also be observed. Most plans from this period relate to spatial planning issues. Examples in the plans are the importance of taking district heating and climate conditions into account when planning for new residential areas.
Newer energy plans and the energy policy after 1991

The national goals for more renewable energy sources in the energy system as well as the financial support program, LIP, with subsidies for a sustainable energy system can be traced in the energy plans. For example, goals and visions describe potential wind power projects and possibilities for combined heat and power plants based on biomass fuels.

5.2 Municipal energy planning and Swedish environmental policy

As presented section 4.3, environmental issues are not highly prioritised in the reviewed energy plans. Since the plans focus on local concerns, national environmental policy is generally not referred to. As in the case of Swedish energy policy, there are however traces of contemporary environmental policy in the energy plans.

Older energy plans and the environmental policy 1977-1982

The earlier environmental policy was very local and project oriented. The Environmental Protection Act that aimed to control environmental impacts from environmentally hazardous activities at specific locations is one example of this local policy perspective. The energy plans developed from 1977 through 1982 indicate an influence of this focus, as they too are local and project-oriented as well. The environmental issues included in the plans are also rare during this period, which may reflect the fact that environmental aspects had only begun to be placed on the political agenda.

Middle energy plans and the environmental policy 1983-1991

During the second period (1983-91), environmental issues had made their way up on the political agenda. Air pollution and acidification were important issues as was how to use and manage natural resources in an efficient way. There was also a legal call for EIA in energy plans, which may have served as a reminder that emissions may have environmental effects over a longer time perspective. This has been indicated by the fact that the effects of the environmental impacts caused by the energy plants are assessed in some of the energy plans. Furthermore, acidification and the short-term effects of resource extraction are common environmental issues that are considered in the energy plans.

Newer energy plans and the environmental policy 1992-1999

In 1991, a Government Bill on ecologically sustainable development was presented, and in 1992 the Rio Conference put the concept of sustainable development as well as global issues on the political agenda. These notions in environmental policy are to some extent reflected in a few energy plans.
that either recognise the energy sector’s contribution to global warming or relate to LA21 in the plan. During this period, new environmental goals were also presented. The energy plans made during this period include environmental goals both at the national and at the local level; this indicates the political force of the goals.

5.3 Municipal energy planning and other policies, trends and legislation
The reviewed energy plans also illustrate some other trends in society. This section considers the trends described in section 2.3.

Decentralisation and deregulation of the electricity market
The self-cost principle might affect municipal energy companies and therefore also the local energy system; however, since none of the energy plans discuss costs for the energy system, this might not have been an important issue in this forum. None of the plans addressed deregulation.

Spatial planning
According to Lamm (1990), energy issues have generally not been included in spatial planning before 1987. This review shows that most of the energy plans issued before 1987 address spatial planning issues because they are important for the local energy systems. In the newer plans, spatial planning is mentioned in connection with energy plant project issues.

Local Agenda 21 activities
Only two of the energy plans written after 1992 relate to LA21 activities. This indicates that either no LA21 activities were in progress in the municipality, or that the relation between sustainable development and energy issues had not been recognised. However, two plans relate closely to the LA21 activities. One is in fact issued as part of the LA21 work, and the other has the Swedish LA21 curriculum attached.

5.4 Factors influencing the scope
This review indicates that the energy plans have followed energy and environmental policies. Moreover, other societal trends can be observed in the contents of the plans as well. However, energy systems have a long life span and therefore other factors might affect the shape of the energy plans as well.

One example is economic considerations. The municipal energy systems have to be cost-effective and must be so for a long time. There is not much room for taking risks with new fuels or new technologies. In this sense,
there is a conflict between economic interests and a sustainable energy system.

The energy plans in this study have a very general character with vague goals described. Maybe this is a requirement of municipal energy plans. Since the planning process and the time-span of the plan takes many years, it is important that the plans anticipate new national energy and environmental policies, subsidies, or other unexpected changes of the circumstances. This could also be the reason why political measures are often not included in the plans. It might be a bad idea to base the energy system on subsidies that might disappear with the next national government.
6. Concluding remarks

Scope of the energy plans

This review shows that the quality and scope of the energy plans vary widely: the status of energy plans varies and the contents of the plans are also largely different. This variation is mostly the result of plans written at different times and therefore are based on different national energy policies.

The energy plans have become more analytical over time and the system boundaries seem to have widened. In the 1980s, the focus was on energy efficiency in buildings and on local heat plans. During the late 1990s, energy system efficiency and district heating were the focus. This widening of the system boundaries also applies to environmental issues, where a shift in focus from local pollution to global environmental effects is observed.

The scope of the plans in terms of inclusion of energy sectors is limited. Industrial energy use, for example, is mentioned only in a few plans and only two plans address transportation issues. Furthermore, no costs for the energy system are calculated.

Energy plans in relation to national policy

Contents of the plans show traces of the Swedish energy and environmental policies established since the 1970s. However, since the plans are locally oriented, national environmental policy is generally not referred to.

The older energy plans are local and project oriented according to the environmental policy during that time. The local perspective is obvious also in the energy conservation issues, where measures for oil reduction and energy efficiency in buildings were important. The advantages of electrical heating are highlighted in some of the plans, but the electricity supply is related to local hydropower rather than a national nuclear power program.

During the second period (1983-91), the environmental issues had made their way to the political agenda, and there was a legal call for EIA in energy plans. This can also be seen in the energy plans; the effects of the environmental impacts caused by energy plants and acidification are often addressed in these energy plans.

The diffuse goals of the national energy policy from 1985 through 1991 are reflected in the diffuse goals in the energy plans from this period. The large amount of available electricity can also be recognised in the energy plans: many plans describe how the municipality should prepare for extended heating with electricity.
The 1991 energy policy on ecologically sustainable development is to some extent reflected in a few newer energy plans, which either recognises the energy sector’s contribution to global warming or relates it to LA21 activities.

The 1997 energy policy with national goals on more renewable energy sources and the financial support program (LIP) with subsidies for a sustainable energy system can be seen in the energy plans. For example, goals and plans describe potential wind power projects and possibilities for combined heat and power plants that use biomass fuels.

Goals in the energy plans
Most plans describe goals for the municipal energy system. However, the goals stated in the plans are vague and leave room for new energy or environmental policies. The plans often include plans for reduced energy use and environmentally compatible energy sources rather than specific goals.

Most municipalities identify national goals for the energy sector and what they contain. Only one plan includes an analysis about what implementation of these goals would mean for the local energy system.

Implementation of the plans
Since the goals are vague (which means that the description of how local authorities can manage municipal energy systems are absent), implementing energy plans seems to be a subordinate issue in the energy plans. One important part of the implementation seems to be energy advisement. Most of the municipalities have planned for a municipal energy advisor. The advisory role has also widened from mostly technical advice in the early 1980s to more general advice on subsidies, taxes, and environmental issues.

Final remarks
The energy plans in this study have many differences, and some of these differences may be due to the differences in size and financial means of the municipalities. However, there are many issues that are not fully covered in the plans. One example is the implementation of the goals in the plans. How can the energy plan serve as a tool for developing the energy system if there is no strategy for implementing the plan? Transportation issues are often not considered as well. Transportation is important to both energy use and environmental impacts, but these are only mentioned in two plans, of which one makes a deeper analysis of the aspect. A possible conclusion
from this is that the effectiveness of the studied energy plans as instruments to control the development of the local energy systems can be questioned.

Although there is a requirement for environmental assessment in the energy plans, environmental analyses in the studied plans lack detail. Many plans are incomplete as they miss many important issues. The concept of strategic energy planning offers many opportunities for strategic environmental assessment, but this opportunity is not always used. The energy plans are project and plant oriented rather than strategic.
7. References


Acknowledgements

The authors are most grateful to the Swedish National Energy Administration for its financial support of the research project: “Strategic Environmental Assessment of Local Energy Systems”.
## Glossary

**Translations used in the report**

<table>
<thead>
<tr>
<th>English</th>
<th>Swedish</th>
</tr>
</thead>
<tbody>
<tr>
<td>General plan</td>
<td>Generalplan</td>
</tr>
<tr>
<td>Legal usage</td>
<td>Rättsspraxis</td>
</tr>
<tr>
<td>Local authority</td>
<td>Kommunen som myndighet</td>
</tr>
<tr>
<td>Municipality</td>
<td>Kommun</td>
</tr>
<tr>
<td>Municipal council</td>
<td>Kommunfullmäktige</td>
</tr>
<tr>
<td>Municipal company</td>
<td>Kommunalt bolag</td>
</tr>
<tr>
<td>Municipal comprehensive plan</td>
<td>Kommunal översiktsplan</td>
</tr>
<tr>
<td>Municipal act</td>
<td>Kommunallagen</td>
</tr>
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<td>Self-cost principle</td>
<td>Självkostnadsprincipen</td>
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<td>Spatial planning</td>
<td>Fysisk planering</td>
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<td>Principle of public access to official documents</td>
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</tbody>
</table>

**Swedish governmental organisations**

<table>
<thead>
<tr>
<th>English</th>
<th>Swedish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swedish National Energy Administration</td>
<td>Energimyndigheten</td>
</tr>
<tr>
<td>National Energy Administration</td>
<td>Statens Energiverk</td>
</tr>
<tr>
<td>Swedish National Audit Office</td>
<td>Riksrevisionsverket</td>
</tr>
<tr>
<td>The Swedish Environmental Protection Agency</td>
<td>Naturvårdsverket</td>
</tr>
<tr>
<td>National Industry Board</td>
<td>Statens Industriverk</td>
</tr>
</tbody>
</table>

**Swedish non-governmental organisations**

<table>
<thead>
<tr>
<th>English</th>
<th>Swedish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swedish association of Local Authorities</td>
<td>Kommunförbundet</td>
</tr>
</tbody>
</table>

**Acronyms**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>PBA</td>
<td>Plan and Building Act</td>
</tr>
<tr>
<td>LA21</td>
<td>Local Agenda 21 initiatives</td>
</tr>
<tr>
<td>LIP</td>
<td>Local Investment Program</td>
</tr>
<tr>
<td>SFS</td>
<td>Swedish statute book</td>
</tr>
<tr>
<td>SEA</td>
<td>Strategic Environmental Assessment</td>
</tr>
</tbody>
</table>
### Appendix 1. Categorisation of Swedish municipalities

The Swedish association of local authorities categorises Sweden’s 289 municipalities into nine groups according to inhabitants and employment structure.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Big city</strong></td>
<td>Municipality with more than 200,000 inhabitants</td>
</tr>
<tr>
<td><strong>Suburb municipality</strong></td>
<td>More than 50% of the inhabitants travel to another municipality to work</td>
</tr>
<tr>
<td><strong>Large town</strong></td>
<td>Municipality with 50,000-200,000 inhabitants with less than 40% employed in the industrial sector</td>
</tr>
<tr>
<td><strong>Medium sized town</strong></td>
<td>Municipality with 20,000-50,000 inhabitants with less than 40% employed in the industrial sector</td>
</tr>
<tr>
<td><strong>Rural municipality</strong></td>
<td>Municipality with less than 5 inhabitants per square kilometre, and less than 20,000 inhabitants.</td>
</tr>
<tr>
<td><strong>Industrial municipality</strong></td>
<td>Municipality with more than 40% employed in the industrial sector, and which is not a rural municipality</td>
</tr>
<tr>
<td><strong>Agricultural municipality</strong></td>
<td>Municipality with more than 6.4% employed in the agricultural sector, and which is not a rural municipality.</td>
</tr>
<tr>
<td><strong>Other large municipality</strong></td>
<td>Other municipalities with 15,000-50,000 inhabitants</td>
</tr>
<tr>
<td><strong>Other small municipality</strong></td>
<td>Other municipalities with less than 15,000 inhabitants</td>
</tr>
</tbody>
</table>
Appendix 2. Questions used for categorisation

Background information to the energy plan:

i  When is the plan written?
ii  When is the plan adopted?
iii Who is/are appointed as writer or responsible for the plan?
iv  What is the owner relationship to any municipal energy company?
v  Does the municipality have any energy advisor?
vi Has the local government implemented an environmental management system?
vii Is there any ”significant actor” within the municipality?
viii What are the time and spatial perspectives of the energy plan?
ix  How is the demographic development of the municipality described?

Questions for analysis of the energy plan

The questions aim at analysing if and how different aspects of the energy system are included in the energy plan. The results will form the basis of a further analysis of what factors determine the municipal energy planning.

The questions can be answered as follows:

F = Full description of the issue
S = Some description of the issue
N = No description of the issue

What is regarded as full and some information has been judged separately for each question.

1. The municipal energy plan and its context

The questions aim to analyse whether the energy plan includes aspects on what context the energy plan will be used. The results aim to form the basis for a further analysis of the relationships between the energy plan and other municipal planning as well as energy related projects in the municipality.

1.1 How are general goals for the energy sector described?
1.2 How is the plan related to regional goals for the energy sector?

1.2.1 How is the energy plan related to national goals for the energy sector and to national energy policy?

1.2.2 How is the content of the energy plan related to economic aspects, both municipal and national? Comments?

1.2.3 How are economic aspects described regarding employment (Local Investment Programs)?

1.2.4 How are the means for the municipality to influence the energy system described?

1.3 Are national means of control described in the energy plan?
1.3.1 Is the relation between the municipal energy planning and other municipal planning described (spatial and/or other planning)?

1.4 Is the relation between the energy plan and the local Agenda 21 described?

1.5 How is the position on national solutions described, e.g. a natural gas pipeline?

2. Analysis of the energy system
The questions aim to form the basis for further analysis of the system approach to the energy plan.

2.1 General analysis of the energy system
The questions will form the basis for a further analysis of what system perspectives are applied in the energy plan, from what basis the plan is made, and what visions are present for the development of local energy systems.

2.1.1.1 How are interactions between different actors in the energy sector described? Comments.

2.1.1.2 Is the basis for the energy services that the municipality is to provide described? (Heat and/or transport)

2.1.1.3 Is the municipal local energy system described from a local, regional national, and/or global perspective?

2.1.2 How are contemporary conditions for supply of locally produced electricity described with reference to
a. Renewable fuel?
b. Fossil fuel including natural gas?
c. Waste?

If no local production occurs, is the purchase of electricity for municipal energy companies described?

2.1.3 How are the future conditions for supply of locally produced electricity described with reference to
a. Renewable energy sources?
b. Fossil energy sources including natural gas?
c. Waste?

If no future local production is assumed to occur, is any future purchase of electricity by the municipal energy companies described? Is any clear position taken?
2.1.5 How are contemporary conditions for the supply of heat described with reference to
   a. District heating?
   b. Central heating?
   c. Small-scale solid fuel heating?
   d. Heat pumps?
   e. Oil?
   f. Solar heat?
   g. Electricity?
   h. Other energy sources?

Is any clear position taken?

2.1.6 How are the future visions for the supply of heat described with reference to
   a. District heating?
   b. Central heating?
   c. Small-scale solid fuel heating?
   d. Heat pumps?
   e. Oil?
   f. Solar heat?
   g. Electricity?
   h. Other energy sources?

2.1.7 How are contemporary energy carriers described with reference to
   a. Municipally owned estates including housing?
   b. Privately owned estates?
   c. Industry?
   d. District heating?

2.1.8 How are visions for future energy carriers described with respect to
   a. Municipally owned estates including housing?
   b. Privately owned estates?
   c. Industry?
   d. District heating?

2.1.9 Is the energy system described in the energy plan somehow related to the quality of energy (exergy)?

2.2 Energy plants within the local energy system
The questions aim to form the basis from which it is further analysed whether the energy plan is plant oriented or not.

2.2.1 Are there any references to land-use when expansion of the energy plant is discussed?

2.2.2 Are there any references to energy plant aspects in the energy plant? Comments?
2.3 The use of energy
The questions aim to form a basis for a further analysis of the basis from which the energy plan is analysed together with an analysis of what plans the municipality has for future energy use.

2.3.1 Is the current energy use within the municipality described, e.g with ratios and/or specific uses?
2.3.2 Are the visions for future energy use in the municipality described?
2.3.3 Are visions for future energy use in the transportation sector described?
2.3.4 Are there any examples of energy efficiency measurements described with reference to
   a. The housing sector?
   b. The industry sector?
   c. The transport sector?
2.3.5 How are the costs of the energy system described?

3. Environmental assessment of the energy plan
The questions aim to form a basis for an analysis of how the plan relates to national, regional, and local environmental goals, environmental impacts, and resource management issues.

3.1 Environmental assessment
3.1.1 Does the energy plan relate to national environmental goals?
3.1.2 Are local environmental goals described?
3.1.3 Are the current and to the energy sector related environmental impacts assessed with respect to
   a. the global level?
   b. the national level?
   c. the regional level?
   d. the local level?
3.1.4 Are the current and to the energy sector related environmental direct effects assessed with respect to:
   a. the global level
   b. the national level
   c. the regional level?
   d. the local level?
3.1.5 Are the current and to the energy sector related environmental indirect effects assessed with respect to
   a. the global level
   b. the national level?
   c. the regional level?
   d. the local level?

3.1.6 Are environmental goals for the energy sector specified? If so, what are the goals?

3.2 Management of resources
The questions aim to form the basis for a further analysis of how the plan deals with different resource management aspects.

3.2.1 Are conditions for resource extraction for energy use specified at the local, regional, national, and/or the global level?

3.2.2 Are the direct and indirect effects of resource extraction for energy use described at the local, regional, national, and/or global level?

3.2.3 Are the goals for resource management in the municipality specified?

4. The planning process
The questions aims to form a basis of a further analysis of the layout of the plan and how the plan relates to the organisation of the planning process, alternative developments of the energy system, future environmental impacts and effects and finally how the plan will be implemented.

4.1 Layout of the energy plan
The issues aim at giving a picture of the layout of the plan.

4.1.1 How is the content of the plan concluded? Comment?

4.1.2 Does the plan include references?

4.2 The planning process
The questions will form the basis of the analysis of who works with the plan and how the work has been conducted.

4.2.1 Is the organisation for the planning process described? Comments?

4.2.2 Are the methods and tools used during the planning process described? Comments?

4.3 Scenarios
The questions aim at analysing what different scenarios and/or visions of the future energy system are described in the energy plan.

4.3.1 Are alternative possibilities for development and/or scenarios described in the energy plan? Comments?
4.3.2 Are the alternatives and/or scenarios compared?

4.3.3 Are the future and to the energy sector related environmental impacts assessed with respect to:
   a. the global level?
   b. the national level?
   c. the regional level?
   d. the local level?

4.3.4 Are the future and to the energy sector related environmental direct effects assessed with respect to
   a. the global level?
   b. the national level?
   c. the regional level?
   d. the local level?

4.3.5 Are the future and to the energy sector related environmental indirect effects assessed with respect to
   a. the global level?
   b. the national level?
   c. the regional level?
   d. the local level?

4.4 Implementation of the plan
The questions aim to be the basis of an analysis of how the municipality will realise the shape of the future energy system.

4.4.1 Are measures and an action plan specified?

4.4.2 Are strategies for managing the energy system development specified?

4.4.3 Are the routines for following up goals specified?

4.4.4 Are those responsible for reaching the goals specified?

**General assessment of the energy plan.**
Appendix 3. Literature that have formed basis for the questions

Reports

The MILEN guide series for sustainable local energy systems, produced by the Swedish energy agency:

*Environmentally adapted local energy planning* (Miljöanpassad lokal energiplanering) (1991) is the first guidebook in the series. It provides information about renewable energy sources, energy efficiency, combined heat and power, natural gas, and how to choose between different kinds of energy systems solutions.

*New concepts about economy, energy, and environment at the local level* (Nya grepp om ekonomi, energi och miljö på lokal nivå) (1994) is a follow-up to the first guide book in the series. It discusses connections between energy, environment, and economics at the local level in terms of cost-efficiency, energy conservation, and reduced environmental impact.

*Environmentally adapted local energy plans – Examples* (Miljöanpassade lokala energiplaner - Exempel) (1998) gives examples on planning processes, goals stated, and how environmental assessments are made in some energy plans.

*Environmentally adapted efficient heating and electricity use* (Miljöanpassad effektiv uppvärmning och elanvändning) (1998) discusses different kinds of heating systems in terms of cost, environmental impact, and energy efficiency. Practical examples on how to transform energy systems are also provided.

*Local heating strategies* (Lokala UppvärmningsStrategier, LUS) (1998) provides ideas on how transformation of local energy systems can be discussed and organised.

*MILEN inspiration: International local energy planning* (MILEN inspiration: Internationell lokal energiplanering) (2001) presents examples of international local energy planning in terms of how implementation programs should be stated and performed or how the planning process can be organised.

*A sustainable local energy strategy* (En hållbar local energistrategi) (2001) deals with the importance of working with local energy strategies and some guidelines on how to work with these issues.
Other books issued by the Swedish Energy Agency

*Regulations for local energy systems* (Regler för lokala energisystem) (1999) summarises the legislation related to local energy systems.

*Sustainable energy future? Long-term environmental goals with system solutions for electricity and heat* (Hållbar energiframtid? Långsiktiga miljömål med systemlösningar för el och värme)

*Building sustainable energy systems – Swedish experiences* is an edited book that describes how the Swedish energy system has evolved.

Other books

*Local energy strategies* (Lokala energistrategier), by Per Lindquist (2000) is a report from a study where five municipalities and their energy strategies are compared.

*Efficient energy planning for a sustainable society* (Effektiv energiplanering för ett hållbart samhälle) (2001) is a handbook on energy planning issued by the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning. This book is the Swedish version of the international *Guidebook for Advanced Energy Planning* issued by the International Energy Agency after a co-operation project between Sweden, Germany, the Netherlands, and Italy. The book describes how energy planning can be conducted. Different methods and computerised tools are described.