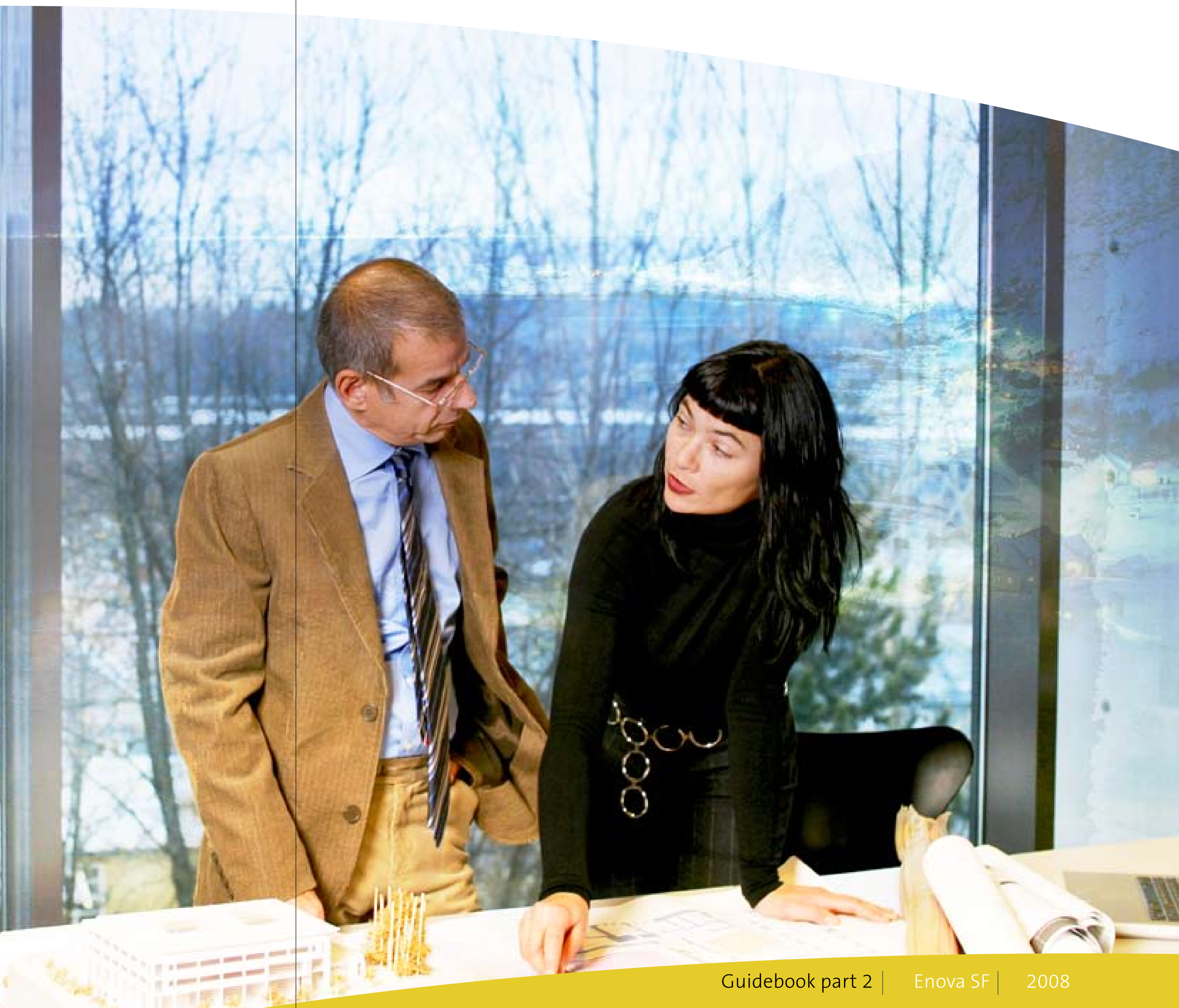
Municipal energy and climate planning

– a guide to the process



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Intelligent Energy Europe

Preface

The municipalities play an important role in the international, national, regional and local efforts to reduce greenhouse gas emissions through improving energy efficiency and increasing the use of renewable energy. Developing an energy and climate plan is an effective and important first step in this process.

This guidebook "Municipal energy and climate planning" is meant to be a tool for municipalities that aim to establish their own local energy and climate plan. This guidebook has been prepared by Enova in collaboration with the Norwegian Association of Local and Regional Authorities (KS), the Norwegian Pollution Control Authority, Institute for Energy Technology (IFE) and New Energy performance AS (NEPAS). The guidebook is part of Enova's program for Norwegian municipalities.

Although the guidebook has been prepared in a Norwegian context, referring to Norwegian legislation and support programs and using examples from Norway, the methodologies and topics are general and thus also relevant for municipalities in other countries. The hope is therefore that national initiatives are taken to translate this English version of the guidebook into more languages and at the same time include specific national issues. In this way, the guidebook can be made locally available and support energy and climate initiatives at local level all over Europe. In January 2008, the European Commission launched the initiative "The Covenant of Mayors", and a typical target group for this guidebook could be the partner cities and municipalities of this European Commission initiative.

The guidebook is based on certain national and international methodologies related to local energy and climate planning. One project funded by the Intelligent Energy for Europe Programme - "A three fold approach to sustainable energy planning at local level" (3-NITY) has developed three integrated elements for this specific purpose - namely; Sustainable Planning, Sustainable Measures and Activities and finally Sustainable Excellence. These three elements involve specific tools and methodologies that provide detailed discussions of all relevant topics needed to establish a useful energy and climate plan. The guidebook is in fact the publishable report of the 3-NITY project.

The guidebook "Municipal energy and climate planning" is a practical tool for use once the decision has been made and the municipalities are ready to start the actual planning process. The objective is to put in place a long-term strategy including an action plan with a clear focus on practical implementation of measures and activities at the local level. This guidebook explains more of the details of the planning process, and provides a practical introduction to the different steps in the process.

An energy and climate plan has two main parts:

Part 1: Factual basis and scenarios
Part 2: Planning and implementing measures

Part 1 will require substantial efforts the first time the planning process is carried out. However, if done properly, regular future updates will be relatively easy to implement.

Part 2 is based on the scenarios and potentials identified in Part 1, and is the most important part of the plan. It involves practical measures and activities for continuous implementation, and should be frequently updated and supplemented.

The plan must have quantitative targets for energy efficiency improvement in relevant sectors, starting with municipal buildings and installations; targets for heat and power generation based on local renewable energy sources; and targets for reduction of greenhouse gas emissions. Moreover, the plan must describe the municipalities' organisational capabilities to actually implement the plan. This is in fact the most critical factor, and where many municipalities face challenges in moving from planning to implementation.

Most Norwegian municipalities have already started planning for the consequences of climate change. More extreme weather conditions and heavy rainfall will present new challenges related to land use and infrastructure. This guidebook focuses on measures that can reduce the negative effects of climate change; however, municipalities may decide also to include a specific chapter discussing local vulnerability and the impact of climate change.

Good luck with the important work of energy and climate planning in your municipality!

Nils Kristian Nakstad
Executive Director, Enova SF

1 Introduction

Developing an energy and climate plan is only one of several processes that are necessary for a municipality to achieve its targets for energy efficiency, renewable energy and reduction of greenhouse gas emissions. These targets should be both quantitative in nature, e.g. kWh saved and reduced CO2 emissions, as well as qualitative, such as increased competence and awareness related to climate challenges.

The main processes are:

History
Many municipalities have already developed their plans, implemented specific measures, improved competence and achieved good results. Typically, these municipalities want to achieve even more! Other municipalities have ambitions but have not yet really got started.

Energy and climate planning
The energy and climate plan itself is really only the documentation of a publicly initiated process where all relevant sectors in the municipal administration and their stakeholders have been involved. An agreed distribution of roles, responsibilities, priorities and tasks is one important outcome of the process. The very fact that people work on the plan contributes positively to increasing knowledge at the local level. The plan should be adopted politically and become an integral part of the municipal planning hierarchy.

Implementation
This is by far the most important process, and typically where many municipalities fall short by not being able to take the process from plan to action. The plan must include a manageable action plan with agreed roles and responsibilities for the identified measures and activities. The easiest measures and activities should be implemented first, gradually increasing the complexity of the measures as competence and experience is built up. However, all new developments should be planned for a long term perspective where the intensity of energy consumption and greenhouse gas emissions become sustainable over time.

The figure below illustrates these processes, and shows the role played by the energy and climate plan in a long term perspective that can span several decades.

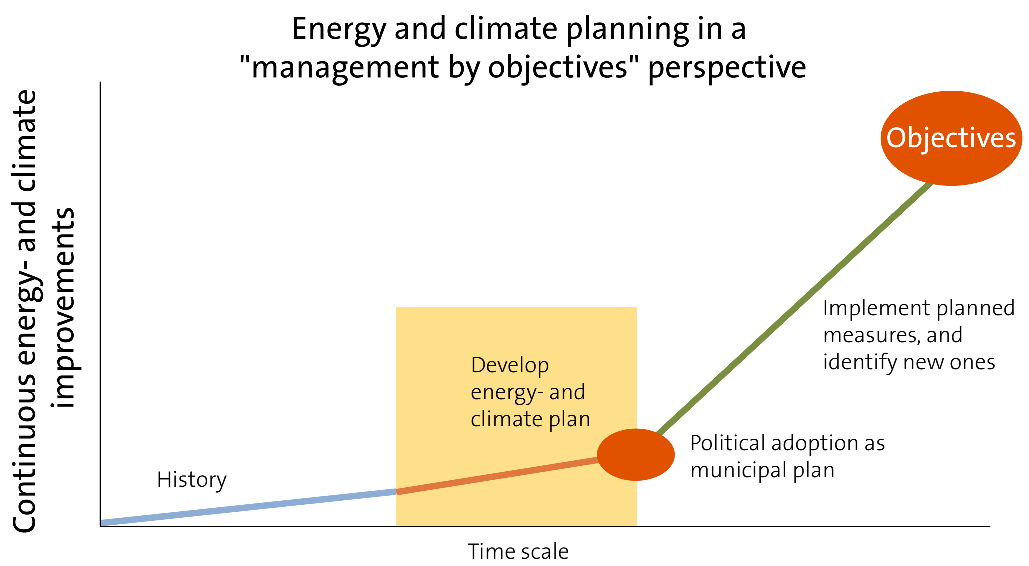


Figure 1: Energy and climate planning in a ”management by objectives” perspective

2 Organising the energy and climate plan work

2.1 Organising the energy and climate plan work

Political mandate
A policy decision must be made to develop a plan. In this connection, the existing municipal plan should be reviewed in order to identify items that can support the political mandate. Stronger wording can be proposed in the plan text, if applicable. Some municipalities, such as Skedsmo, have prepared a new chapter on energy in the municipal plan. The municipality of Larvik has also laid down guidelines for energy in the land use portion of the municipal plan (see Appendix 5).

Critical success factors, local drivers and organisational commitment
What are the critical success factors for an energy and climate plan - and what is the real motivation for municipalities to draw up their own energy and climate plan?

Critical success factors can include:
- The municipality's political willingness to pass and follow up resolutions dealing with energy and climate
- The municipality's organizational/financial capacity to implement the measures entailed in an energy and climate plan

Potential local drivers (motivation)
- Large local/regional potential for renewable energy
- Local environmental considerations
- Local jobs
- Substantial growth
- Direct financial savings and a desire to profile the municipality/local stakeholders as environmentally friendly

Organization and foundation of the work
All relevant municipal sectors must be involved in areas where it is natural that they contribute and share partial responsibility. The general responsibility for coordinating the process should, however, be assigned to the section or department that has the greatest vested interest in the plan (ref. drivers). If the initial motivation is purely political in nature, the mayor or chair of a committee may be assigned the primary responsibility for driving the process from the political aspect.

If planning purposes are the main motivation, the municipal planning department (e.g. the planning manager) should take on this responsibility, while if the main focus is on energy consumption in the municipality's own buildings, then the building/property manager should manage the process. Placing the administrative responsibility in a single location is an advantage, and preferably with a single person who can be expected to assign high priority to the process. Experience indicates that a good plan process requires intense concentration, both politically and administratively.

Trysil municipality is a good example of this. Here the challenge was to stem the steady decline in population. Trysil's main objective is to create new jobs linked to its forestry resources; and for this reason, the energy and climate plan was assigned to the manager for commerce and industry.

There are various models for how the municipality can organize its efforts aimed at energy and climate, as well as how this work can be rooted in the existing organization. It is important to find the model that is best suited to your municipality: large/small municipality, urban/rural, more/less developed. It is also important to ensure that different segments within the municipality can cooperate in the planning process in order to achieve greater momentum, improved climate effects and better profitability for the measures. Example: development of industry and commerce linked to renewable energy resources, coordinated land use and transportation planning.

As mentioned, broad participation is important, as is a good, orderly system for the planning process. Good organization entails different ways of achieving this - e.g. through establishing a steering committee composed of the most key stakeholders along with a broader reference group who meet at the beginning and towards the end of the process. A working group should also be set up, with a basis in the municipal organization that coordinates the actual work. In smaller municipalities, it will often be possible to involve the relevant stakeholders using simpler processes and management models. From the very start, it is important to clarify the purpose of the planning work. As many as possible of the key municipal players should be assigned responsible roles to ensure strong ownership of the process in the organisation. Also, clarify where the various municipal players have tasks to perform, and how they can influence the actual implementation of the measures proposed in the plan. To achieve the greatest possible results, private sector stakeholders that cannot be ordered to act should also

be motivated to take action. A good energy and climate planning process should result in agreements where stakeholders other than the municipality itself commit to implementing measures. How and when the plan will be processed administratively and politically must also be clarified.

It is important to point out that an energy and climate plan will contain activities and measures where the municipality does not assume responsibility for the results, but is merely a central facilitator and instigator.

Energy and climate plan group

The municipality's own employees, local stakeholders (forest owners, housing cooperatives, business and industry, residents and external consultants, if applicable) and interested parties must work together in the process and take responsibility!

In the autumn of 2007, the newly elected municipal council in Rælingen decided to establish a dedicated committee to handle the municipality's energy and climate tasks. This is a way of putting energy and climate issues on the local political agenda. The first step will be to ask the municipal administration to draw up an energy and climate plan.

2.2 Coordination with local energy studies

The area licensee or power grid company should be included in the energy and climate plan work. Electricity is the most common energy carrier in Norway, and the area licensee knows more than any other party about power consumption and plans for the electricity grid. Correspondingly should gas grid companies and district heating companies be included where this is relevant.

The area licensee is obliged to conduct a local energy study for the municipalities in its area. It may be advantageous to coordinate this process with the work on the energy and climate plan:

- It provides an incentive to build local ties: municipality - power grid company - stakeholders - consultants, where the most relevant parties com municate (other parties must also be represented in the energy study work, such as the licensee for district heating)
- The municipality does not have to deal with overlap ping documents
- It is labour-saving
- The quality of the plan/study is improved because links between the energy system and climate emerge more clearly
- Opportunities to implement measures that affect the use of electricity increase when the power grid company and the municipality are linked more closely than is often the case

In those cases where the energy and climate plan also fulfils the content requirements of a local energy study, the area licensee can present the energy and climate plan as the local energy study. More information about local energy studies can be found on the NVE's (Norwegian Water Resources and Energy Directorate's) website on this topic. [13]

3 Gathering information

Access to up-to-date statistics about factors such as energy consumption, resource base and greenhouse gas emissions for the municipality is important when commencing the work on an energy and climate plan. Statistics Norway (SSB), the Norwegian Water Resources and Energy Directorate (NVE) and the Norwegian Pollution Control Authority (SFT) have drawn up various summaries for Norway, that are available on the Internet.

However, when gathering data and information, it is important to know what this information actually describes. Energy sources are often converted into energy carriers, which are in turn transported to the consumer. The energy may change form several times along the way, and part of the energy may be lost. Some energy can also be lost at the point of consumption. Therefore, statistics often differentiate between “end use” and “net energy”. When electricity is converted into heat, 100 per cent of the end use is utilised. If bioenergy is converted in the same way, often only 70-85 per cent is fully utilised - the rest is lost with the flue gas. For this purpose, the word “utilised” should be understood to mean fully utilised/put to its intended use.

3.1 The Norwegian energy system

Energy consumers do not demand energy per se, but rather the services that the energy can provide, such as transportation, lighting, heating, cooling or power. Energy is also used to power industrial processes. The energy resources at our disposal are often in a different form than what we need, and they are often found in another location. Conversion and distribution of energy are often associated with both loss of energy and greenhouse gas emissions.

The amount of energy obtained from a forest in the form of biomass is not the same as the amount of heat that comes from the pellet stove further out in the energy chain. Therefore, it is important to be aware when using statistical figures that the user must differentiate between primary energy sources (e.g. 1 m3 biomass) and service provided by that energy (e.g. 1 kWh of heating). Society does not demand electricity or fuel; it demands warm rooms and transportation services.

Schematic overviews of stationary energy systems are provided in Figures 2a and 2b. The figures show how various energy sources are converted into energy carriers which are ultimately turned into energy services for the end user.

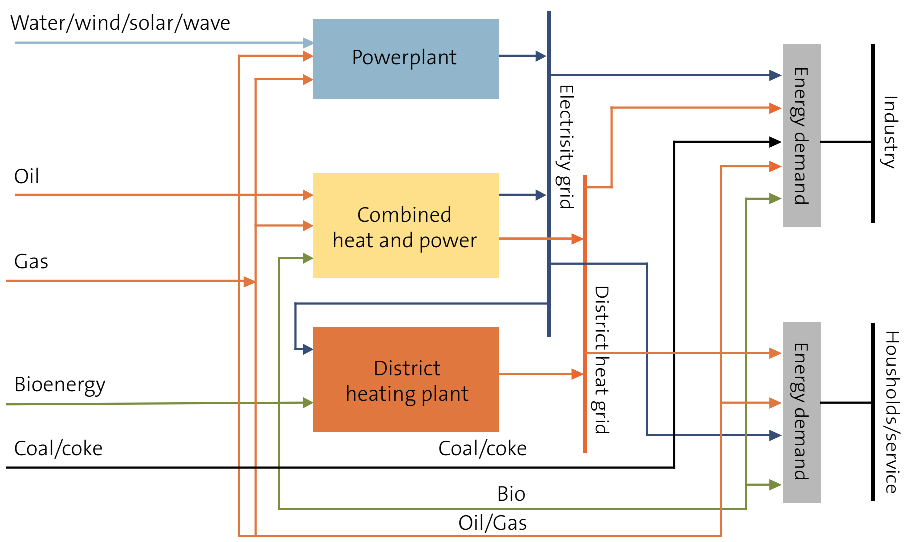


Figure 2a: Example of a schematic overview of a stationary energy system

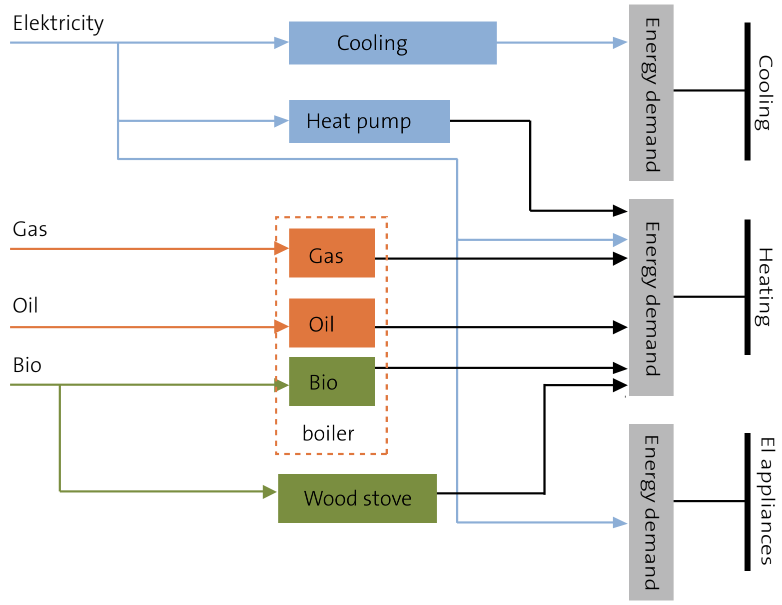


Figure 2b: Example of a schematic overview of a stationary energy system

The SSB’s energy data distributed by municipality, presented below, reports the consumption of energy carriers by end users.

3.2 Energy and climate data for the municipality

SSB is the main source of municipal energy statistics. Each year, the SSB updates municipal energy statistics covering all consumption, both stationary and for transportation. This is described in more detail in Chapter 4.1.3. The figures for energy consumption other than electricity are somewhat uncertain. This is because some forms of consumption are calculated with available background statistics or surrogate data. Therefore, local changes will not always be captured in SSB’s statistics. Information about data quality can be found in the SSB Memo 2004/40 [1]. Updated energy consumption statistics distributed among various types of commercial buildings and industrial sectors can also be found on Enova’s website under the Building Network and the Industry Network.

Climate data for the respective municipalities can be obtained both from the SSB and by using SFT’s climate calculator, which is based on “Environmental Status”. The latter is a collaborative effort among the environmental directorates and includes data entered from all municipalities.

SSB’s statistics bank also contains greenhouse gas emission data for the respective municipalities. This is an important source for “Environmental Status”.

These are all largely the same figures, but presented somewhat differently.

SFT’s climate calculator can also be used to create very simplified reference paths for 2012 and 2020 by entering annual changes in consumption.

Other relevant statistics for an energy and climate plan can be found in SSB’s Statistics Bank. This is an easy-to-use search portal with special pages dedicated to various data about municipalities.

Examples of such information:

- Facts about the municipality
- Resources
- Waste
- Land use
- KOSTRA (municipal - state reporting system)
- Population and housing census 2001
- Population projection in the municipality

The main source of data about the scope of road transportation at the municipal level is the traffic census conducted by the Directorate of Public Roads (indirectly discussed below), which only provides the average number of vehicles per day on an annual basis for lighter and heavier vehicles on highways and county roads. NSB (the Norwegian State Railways) must be consulted regarding rail traffic. Similarly, data regarding bus and ferry/high-speed boat traffic must be obtained from the companies operating in the municipality.

Separate traffic counts and/or surveys will probably have to be conducted to obtain more information e.g. about traffic within the municipality. This may be appropriate in some municipalities, although it will entail some costs. This is a way for the municipality to obtain the following supplementary information:

1. Knowledge about pedestrian and bicycle traffic
2. Improved knowledge about traffic on municipal roads
3. Knowledge about how much of the traffic on other roads that starts/ends in the municipality, and can thus be influenced by local stakeholders
4. Substantial other information of potential interest for some municipalities, ranging from purpose distribution of personal travel to capacity exploitation for freight vehicles

3.3 Potential for local energy efficiency

Municipal buildings

Potential energy reduction depends on the number/volume of buildings and their condition.

Statistics for all of the municipalities' building area should include schools, health-related buildings, administration and cultural/sports-related buildings. Some municipalities also want this work to include municipal housing projects. The figure that is needed is the total gross heated area, and these statistics should be updated annually due to the major changes that occur through changed usage, remodelling, additions, etc. Empirical figures from Enova show that the municipal building area is equivalent to 5-8 m2 per resident of the municipality. For example, the municipality of Trondheim, with approximately 160,000 residents, has 800,000 m2 of municipal building surface, which equates to 5 m2 per resident. The area per resident is normally somewhat higher in smaller municipalities. The Norwegian Association of Municipal Engineers, Forum for Buildings and Property in the Municipalities (FOBE), can assist in providing good key figures. FOBE has a number of topical task forces at work, and constitutes an important resource for Norwegian municipalities.

Energy consumption includes all energy input to the buildings, and it is quite a challenge to stay up-to-date here. The challenges lie in the fact that electricity, fuel oil, biofuel and district heating are all measured differently and cover different areas, thus making it difficult to maintain access to good energy statistics. The grid companies are a good source of assistance for the municipalities. Enova recommends establishing energy follow-up in all municipalities. A person should be designated as an energy coordinator, with responsibility for working on energy follow-up, preparing reports and actual reporting to management and operations personnel in the buildings.

Enova can provide considerable support for municipalities that establish energy management, and that make physical investments in their buildings.

The potential for energy reduction emerges through comparing actual measured consumption and normative figures prepared by Enova. The actual consumption and the normative figures are developed as kWh per m2 of floor space per year. School buildings normally use 150-250 kWh/m2/year, while health-related buildings use 200-300 kWh/m2/year. Consumption varies with the age of the buildings, intensity of use, building standard and outdoor climate. Therefore, it is quite a difficult task to quantify the savings potential for the municipality's buildings. An example of how this was summarised in the municipality of Arendal is found in Appendix 6.2.1.

Other buildings in the municipality

Based on the SSB's energy consumption statistics for the municipality as mentioned in Chapter 3.2, and a comparison with energy consumption figures from various types of buildings and companies, an estimated potential for local energy reduction can be deduced. Calculations made for individual buildings show an extensive spread here, but are normally in the range of 10-30 per cent.

In the absence of good statistical material and good methods for calculating energy economisation potential, a figure of about 20 per cent of current energy consumption can be used as a realistic average for the municipality. However, this does not apply to the municipality's own buildings and facilities. A detailed study is required for these items, with reference to specific energy reduction measures and associated costs.

Households

The best point of departure for the housing sector is probably the latest housing census by SSB, which contains statistics on the type and age of residential buildings in the municipality, energy consumption and the type of energy carriers that are used. In many cases, it may be just as easy to deal with general information about opportunities and potential energy reduction found on Enova's website.

Private commercial buildings

As previously mentioned, the basis should be taken from statistics in Enova's network of buildings, and comparing these figures with the municipal statistics from SSB.

Industry

Here too, the basis should be taken from statistics in Enova's industry network, and comparing these figures with SSB's industry statistics for the municipality.

Transportation

There is only a meagre statistical basis for calculating potential reductions in mobile energy consumption. This is discussed in more detail in Chapter 4.1.3.

3.4 Potential for local energy resources

The task of the Norwegian Water Resources and Energy Directorate (NVE) is to obtain overviews of the overall energy potential in Norway that can be economically and technically exploited. Resource mapping is conducted to increase knowledge about how much energy is available from various sources such as small hydro power stations, waste heat and biomass. Both energy potentials and descriptions of various technologies and energy forms can be found on the NVE website [3], which also contains dedicated pages containing relevant information for municipalities.

The area licensee (the power grid company) has prepared a local energy study for each individual municipality. This study is also supposed to contain estimates of the potential for local energy resources, but in those cases where the information is deficient, local sawmills and woodworking companies should e.g. be contacted to obtain information about waste wood, and forestry companies should be contacted regarding bioenergy resources. In many places, the municipality itself has useful information about resources available from agriculture. When mapping the local energy resources, it is also important to record the price of the various resources. Such an overview is often useful in determining the difference between technical and economic potential. Reference is made to the example of such a distribution for biomass in Appendix 7.

4 Practical development of the plan and how to prepare reports

4.1 Part 1 - Factual basis and scenarios

4.1.1 Summary of the factual basis

A brief summary of the status of the municipality's energy and climate situation is to be prepared. Based on an overall evaluation of this summary, the municipality can set energy and climate targets, draw up a reasonable strategy and promote the measures necessary to achieve them.

Framework conditions

A brief account shall be prepared of the framework conditions that apply to the work on energy and climate, both nationally, regionally and locally/on the municipal level, with particular focus on the latter.

4.1.2 Beskrivelse av nå-tilstanden

This describes the current situation in the municipality in an energy and climate perspective, in relation to the population, residence patterns, business and industry, environment and other factors. A short description should be prepared of special factors in the municipality that are of significance for the composition and size of energy consumption and greenhouse gas emissions, such as large companies, large hydro power stations and large windmill parks. This can also reflect important industrial and commercial interests. Earlier political decisions that bind the municipality should also be discussed. The heading can be "Where do we stand, and what brought us here."

4.1.3 Status and development of energy consumption and related greenhouse gas emissions

The energy consumption pattern determines both the development and the dimensioning of the municipality's energy system. Energy consumption will largely guide the need for distribution networks and determine how much energy must either be produced locally or brought in from outside. Documentation of the historical development in energy consumption is therefore a key issue in connection with future planning.

Format

The presentation of the consumption data will depend on the format utilised in the most important sources of data. Consumption is divided by energy carriers and consuming sectors. As discussed in Chapter 3, consumer data may largely be obtained from SSB, power grid companies and any district heating companies that have a licence in the municipality.

SSB keeps statistics for all energy carriers, although the format differs somewhat between electricity and other energy carriers. The consumption statistics for electricity are more roughly categorised into sectors as compared with other energy carriers, and it may therefore be beneficial to use the consumption figures provided by the power grid companies. The power grid and district heating companies will normally have relatively detailed sector categories for consumption data, but this does vary. SSB has a more coarse sector categorisation of its consumption statistics for the other energy carriers. As the coarsest categorisation will be the determining factor when the data is summarised, electricity consumption (as well as district heating, if this is obtained directly from the district heating company) will have to be adjusted with respect to the other energy carriers.

We recommend that consumption be sorted according to SSB's statistics, by the following sectors and energy carriers:

Sectors

- Primary industries
- Industry
- District heating
- Services
- Households
- Road traffic
- Aircraft
- Ships
- Other transportation

Stationary combustion

Energy carriers

- Electricity
- Coal, coal coke and petroleum coke
- Wood, wood waste, waste liquor
- Gas
- Petrol, kerosene
- Diesel, gas oil and light fuel oil
- Heavy oil, waste oil
- Waste

Mobile combustion

The value stated for all types of fuel is the net calorific value, or the energy content, prior to combustion and conversion into heat. As regards electricity and district heating, the energy supplied to the consumer is reported prior to loss incurred through conversion/heat exchange on the part of the end user. The tables also contain a forecast for the development of energy demand in the municipality for the next 20 years. Here it is important to take into account a possible realisation of the energy conservation potential in all sectors, as well as the fact that new development must take place in accordance with more stringent energy requirements. Municipalities that host large, dominant industrial companies are encouraged to prepare a separate table for the applicable company/companies. This makes it easier to compare the municipality with other municipalities that do not have energy-intensive industry.

A template to be used for tables can be found in Appendix (2).

Status - stationary consumption

Because temperatures vary from year to year and from place to place, energy consumption must be corrected for degree-days. This is done in order to allow a comparison of consumption over a period of time in different geographical areas. All energy that is used for heating must be corrected for degree-days. The percentage of energy used for heating varies from sector to sector, as well as between energy carriers. The degree-day correction is accomplished by using a correction factor which can be calculated on the basis of a normal degree figure and a degree figure for each year. A degree-day calculator that can be used to perform such computations can be found on Enova's website, www.enova.no.

One problem encountered here is that the normal degree-day statistics are based on the period from 1961-1990, which was colder than it is now, particularly during the heating season. During the years 1991-2006, the average temperature for the country as a whole in the months from December through February has been nearly two degrees higher than in the 1961-1990 period. Work has been done in recent years to resolve this problem, and a new basis for degree-day corrections is now available [11]. "Klimadata M21" (Climate Data M21) is a computer tool containing a considerable amount of climate data for buildings and technical facilities from 175 weather stations throughout Norway. This program was published by chartered engineer Eiliv Sandberg in 2007.

District heating is categorised as a separate sector in the SSB's statistics. This may be confusing when we know that it is also an energy carrier (water-based heating). However, since district heating is generated through combustion/conversion of other energy carriers, it is easier to categorise it as a sector in order to avoid a situation wherein the same volumes of energy are reported in multiple places.

In this way, we can also see which energy carriers are used to generate district heating. It is important to keep track at both ends - what the district heat is created from, and who is using it.

Future development - stationary consumption

Even at this early stage of the planning work, it is important to quantify potential energy savings, i.e. to make an assessment of the possibilities for reducing energy demand on the part of the end user. A rough estimate of energy savings alternatives is made during the survey phase. This is done by using a benchmark or a reasonable level for specific energy consumption in households and in various types of service buildings, and comparing this with the actual level in the municipality. Climate and the mix of building types in the relevant municipality must also be taken into account.

Comments should also be provided to the extent that dispersion coefficients are available for some of the building categories. The municipality should have dispersion coefficients for its buildings. The grid owner may also be able to produce these figures for more/other buildings. On this basis, potential energy savings can be estimated, particularly for entities that have a high specific consumption. It has been proven that this dispersion coefficient is extremely stabile, both among households and enterprises that have relatively similar buildings, in technical terms. Data regarding energy consumption in various categories of non-residential buildings/commercial buildings can be found in Enova's Building Statistics on www.enova.no.

As regards industry, it is important that larger companies be contacted in order to map both approved energy conservation projects and to evaluate future possibilities. We recommend a visit to Enova's website, under the Industry Network (Industrinettverket) link (currently available in Norwegian only, English version being prepared). This link contains useful, updated energy consumption statistics for various categories of Norwegian companies. The IEE/EU-funded project "BESS" has energy statistics and benchmark-figures for various SMEs sectors in several European countries available online. www.bess-project.info

Information about relevant energy conservation projects and assessments from major private service enterprises, as well as from the municipality itself, should be part of the basis for drawing up a forecast for future energy demand trends in the municipality. The factors that are examined and discussed in this section will form an important basis for the work on projections and scenario development as discussed in Chapter 4.1.9, and obviously also during the work on goals and measures.

Status - mobile consumption

In contrast to stationary consumption, it is difficult to divide the fuel consumed in the transportation sector among geographical areas. As illustrated, SSB's statistics for mobile energy consumption are divided between road traffic, air and ship traffic, as well as other mobile consumption. As regards road traffic, the municipal distribution was made using distribution formulas for five different types of vehicles. A number of sources have been employed to develop these distribution formulas. For highways and county roads, raw data such as length and average number of vehicles per day per year, known as average annual daily traffic, is used as a basis. For municipal roads, the consumption is divided according to municipal population, with the exception of the 15 largest municipalities where these numbers are collected directly. This means that the consumption figures for large municipalities with a high share of traffic on highways and county roads are considered to be reliable. Great uncertainty is linked to the basis of figures [8] in smaller municipalities with a higher percentage of driving on municipal roads.

In many municipalities that are small in terms of population but large in area, most of the traffic will be on highways or county roads, and much of this will be through traffic. The highest percentage of driving on municipal roads takes place in urban municipalities with large populations; however, the largest of these are, as mentioned, covered by separate measurements.

As regards shipping, only the energy consumption within 0.5 nautical miles of the harbours is included in the municipal statistics. Other consumption is placed in the general maritime zone category. The quality of municipal distribution of shipping statistics is considered to be poor because the available data is old. As regards aviation, only consumption occurring less than 100 meters above ground is allocated to the municipalities, while the rest is placed in the general airspace category. These figures are considered to be of good quality. Municipal distribution of other mobile consumption, which includes railways, motorised implements, snowmobiles and small boats, is also considered to be of sufficiently good quality. In most municipalities, the most important components of other mobile consumption are tractors and machinery used in agriculture and forestry activities, building and construction activities, and internal transportation in companies/in industrial areas. In principle, the latter category is to be reported by the companies, while consumption by tractors and machinery is estimated. Any diesel-powered train traffic is also included here. Upon request, SSB can provide information regarding the distribution of other mobile consumption [8].

Future development - mobile consumption

National studies and forecasts are the best available basis for making assessments regarding future changes in mobile consumption in the municipality. Based on these studies and forecasts, as well as figures showing recent years' developments in the respective municipality, it should be possible to indicate what the future traffic pattern in the municipality will look like. It is reasonable to assume that the need for transportation will increase somewhat, but that vehicles and boats/ferries will consume less fuel per kilometre. The municipality itself has considerable opportunities to facilitate a reduction in the need for local transportation, while there are fewer options as regards affecting through traffic. Therefore, municipalities are recommended to prepare a separate table for traffic on the network of trunk roads in the municipality. The factors that are studied and discussed in this section will form an important basis for the work on projections and scenario developments discussed in Chapter 4.1.9, and obviously also for the work on goals and measures.

Related greenhouse gas emissions

A necessary precondition for reducing greenhouse gas emissions is knowledge about how much is currently being emitted, and where these emissions come from. SSB and SFT have statistics for all emissions on the municipal level, sorted by source and component (type of emission). The municipal distribution is based on national calculations, broken down to the municipal level. There is some uncertainty associated with the distribution formula used here. The greenhouse gases can either be examined separately (CO2, CH4 and N2O account for 97 per cent of the greenhouse gas emissions), or together in CO2 equivalents. Presenting the emissions distributed by components is recommended, so as to clarify their origin. Source distribution is divided between stationary and mobile combustion and process emissions, and then further divided by sectors.

SSB utilises the following attribution of greenhouse gas emissions (CO2, N2O and CH4). Process emissions are also included in the summary, even though these are not combustion-related emissions.

Process emissions will be discussed in more detail in Chapter 4.1.4.

Stationary combustion	Mobile combustion	Process emissions1
Oil and gas production	Light vehicles	Oil and gas production
Industry and mining	Heavy vehicles	Industry and mining
Other industries	Motorcycles and mopeds	Agriculture
Households	Domestic aviation	Landfill gas
Combustion of waste and landfill gas	Ships and boats	Other process emissions
	Other mobile combustion	

[1] Process emissions are emissions that originate from processes other than combustion, e.g. industrial processes. Therefore, some sectors are listed two places in those cases where a differentiation between combustion emissions and process emissions is required.

Emissions associated with consumption of electricity are not included in the SSB's statistics. Since electricity is a commodity traded in a common market, and Norway has connections abroad, we are inextricably linked to the energy system in Northern Europe. Generation of electricity in Norway takes place almost exclusively through renewable hydro power. Nevertheless, the marginal production (which is adjusted to accommodate fluctuations in demand, supply and import/export) will occur in power plants abroad that are fired with fossil fuels. Whether it is plants fired with natural gas or coal that provide this marginal production depends on the plants' variable operating costs, which in turn depend on the price of coal and natural gas, as well as the price of CO2 quotas.

As mentioned, the marginal production of the plants depends on their variable operating costs, which in turn depend on the fuel price of coal and natural gas, as well as on the price of CO2 quotas. Therefore, it is difficult to indicate the exact mix. An average value of 0.6 kg CO2/kWh is recommended. It is obvious that this reduction does not take place within the borders of the municipality or of Norway, and will therefore not constitute a direct contribution to Norway's achievement of its Kyoto goals. Nevertheless, this is the actual, physical consequence of marginal electricity consumption in Norway.

Templates for tables can be found in Appendix [2].

4.1.4 Status of greenhouse gas emissions from processes, agriculture and landfills

Calculating greenhouse gas emissions

Calculation of greenhouse gas emissions (as well as emissions of other substances) takes place using figures for activities that are multiplied by an emission factor. This takes place in a cooperation between SSB and SFT. Only certain types of emissions are determined through measurements and/or what is self-reported.

- Examples of activities: amount of waste handled in different ways, amount, N, of spread fertilizer, number of hectares of cultivated soil
- Examples of emission factors: tonnes of methane per tonne of deposited waste, kg. of methane per cow, etc.

Considerable uncertainty is linked both to activities and, in particular, emission factors. This can result in significant errors in the calculated greenhouse gas emissions. In many cases, therefore, the calculated emissions may deviate substantially from the actual emissions. Furthermore, the calculation method is simplified in such a way that a number of measures that reduce emissions, for example within agriculture, cannot be credited using the current calculation methodology.

Sources of statistics for calculating emissions:

- SSB (Statistics Norway)
- "Miljøstatus" (State of the Environment Norway)
- SFT.no (website of the Norwegian Pollution Control Authority)

Templates for tables can be found in Appendix [2].

4.1.5 Resource surveys

Mapping the energy resources will clarify the latitude the municipality has with regard to development of the energy system, and it will also constitute an important part of the decision basis for potential measures. It can also be useful to look at the resource base in context with current production and consumption. Some municipalities which currently have a net import of energy could possibly take steps to become exporters of energy. An overview to illustrate this point could be a crucial determining factor. The potential for improved energy efficiency can also be said to be an energy resource, as it frees up energy that is already being used. In a planning context, this potential is normally included under potential end user measures, in other words, when projecting energy demand in the municipality.

Hydro power

Future development of new large power stations is probably unlikely, even though a potential still exists. However, there is a large and realistic potential for developing the many smaller watercourses found all around Norway. This can also provide extra income for landowners, and may be interesting for municipalities that see the possibility of becoming self-supporting in terms of energy. Hydro power plants are classified into two main categories according to size: small-scale and large-scale. Small-scale hydro power plants have an output of less than 10 MW, while large-scale hydro power plants have an output of more than 10 MW.

Small-scale hydro power

Small-scale hydro power plants can be further divided into three categories: micro power plants (<100 kW), mini power plants (100-1000 kW) and small power plants (1-10 MW). NVE has developed a digital resource mapping of small power plants from 50-10,000 kW. The GIS method (Geographic Information System) is based on digital maps, digitally accessible hydrologic material and costs of various parts of facilities. The mapping was done on the municipality level, and the results were presented in the report "Calculation of potential for small power plants in Norway" (2004). The report also includes the results of the manual mapping "Comprehensive plan for watercourses". This resource survey is available on the NVE's website, together with underlying material describing the model's assumptions and limitations [3]. In some cases there will be limitations in the overlying power grid. Therefore, area licensees should be consulted to help determine which projects are best suited as regards costs, power grid connection, etc.

Large-scale hydro power

As mentioned, there is reason to believe that there will not be any large-scale hydro power development in Norway in the future. However, a potential for large-scale hydro power still exists in several places and this should be included in the survey. The digital resource survey from GIS does not encompass large-scale hydro power. It is thus the "Comprehensive plan for watercourses", available on the NVE's website, that provides the best overview of these resources. Evaluating the possibility of rehabilitating existing power plants is also recommended, to reduce losses and thus increase production capacity. NVE estimates that rehabilitation of existing power plants could increase total production in Norway by as much as 10 TWh/year.

Wind power

Many places in Norway, particularly along the coast, have an annual average wind speed of 7-9 metres per second. Theoretically, this provides good conditions for exploiting wind energy. Building windmill parks is, however, often limited by local aesthetical considerations, and such issues have often generated a great deal of involvement by the community. Economic considerations will also be decisive, as wind energy has yielded a higher power price than the market average in recent years. Mapping wind power potential is done using wind measurements over an extended period of time. Data from weather stations will be a good point of departure as they often have wind gauges installed. However, wind speed is often determined by local conditions and may vary considerably even between places that are geographically close together. A national wind atlas for the Norwegian coastline can be found on NVE's website [2]. The wind atlas is divided by county, and then by sub-areas, although not down to the municipality level. In other words, measuring points must be located in the area that encompasses the municipality, followed by an assessment of the potential in the municipality. So far, the wind atlas only covers the coastal areas, but there are plans to make similar analyses also for the inland areas. Inland municipalities may want to look to Sweden for the time being. Several wind power projects have been initiated in central areas of Sweden, and the wind measurements there could provide an indication of the conditions in parts of the Norwegian interior. It is, however, extremely important to take local variations into account. Many coastal municipalities have already considered applications from power companies for development of windmill parks. In most cases it would be a good idea to hire external consultants to develop a realistic picture of the potential for wind power in the municipality.

Bioenergy

Bioenergy is a term that encompasses all energy that can be extracted from organic material, or so-called biomass. Biomass is available in many different forms with varying energy content. The most important bioenergy resources are forest fuels, secondary wood from the forestry industry, straw, energy crops, livestock fertilizer, combustible waste, wet organic waste and landfill gas [9]. Unexploited forest growth is found in most of Norway's municipalities, which could be extracted in a realistic and ecologically prudent manner, in addition to, and not least "GROT" (branches and tops) in municipalities where there is significant forestry.

Trees growing outside of actual forest areas can also be a source of fuel.

Compared with the data that can be obtained from SSB, more in-depth assessments of available bioenergy resources have been made in many areas of the country (including both ecological and competing financial considerations). If the municipality itself does not have its own forestry manager or equivalent position, the chief county forester/county forester will be able to provide important information. Dedicated bioenergy projects are now underway in several counties, including participation by county governors, county administrations and industry actors. It would be natural for the municipalities to contact their county governor regarding these activities [12].

Generally speaking, it can be difficult to obtain good figures for the biomass potential in a municipality. The local forestry industry/forest owner association and SSB have figures for annual forest felling, while the "Landskogstakseringen" (a national sample register of Norwegian forests and outlying fields/grazing areas) may have estimates for some regions showing the sustained yield that may be useful background information. In many cases, it will be interesting to look at the resource base in a larger region, such as in connection with plans to build large incinerators or pellet factories.

Compared with current extraction, ecological and technical studies show that an additional approximate 30 TWh of biomass new growth can be used for energy purposes on a national basis. Resources such as livestock fertilizer may be available from agriculture for biogas production, and possibly also areas that can grow straw and energy crops. As regards bioenergy from agriculture, the municipality's own agriculture manager may have some overviews that can be supplemented by representatives of the industry. Refuse collection companies have an overview of waste used for energy recovery, as well as landfill gas. The municipality's resource base for bioenergy can be calculated using energy content values for the various types of biomass, see Appendix [3].

Solar energy

In Norway, solar energy is primarily of interest for heating. This can take place in several different ways, from exploiting passive solar radiation when designing new buildings and their placement on building lots, to installing solar collectors that convert solar energy into domestic hot water or water-based heating to heat rooms. If dimensioned correctly, solar energy can provide 30-40 per cent of the total heat requirement (including hot water) in a residence [9]. The sunniest parts of the world receive solar radiation equivalent to 2500 kWh/year per m2. The annual solar radiation in Norway varies from approx. 700 kWh/m2/year in the north to 1100 kWh/m2/year in the south. There are also significant variations throughout the course of the year. A sunny June day in Southern Norway can yield about 8.5 kWh/m2, while an overcast winter day can yield as little as 0.02 kWh/m2 [1]. Even if the radiation is a known quantity, it can be difficult to determine the exploitation potential. The energy requirement for domestic hot water in the summer months can be used as a rough estimate. As the annual requirement for an average family is approximately 4000 kWh, about half of this can be provided by solar collectors in the existing dwellings. With new construction of dwellings, however, there are greater opportunities to integrate solar collectors in a way that can cover up to about 40 per cent of the total heat requirement with reasonable profitability, based on today's energy prices.

In addition come the possibilities of building larger facilities that could be connected to local or district heating plants. It is difficult to estimate this potential, and in the current situation, this should not be included in the resource overview.

Heat pumps

Most municipalities have one or more heat sources available that allow the use of heat pumps. In this context we are primarily thinking of central solutions with distribution of heat to multiple end users. Small units in individual dwellings are considered to be end user measures, and will not be discussed further here. When designing central heat pump solutions, it is an advantage to have a nearby, temperature-stabile heat source in order to achieve maximum efficiency.

Examples of such sources include:

- Background heating with boreholes
- Sea/lake/river water
- Waste heat
- Sewers

The Norwegian Geological Survey (NGU) is working on an overview of the potential for background heating, and they can assist with information about the possibilities that exist in the respective municipalities. More information can be found on the NGU's website [5]. If the plan includes using lake or river water, it is important to make sure that the source does not freeze solid during winter. This may be a challenge in some municipalities.

With regard to waste heat, it is primarily low-grade waste heat that is a potential heat source for heat pumps. High-grade waste heat in the form of steam or flue gas can be used directly for heating. Waste heat can, as such, be considered to be a separate energy resource and, where this is applicable, it is listed separately in the overview.

Fossil gas and petroleum products
Some municipalities in Norway host landing sites for oil and gas, and/or terminals for LNG (liquefied natural gas). Positive climate effects will result in those cases where use of fossil gas is substituted for the use of oil or coal. This use is often limited by the lack of an infrastructure for gas.

Templates for tables can be found in Appendix [2].

General information: References to the websites of authorities/institutions/organisations that know more about the individual solutions can be found in Appendix 1 References, as well as on Enova's website.

4.1.6 Energy conversion: generation and distribution

In this connection, energy generation means the percentage of the resource potential that is extracted and utilised/sold in the market.

The overviews should contain:

- Power generation from water, wind and biomass
- Bioenergy in the form of wood (also self-cut), wood chips, pellets, etc.
- District heating generation from various energy carriers (also larger heat pump facilities)

All generation and distribution of energy should be clearly and thoroughly mapped. Generation can be sorted according to the same categories as the resource survey; that is, small and large-scale hydro power, wind power, bioenergy, solar energy and heat pumps. Biomass can be used to generate both heat and electricity, however, when producing electricity, heat and electricity will normally be generated simultaneously in order to better exploit the energy in the biomass (cogeneration). Processes are also being developed for production of biofuel from biomass, but some technological development remains before so-called second generation biofuel can be produced economically. Nevertheless, smaller quantities of biofuel can be produced from sources such as fish waste, offal, fat used for deep frying, as well as other types of fat.

With regard to distribution, electricity and district heating are the primary topics, as well as gas in certain locations. It is important to take account of future challenges associated with the distribution network, such as any bottlenecks and planned revisions. Information about this can be found in the local energy studies. Transporting fuel oil, fuel, wood, chips, pellets and combustible waste fractions can also be categorised as energy distribution. This often takes place in bulk lots on roads and railways, and is then not normally included as part of the fixed infrastructure in the energy system. However, such transport must be included in the assessment of the overall energy system in the municipality, as it both entails costs, requires energy, burdens the road and rail network and often entails greenhouse gas emissions.

Normally, few calculations are required for documentation of generation and distribution. Most of this information is available from the energy producers and the power grid companies. This applies particularly to electricity, district heating and gas.

It is important that the municipality has insight into and knowledge about the topics discussed here, but it is as facilitator and instigator vis-à-vis other stakeholders that the municipality can most efficiently achieve results. This applies throughout the entire value chain - from enhancing exploitation of local energy sources to increased flexibility on the user side. However, many municipalities have ownership interests in the local energy company, and can thereby exert influence

on the development of the energy system. The municipality is, not least, a significant building owner and purchaser of goods and services, and can therefore set a good example for other stakeholders.

Templates for tables can be found in Appendix [2].

4.1.7 The energy system

An energy balance sheet should be set up for the municipality, with graphical presentations of the energy system. This is a way of gathering much of the plan's technical content into just a few figures, which are handy to have for use in conclusions and summaries. A so-called energy flow chart (Sankey diagram) provides a good picture of the energy flow within the municipality, as well as across municipal borders. Mapping the generation, distribution and consumption of energy largely provides the necessary data basis for preparing such a diagram.

The diagram can be designed in many different ways, and with as much detail as desired. Special software tools have been developed for this purpose, but it can also be made using more common drawing programs such as Visio or Adobe Illustrator. However, in the interest of saving time, special tools are recommended. Many such programs are available on the Internet, such as Sdraw and eSankey.

The diagram in Figure 3 is fairly simple, showing only generation and consumption divided among hydro power, bioenergy and fossil fuels for stationary and mobile purposes. Efficiency rates and distribution loss are not included. The energy supply is divided between imported and local resources to highlight the degree to which the municipality is self-sufficient in terms of energy

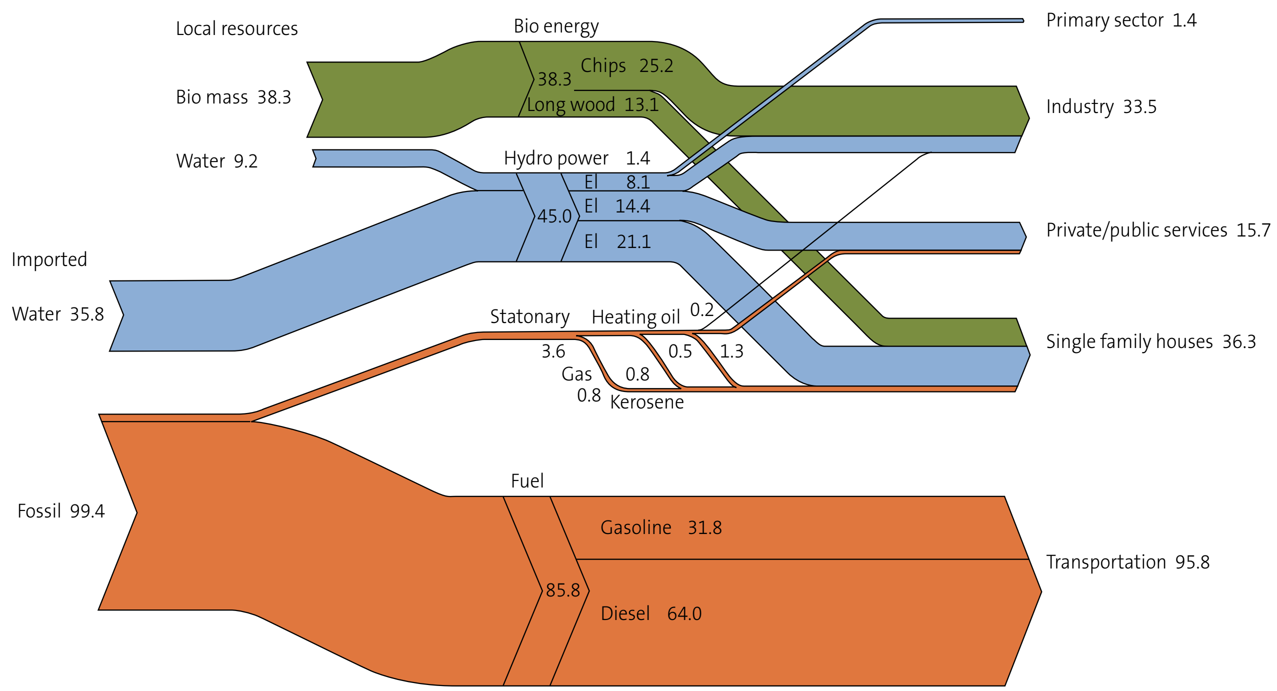


Figure 3: Example of an energy flow diagram, obtained from the energy and climate plan for Stor-Elvdal municipality (GWh). Sankey diagram.

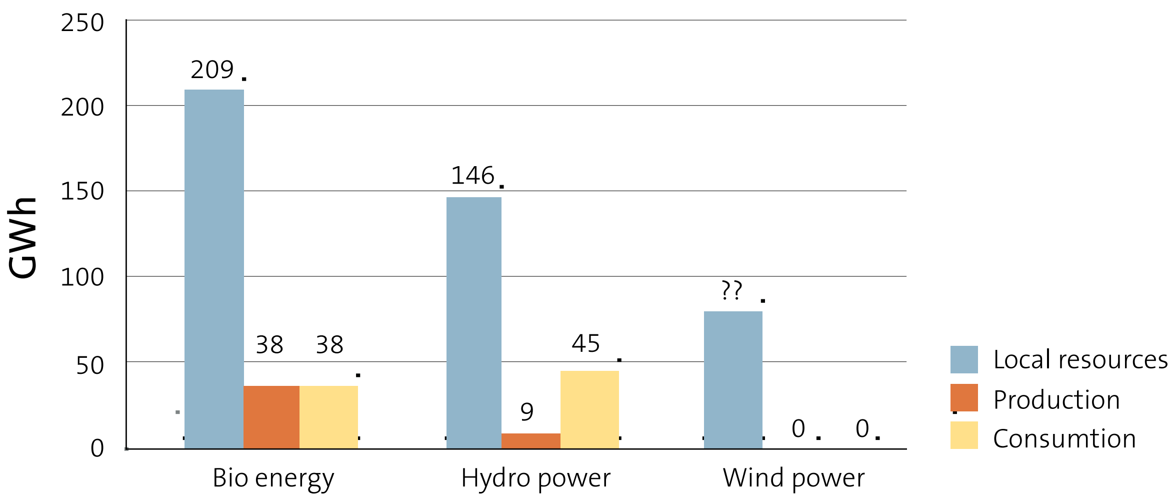


Figure 4: Energy flow in Stor-Elvdal municipality

4.1.8 Assessment of local environmental factors

In addition to having a positive impact on the climate, measures that reduce use of coal and oil will often also reduce other emissions that can harm the environment and have adverse local health effects. It is also obvious that measures that reduce the need for transport and conversion to more environmentally friendly means of transportation can have a similar positive effect.

Nevertheless, there are also potential conflicts between greenhouse gas reduction targets, energy restructuring, increased generation of renewable energy and local environmental considerations. Development of windmill parks and small hydro power plants can often entail conflicts of variable intensity as regards preservation of natural resources. Conversion from oil to biomass in heating plants can lead to more road transport and increased emission of nitrous gases. Large-scale production of biomass can also lead to a loss of biodiversity. An evaluation of such potential local conflicts is important, with reference to any previous evaluations made by the municipality or regional authorities. This can lay the foundation for the ongoing process of choosing and prioritising measures and projects. The NVE can provide information and examples from all projects for which licences have been sought.

4.1.9 Future development, projections and scenario development

Municipal development

The municipality's own long-term plan shall, of course, be used as a basis when describing the expected activity in the coming 10-20 year period. Expected residential construction and development plans in industry and business are determining factors for how both the population and energy consumption will develop. This survey provides important signals about the types of challenges the municipality will face. Some municipalities expect strong growth, which would indicate increasing demand for energy. Other municipalities experience the departure of companies and the jobs that go away with them. In such cases, it may be a good idea to reverse the issue and use energy generation and local resources to create jobs. In any event, it is important that politicians and the administration reach agreement on which forecasts to use in the continued work on the plan. This will also lay the foundation for developing demand. Ideally, the municipality should prepare several forecasts/development paths, such as a reference path, an optimistic path and a more moderate path. This may be perceived as being overly complex. As a starting point, a municipality with relatively stabile prospects can make do with a reference path, thus making it possible to estimate the effects of measures. However, the municipality should address and comment on any special external factors that could entail major deviations from the reference path - as well as consider whether and how the measures must be adjusted. These special factors could be (1) higher or lower than expected population growth, (2) greater or less than expected growth in business and industry - particularly major establishments or shut downs, and whether they are considered to be conceivable, and (3) major changes in energy prices.

SSB's population forecasts for average national growth (MMMM) provide a good basis for the projections. In many cases, the local energy studies also contain estimates for expected development in consumption per citizen.

Historical data for energy consumption on a national basis shows that energy consumption per citizen within the household sector has stagnated, remaining relatively stabile since the mid-1990s. This can also be used as an assumption at the municipal level, unless there are known local variations. Energy consumption in the agricultural sector depends in part on changes in operating patterns. Conversion to more ecological operations will, among other things, lead to more mechanical preparation of the soil and increased fuel consumption. The development in the transport sector will normally follow population growth and consumption per citizen. Energy consumption for passenger transport is somewhat connected to both of these, while energy consumption for freight transport is, on the other hand, controlled more by the development in business and industry and, in many municipalities, by the development for just a few transport-intensive companies. With regard to the industrial and service sectors, major shutdowns/development plans should be taken into account as they can lead to changes in energy consumption that do not necessarily follow population trends.

Another recommendation is to prepare projections for the price development of the various energy carriers. The previously mentioned indicators will give some idea of the size of future demand, while the price development will largely determine how much the individual energy carriers will cover, that is, the energy mix. The price of oil is linked to a global market, the price of electricity is linked to a Scandinavian/European market, while national, regional and local differences in biofuel prices are much greater. The authorities can also regulate the price level of the various energy carriers through taxes, thus making it very difficult to forecast price development; nor is it expedient for the municipalities themselves to make such predictions. Good advice can be sought from Enova or NVE, but for the municipalities' own projections it may be equally appropriate to apply the current price scenario for the years to come.

If this is viewed in context with other indicators, such as historical development in consumption, population trend forecasts and expected development in consumption per citizen, projections can be prepared to give an indication of energy consumption in the municipality in the upcoming 10-20 year period. Together, these projections will make up an important part of the necessary input data, if the municipality wishes to use software tools for scenario development.

Scenario development

As previously mentioned, preparing at least three different scenarios is recommended to ascertain how energy demand in the municipality can change, and the consequences this will have on emission of greenhouse gases.

Examples of scenarios:

- Reference scenario: Based on the development the municipality has experienced in recent years, taking into account the consequences of decisions already made (BAU - business as usual).
- Optimistic scenario: Based on what one hopes will occur in terms of a positive development in the municipality, as well as regards technology and environmental and climate requirements.
- Moderate scenario: Based on a more realistic development, both as regards the municipality, technological change and environmental and climate requirements.

The problem often becomes complex when attempting to coordinate all of the above-mentioned possible changes. Using modelling tools in the work on projecting the energy mix could simplify this important part of a municipal energy and climate plan. Availing themselves of such tools, municipalities can compile and systematise all of the collected data in an expedient manner. The results from modelling or simulations will clarify the municipality's development potential and the options it has. There is some software available for this purpose; and which is the right software depends on the size of the municipality and the challenges it faces. More information about available modelling tools can be found in Appendix [9].

Results, summary and discussion
The results of the work on these scenarios will provide the municipality with good indications of how the energy system and the demand for various energy carriers could develop, given a number of assumptions.

Not least, it will provide good indications of what actions are needed in order to reduce emissions of greenhouse gases. The results will outline the municipality's options for further management/administration of the energy system and related emissions of greenhouse gases. The results should be discussed and viewed in context with the surveys that have been done of energy consumption, energy generation and energy resources, as well as forecasts for future trends in the municipality. The results can provide a good basis for subsequent assessments of relevant measures and projects for priority implementation by the municipality. This is an excellent way of quality-assuring the choices and prioritisations that must be made in order to achieve the goals set for energy restructuring and emissions of greenhouse gases. This is described in more detail in Part 2.

4.2 Part 2 - Planning and implementing measures

Based on the analysis of potential future scenarios, an overview should now be prepared covering the measures that should/must be implemented in order for the municipality to achieve its energy and climate goals. Together, the measures and the action plan comprise the most important part of the energy and climate plan.

4.2.1 Summary of measures, with prioritisations and reasons

In this section there should be a summary and explanation of the concrete measures recommended for implementation or further study.

4.2.2 Goals, measures and activities

At this point in the process, there are probably various brief descriptions of potential measures that should be initiated over the short and longer term. However, concrete action plans are needed, all the way down to the activity level, in order to be able to practically convert the plans into actions. The measures part of the energy and climate plan includes a list of concrete measures linked to several secondary goals. These measures can then be further broken down to the activities level. The intention is to have concrete issues to work on. As the tasks are completed, they can be crossed off the list, and new tasks can be added.

Clear secondary goals should be established for both energy efficiency, energy conversion and energy generation. All municipalities can increase the efficiency of their energy consumption, and this should therefore be a central goal in the energy and climate plan. Many municipalities can also convert energy consumption or develop new energy generation.

Primary goal:
The primary goal of the measures section is to concretise the more overarching objectives set forth in the long-term municipal plan, and this goal will be subject to ongoing adjustment as the energy and climate plan is developed. In the 2007 energy and climate plan for Trysil municipality, the primary goal focuses on energy and is worded as follows:

- Through concrete measures and activities, Trysil municipality shall, in cooperation with local market actors, contribute to better energy efficiency and increased use of local bioenergy resources. This devel opment is expected to provide a substantial contribution to local value creation and employment.
- In the time up to 2025, all stationary energy con sumption is to become CO2-neutral in that more than 50 per cent of the energy consumed for heating shall transfer to district heating, nearly 20 per cent shall be covered by locally produced wood pellets (primarily in new buildings), and the rest shall be covered by earth/water heat pumps, traditional wood heating and electric heaters (primarily in older buildings). In addition, a transition to biofuel in the transport sector is desired.
- Key figures from Finland (NTA 2004, Paananen, December 2006) indicate that one new job can be expected for each 400-600 MWh of new locally pro duced bioenergy. With nearly 70 GWh of new bioenergy up to 2024, this indicates something in the range of 115-175 new jobs in Trysil.

The primary goal of the 2007 energy and climate plan for the municipality of Stavanger focuses on greenhouse gases and is worded as follows:

Increasing energy efficiency
- In 2010, the stationary energy consumption shall be at the same level as in 2000, and emissions of greenhouse gases shall be 30 per cent lower in 2010 than in 2000.

Energy conversion and energy generation:
- Use of fuel oil and kerosene for heating and hot water shall be discontinued by 2010.
- Facilitation of development and use of energy sources which are alternatives to electricity for heating and hot water.

Greenhouse gas emissions/environmental targets:
- Emissions of greenhouse gases from landfills to be reduced to 50,000 tonnes of CO2 equivalents in 2010.
- Percentage of passenger transport attributable to automobiles to be reduced from 68 per cent in 1998 to 60 per cent in 2010.
- Collective transport percentage to be increased from 8 per cent in 1998 to 10 per cent in 2010.
- Bicycle percentage to be increased from 6 per cent in 1998 to 10 per cent in 2010.
- Walking percentage to be increased from 17 per cent in 1998 to 19 per cent in 2010.
- Environmentally-friendly vehicles to be increased from about 40 today to 5 per cent of the vehicle fleet by 2010.
- The regional boat transport to/from Stavanger to convert to environmentally friendly fuels.
- Agriculture and construction sectors to convert to environmentally friendly machinery.
- Reduce air travel.
- Stimulate/set requirements for development of more environmentally friendly aircraft.
- Reduce total consumption and increase recycling.
- Raise awareness in households, the public and private sectors regarding resource efficient and environmen tally friendly goods and purchasing.
- Residual waste from households to landfills to be reduced from about 50 per cent in 2001 to 0 per cent in 2010.
- Increased recycling and recovery of household, con struction and demolition waste and waste from business and trade.
- Increased use of environmentally friendly and locally-produced construction material.
- Increased use of locally-produced food products.
- Increased use of organically produced food products.
- Contribute measures and competence that can stimulate development and better living conditions in twin towns, but ensuring that this takes place within their ecological sector

The primary goal for all municipalities should include a realistic target for reducing greenhouse gas emissions through e.g. energy efficiency, conversion from oil and fossil gas to renewable energy sources, reduction of methane emissions from landfills, agriculture, etc.

Ensuring local support for the energy and climate plan work in the municipality
There will be many different potential models for how the municipality should organise the work to achieve such general objectives, but some type of topical program division should be considered. The municipality should place itself in a central and paramount position, and establish specialised topical programs that are run to a lesser or greater extent by relevant, preferably private, stakeholders. For example, a specialised topical program for "energy supply with district heating" should be operated by a district heating company.

Many municipalities already have a well-established structure for setting up and implementing such processes. This can obviously also be used in the work to prepare goals, measures and an action plan for energy and climate.

The figure below shows an example of such a topical program division. The spreadsheet used to prepare the overview can be found in Appendix (5). The appendix developed in the EU-financed project 3-NITY, "A 3-fold approach to sustainable energy planning at local level", also contains linked spreadsheets for detailing groups of primary measures and activities/measures. Examples of these can also be found in the appendix.

It must be emphasised that this is only an example. It will also be relevant for many municipalities to have a topical program within agriculture. For example, in municipalities where there are large companies that have process emissions, consideration should also be given to establishing a special program for these emissions. One of the great advantages of establishing such a program structure is that it will make it easier to establish operative secondary goals that support the primary goal for each topical program, while at the same time the secondary goals give direct guidance on measures and activities under each topical program.

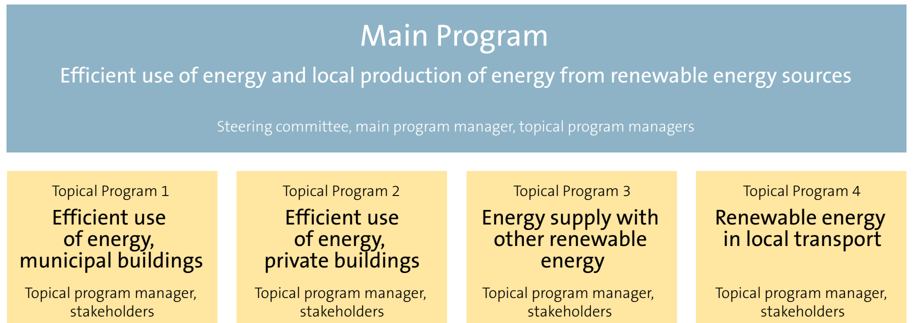


Figure 5: Example of program division

Examples of secondary goals:

Secondary Goal 1
Business development, enhancing expertise and communication
Business development, enhancing expertise and communication in connection with efficient energy consumption and generation of renewable energy in the municipality - the municipality is to play an active role in building up a competitive business community based on alternative forms of energy.

Secondary Goal 2
Efficient energy consumption - municipal buildings
Through goal-oriented energy conservation measures, the overall energy efficiency of municipal buildings shall be improved by XX per cent by 2012.

Secondary Goal 3
Efficient energy consumption - private buildings
Private commercial buildings and homeowners/housing cooperatives shall, through goal-oriented information and assistance in energy conservation measures, improve their energy efficiency by XX per cent up to 2015.

Secondary Goal 4
Energy supply using district heating, local heating (mini-grids) and other renewable energy
Energy supply using district heating, mini-grids and other renewable energy shall be given priority. Oil heating shall be phased out. All new buildings and existing buildings that can be modified to use local, renewable energy sources for heating/cooling shall use such systems.

Secondary Goal 5
Renewable energy in local transport solutions
Renewable energy shall be assigned priority in the local transportation infrastructure. All municipality vehicles shall use biofuels and electricity by 2010.

4.2.3 General tips and aids to concretise measures

Improving energy efficiency - municipal buildings
A package of measures should include the following as regards improving energy efficiency:

- Project follow-up and administration, which means continuous project follow-up and administration, both local and overall, including project management, reporting, financial management and project accounting
- Mapping the status of energy efficiency measures and actual figures for participating buildings

Develop best practice for energy consumption by:

- Further develop central requirement specifications for technical facilities and purchasing agreements that ensure efficient energy consumption
- Make sure that efficient energy consumption receives full consideration in the development of the respective buildings
- Preparations for implementing measures
- Focus on energy efficiency/operations analyses of buildings and technical facilities; reveal and implement measures (the main activity - 80 per cent of the funds)
- Introduce energy management and establish a system for energy follow-up (EOS) in the municipality (storage and administration) and participating buildings
- Consider establishing staff on-call systems for continuous monitoring of technical facilities. This should be implemented in cooperation with the caretakers'/watchmen's organisation
- Implement measures to enhance competence and establish forums and networks for exchange of experience within the municipality
- Establish contact with NKT (Norwegian Association of Municipal Engineers)/FOBE (Forum for Buildings and Property in the Municipalities)
- Implement training and competence-enhancing measures for those who can influence the operations (such as procedures in shops and for service personnel)
- Carry out investments in equipment and measures/solutions that ensure consideration for energy efficiency in new buildings, renovations and remodelling projects
- Carry out investments in minor energy efficiency measures that contribute to increasing the potential for improved energy efficiency, breaking down energy conservation barriers, pilot measures, etc. where documentation of energy results is a central part of the measure
- Carry out internal and external information activities. Ensure good press and media coverage locally and nationally, as well as internally through the municipality's own information channels

Some activities will be prioritised at an early stage of the project. This applies particularly to the following activities:

- In cooperation with Enova, develop a common standard for reporting energy reduction and setting normative figures for individual projects
- Revise standard requirement specifications for technical facilities and solutions in shops. This should be done early on in the project, so that the standards are set as early as possible for selecting energy efficient solutions in the planned investments. If this is not prioritised, the selection of less energy efficient solutions will work against achievement of the project's goals during the rest of the project period
- Introduce energy management

Work list to get started:

- Designate an energy manager in the municipality
- Make sure that there are fresh, complete floor space figures for the buildings
- Install electronic metres so that all energy is measured and data can be processed electronically
- Prepare an overview of the buildings' specific energy needs and compare with normative figures from Enova
- Calculate total energy conservation potential
- Prepare a concrete measures plan/action plan which prioritises the work in the buildings
- Prepare a total budget and target for the energy efficiency work
- Apply to Enova for support/assistance

Reduction of greenhouse gas emissions
Measures aimed at reducing greenhouse gas emissions may have two different main focal points, or a combination thereof:

- Reduce the scope of the activity/consumption, such as the amount of fuel oil, petrol and/or the number of kilometres driven, amount of nitrogen used for fertilizer
- Make the activity more efficient/less polluting, lower the activity's emission factor. For example, the amount of fuel oil can be reduced through improving energy efficiency, or by replacing fuel oil with energy carriers that yield lower/no emissions of greenhouse gases, such as biomass. The emissions from road transport can be cut by reducing the need for transport, by changing to vehicles that use less energy, and by replacing fossil fuels with biofuels or electricity.

Many measures aimed at reducing greenhouse gases often have additional effects that improve usefulness and thus cost-effectiveness. Examples of this include less local air pollution, less run-off of nutrient salts and soil to water (agriculture), less noise and fewer accidents and/or lost time.

Some municipalities such as Årdal and Sunndal have significant emissions from an industrial company that dominates the municipality's emissions through sheer volume, and that is not covered by the municipality's policy instruments. As previously mentioned, both energy consumption by and emissions from such companies should be listed in separate tables so that the municipality also has the possibility to compare itself with other municipalities that do not have this type of industry.
It is just as meaningful to implement minor emission reductions here as in a municipality without industrial emissions, even though it may seem insignificant in relation to the industrial company's total emissions. Finally, the emissions of greenhouse gases are summarised, both nationally and locally.

Indirect emissions - materials, construction and operations
It is easy to forget to include the indirect emissions when introducing alternative technology.

Wind power is not 100% emission-free if one includes the emissions associated with changes in area usage, construction and operation, surface roads and manufacture of the turbine components. These hidden emissions can be identified using so-called life-cycle analyses. Other examples of technologies that have such hidden emissions are hydro power, nuclear power and gas power. These emissions occur in other sectors/other municipalities, or even other countries, from the transport, building and construction activity, manufacture of steel and concrete, or in the waste management sector. Databases do exist - such as the Swiss Ecoinvent - which provide energy consumption and emission figures for the lifetime of most energy technologies. Most of these databases are not free. In a local energy and climate plan, such considerations will often be overly complicated and difficult to concretise. However, municipalities should attempt to take this into consideration in connection with major developments and measures.

Complex measures

The total effect of some measures may be difficult to calculate. In densely populated areas it is easy to think just about the reduction effects associated with the possibility of introducing district heating or local heating (mini-grid) systems, and improved public transportation.

A low emission intensive development can have positive effects including:

- Lower emissions from facilities and operation of infra structure due to shorter road networks, water and sewage facilities, street and road lighting and the electricity grid
- Efficient transport solutions such as:
- Shorter transport distances
- Greater ability to meet transport needs through public transportation, biking and walking, which also decreases the need for transporting people who can not drive themselves
- Better options for district and local heating
- Choosing materials with low emission intensity for infrastructure
- Buildings with low energy needs

Experience indicates that the difference in emissions from a municipality that has a commitment to more low emission intensive development increases over the years, compared with a reference path of normal development. The reason for this could be that low emission intensive development influences the citizens' attitudes towards lower emission behaviour.

The effect of different development alternatives can be calculated using Statsbygg's greenhouse gas accounting. More information about climate measures and greenhouse gas emissions can be found in Appendix (6).

Information sources that can be used to calculate greenhouse gas emissions

Two programs are discussed in Appendix 9, REAM and E-transport, that can be used to identify cost-optimal solutions for the energy system and the resulting emissions of greenhouse gases. These programs do not deal with the transport sector, nor with emissions from processes in agriculture, waste management and industry. Other information sources should be used for these sectors.

- SFT's analyses of measures for greenhouse gas reductions (link can be found on www.SFT.no under "green house gases"), most recently from June 2007. There is a long list of measures here, including effect, costs, cost-effectiveness and potential obstacles. These are based on a general, national level, and cannot auto matically be applied on a municipality level. The report contains calculation methodology and references that may be useful.
- SFT's website for local climate work, including a climate measures page outlining good examples of various types of climate measures that the municipality and other local stakeholders can implement. The page is continuously updated with information such as experience gained from municipalities and contact addresses, telephone numbers and e-mail addresses. Therefore, it is important that you contact SFT if your municipality has experience with a particular measure.

The website also contains links to useful foreign websites, such as the Swedish climate municipalities.

The software found on Statsbygg's website is recommended for calculating emissions from new development projects and the difference between various development alternatives:

- **Statsbygg's emission accounting for development projects, www.klimagassregnskap.no**

This is a concept developed by Statsbygg to plan development projects with low emissions. The concept integrates emissions from the materials used and the traffic generated.

The model, Version 1.0, covers emissions from:

1. Use of materials
2. Building and construction
3. Energy consumption to operate the building
4. Transport to/from the building

- Systematic approach to analysing complex premises and conditions
- Easy to use - comprehensive
- Provides knowledge about emission contributions - what weighs heaviest?
- Shows the emission benefits of changing solutions
- Modules 1-4 can be used separately

Statsbygg must be contacted to obtain access to the model (2007).

4.2.4 Suggested specific details for some typical activities

It is easiest to get end users to implement measures with good profitability, many of which will revolve around improving energy efficiency in some form or another. Rebuilding oil-fired facilities to use pellets or heat pumps can, in many cases, also result in good profitability. A key challenge for Norway is to rebuild residences and commercial buildings from direct electric heating to more flexible solutions using e.g. internal water-based distribution systems. This often entails considerable costs and, as an individual measure with today's energy prices, will not be profitable.

A simpler and quite popular solution for residences today is installation of air to air heat pumps or pellet stoves. This only provides heating to parts of the residence, but with an open floor plan it could provide significant reductions in electricity consumption. As shown in the proposed goals, secondary goals and programs, it is important to focus on the possibilities for improving energy efficiency. The cheapest and most environmentally friendly kilowatt-hour is the one that need not be used. The possibilities for measures that lie in organisational change (energy management), in education, in consulting and advisory services (such as the fact that everyone can help change behaviour) and in the small and relatively cheap technical measures, will be the most profitable for all sectors and user groups in the municipality.

The plan should also focus on the broader process - i.e. the significance of establishing and maintaining a good dialogue both with the municipality's operations personnel and other staff, with business and industry and with the general public, as well as with other municipalities that can offer positive experience. Much of this deals with the possibility of realising organisational and behavioural savings potentials, but it also has an impact on the potential that lies in the technical and/or supply side.

Following are a few examples of how to get started on the work to concretise the recommendations. This work can either be integrated into the energy and climate plan, or the recommendations may be to conduct more detailed partial studies of certain interesting measures after the plan is adopted.

Two typical measures that should be relevant for many municipalities will be used as examples:

Phasing out oil-based heating plants
Energy-related value chain considerations

Mapping/conversion of all oil-based heating plants in the municipality

Currently, approximately X-X,000 tonnes of fuel oil are used for heating in the municipality. This is divided among the end users as follows:

Households	X GWh (approx. XX per cent)
Municipal buildings	X GWh (approx. XX per cent)
Service industry	XXX GWh (approx. XX per cent)
Industry	XX GWh (approx. XX per cent)
Total:	XXX GWh/year

In connection with plans for developing/expanding the district heating network based on renewable energy, much of the fuel oil consumption will be phased out. However, significant potentials will remain that either fall outside of the licence area for district heating, or that cannot be profitably connected to the district heating network. Realisation of this potential, particularly within the household and service sectors, will require an active commitment from many involved parties, both through the use of statutory authority, informational activities, competence building and possibly also financial support schemes from the central and local authorities.

To the extent that it has not already been done within the municipality, all local oil heating plants in the municipality should be mapped, in cooperation with the district heating company, the fire service and possibly other stakeholders.

This should include all sectors, including households. Very specifically, there should be a complete list of addresses and e-mail addresses/postal addresses for contact persons, as well as a digital map showing the respective heating plants.

After this, direct contact should be established with the relevant plant owners to clarify certain questions regarding the presumed standard of the facility, the installed capacity, remaining lifetime and, not least, potential interest on the part of the owner for switching to alternative energy sources. A web-based questionnaire could e.g. be used for this work (Questback or the like, as well as regular mail if there is no e-mail address available).

Positive feedback is automatically recorded by the questionnaire system (as well as manual registration of responses received via regular mail), and the owners are then invited to a public meeting to illuminate various issues linked to the conversion from fuel oil to renewable energy sources, based on technical, financial and practical considerations.

The further process will largely depend on the degree to which an adequate supplier network has been established at the local level. This will be a parallel challenge which it would be beneficial to resolve in cooperation with local business and industry.

The objective will be to stimulate as many as possible of the owners of oil-fired plants to switch to heating plants that can use renewable energy sources. In cooperation with the central authorities, the county, and local business and industry, the municipality should be able to take on the responsibility of initiating such a process. There is also a method that may be useful in some municipalities - specifically, that when enough homeowners have indicated their interest in replacing fuel oil with e.g. pellet heating, then the municipality will place the entire job, consisting of 20 or 50 residences, out on tender. This can result in a noticeably lower price than if all the homeowners ordered the jobs individually. The method: "the-municipality-unites-all-interested-parties-and-thus-achieves-volume-discount" approach has previously been used in places such as Denmark.

Energy-related value chain considerations

A so-called Multi-Category Value Chain Assessment can be made based on the energy and climate plan's measures and activities parts. This is essentially a survey and structuring of the potential value chains that exist, or that can be developed in a local community.

A model, or a methodology for this work has been developed through the EU-financed project "Establishing Local Value Chains for Renewable Heat" (ELVA), www.ieeprojects.net/elva. The objective of this survey is to describe some identified value chains in detail, as well as to link various value chains together where this could appear to have a mutual positive effect among the chains. For example, a hotel or other tourist activity that uses renewable energy for heating may create added value for the tourism industry by exploiting this to market the municipality as a "green destination".

Furthermore, the survey will highlight necessary short and long-term measures for optimising such value chains [10]. In a "Multi-Category Value Chain Assessment" for a municipality with substantial forestry resources and some tourism, the measures can be divided into three main categories for further analysis:

1. Product-based value chains (different types of wood products, fully and semi-finished products for the paper industry, the building industry and biomass for the energy industry)
2. Technology-based value chains (different technolo gies that can be used to convert biomass into energy, directly into electricity and/or heat, or via energy car riers such as pellets or biodiesel)
3. Service-based value chains (different types of service products such as local transport solutions, overnight accommodations and other tourist products (hunt ing/fishing, and other nature-based adventure products))

Under each of these three main categories, it will be possible to identify a number of more or less connected value chains that, in spite of the fact that they have different drivers, market structures and customers, all have forest resources as a common denominator.

On a trial basis, the ELVA project has identified and categorised a number of such value chains that can probably be found in a local community that has both forestry and tourism as important industries.
See also Table 1 in Appendix (4).

Different value chains may often be linked together. An activity in one value chain may have a substantial impact on activities, costs and value creation in other value chains.

The consequence of this must be that value chain considerations must be made in an expanded context, so that these connections between various types of value chains can be identified, analysed and operationalised. This is done by extrapolating backwards in the value chains and finding common denominators between value chains that are otherwise identical. One way of bringing these common denominators to light is shown in a separate table in Appendix (4).

Example of value chain - local heating services

According to consumption figures from the energy and climate plan, the current energy consumption in public and municipal buildings, as well as the household sector, is about xxx GWh/year. Of this, electricity consumption accounts for about xxx GWh/year. More than xx per cent of this consumption of electricity goes to heating purposes. Approximately x GWh/year of this consumption could be replaced in connection with a future development/expansion of district heating. Even with better facilitation for district heat hook-up in future development projects, this consumption can only be met through district heating to a limited degree. It must be a goal to cover parts of this potential by stimulating the household market and other relevant users in the municipality that lie outside the licence area for district heating, to convert/prepare for heating systems based on pellets. For example, x,000 tonnes of pellets could yield a conversion potential in this market of approx. xx-xx GWh/year.

The challenges that could impede the success of such a conversion are numerous, and will encompass both technology, competence, behaviour and, not least, economy. This will demand a totally new way of thinking, particularly in a start-up phase where an immature market must grow rapidly to reach critical mass. The customers must not be hampered with complicated solutions that they have no possibility of handling, and a possible solution could therefore be to offer complete heating services that include planning, installation and operation/service of the facilities, as well as delivery of pellets.

Sale/leasing of facilities and contracts for delivery of pellets

Market studies should be conducted in various market segments: small (individual homes/cottages), medium-sized (apartment complexes) and large facilities (schools, hotels, municipal buildings, etc.).

Framework agreements could be envisaged with relevant equipment suppliers for pellet boilers and stand-alone stoves, or with other suppliers of equipment and services.

- EnergyCabin modules could possibly also be used for temporary heat supply while waiting for the develop ment of district heating to reach new areas.

Competence for planning and installing facilities

A critical factor for establishing a successful concept for sale of heating services based on renewable energy is that the customer perceives the service to be comfortable, cost-effective and reliable.

Such local heating services will be a combination of technological solutions, logistics and service in connection with operation and maintenance of the facilities. Therefore, it is essential that the products and services offered are solidly anchored in competence within all of these areas, both in the planning phase and in the installation/implementation phase.

Therefore, it is likely that local firms that might want to offer such heating services must either possess or obtain access to expertise within the relevant technical discipline, beyond that which is needed to build up and operate an entrepreneurial company.

Service and maintenance

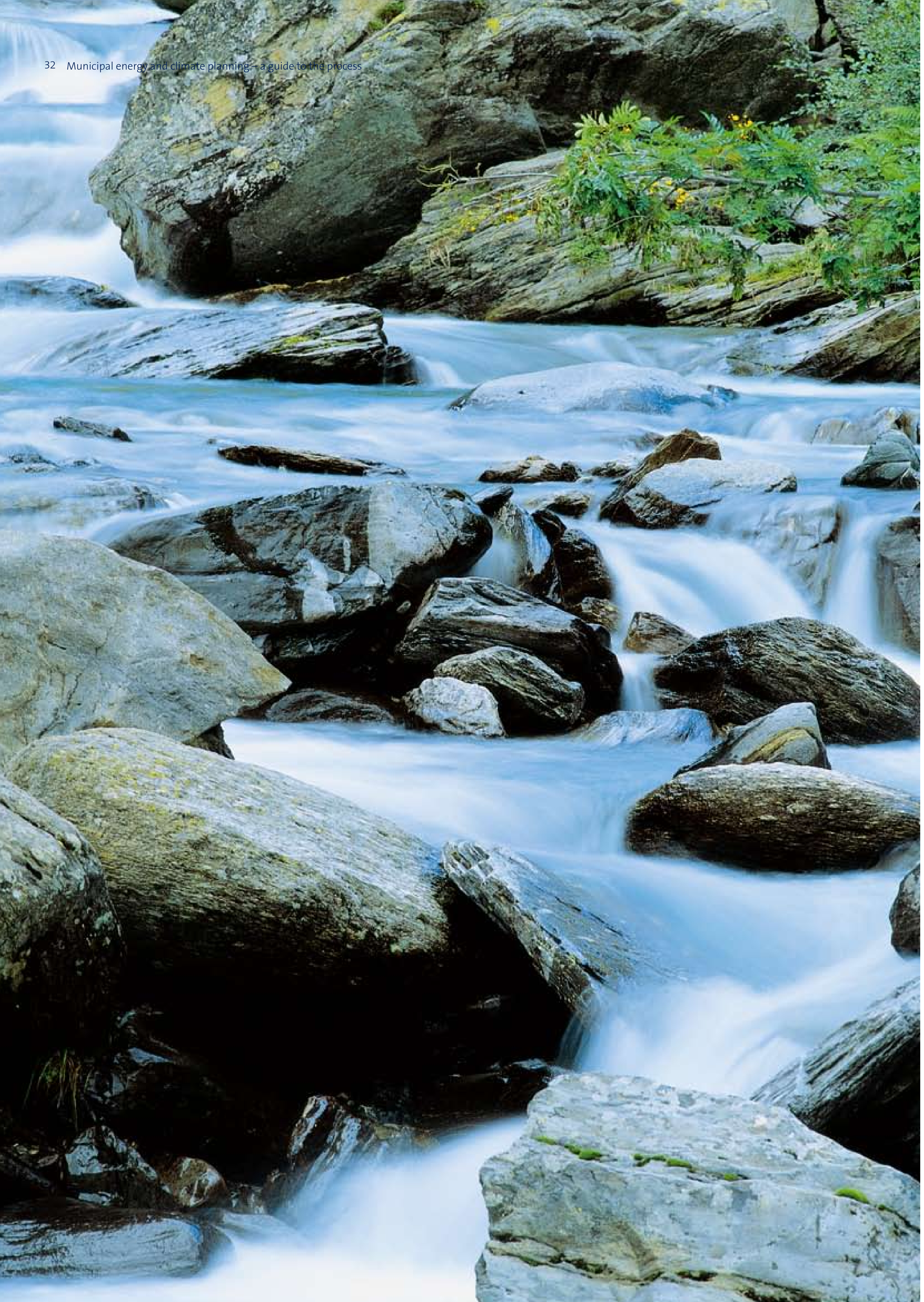
When developing new heating markets where new technology will compete against more established heating solutions, it is important to avoid service interruptions. Regular service and maintenance is a prerequisite here, and with a certain volume of local installations, this can also form the basis for a small, separate enterprise.

Some training of personnel will be needed in order to obtain the correct level of competence. Specific course packages can be established for such service personnel, for example in connection with one of the regional colleges.

The service spectrum that can be geared towards the household sector must increasingly accommodate the comfort requirements that are demanded of such services. Delivering sacks of wood to households is a simple, widely used service. More complex heating systems may give rise to a need for more advanced services such as contractual replenishment of pellets, regular service for direct-fired boilers, etc.

Information, sales follow-up, invoicing and quality assurance

In addition to offering flexible invoicing solutions, such



heating services should also provide continuous information about technical solutions, examples of successful, profitable installations, results from local user surveys and interviews with local role models. This will help the market mature, and gradually also make homeowners more aware of the advantages of pellet stoves and smaller local heating (mini-grid) systems.

Estimates, value chains

The table below represents rough estimated values for the employment effects that can be envisaged over time, if the above-mentioned value-chain is established and grows.

Local heating services" (estimated values)

Link in the value chain	Volume	Employment effect
Sales, contracts	Ongoing	1 person
Planning, installation	50-100 facilities	4-8 persons
Local partial deliveries and installation of Energy Cabin and/or comparable products	25 facilities	8-10 persons
Service, maintenance, logistics	50-100 facilities	2-4 persons
Information, invoicing, quality assurance and after-sales	Ongoing	1 person
Total		16-24 persons

4.3 Conclusion, specific short-term measures

The energy and climate plan is part of the process towards a more sustainable energy system in the municipality. After a policy process, the plan could gain the status of a municipal plan, and that is when the process moves from being a planning process to being a number of measures to be implemented.

It is at this very juncture that many energy and climate plans have run aground, and are likely to run aground in the future - when the plan is to be implemented! Here are a few simple rules to reduce the risk of the energy and climate plan bogging down before the work even really gets started:

1. Continue and possibly expand existing measures that have already yielded a good effect in the municipality.
2. Start with a few simple new measures that carry a substantial signal effect, and take the more complicated measures gradually.
3. Get the schools involved, e.g. through Enova's concept for children and young people, the Rainmakers.
4. Build on the input that has been received from local stakeholders in the planning work.
5. Establish close cooperation with Enova, preferably through concrete projects for which Enova can provide financial support.

Possible proposals for recommendations:

Recommendation 1:
A great many energy efficiency measures have already been implemented in the municipality's own buildings. This work should be continued, and an update of the energy efficiency potential in the municipal buildings should be made, with proposals for additional conservation measures. The continued work to improve energy efficiency should be coordinated with the previously identified, necessary maintenance work.

Recommendation 2:
The municipality should encourage all primary schools in the municipality to become "Rainmaker Schools". Enova can supply information material and teaching units free of charge. These have proven to be very popular.

Recommendation 3:
The municipal plan's energy chapter states that all oil-firing in the municipality shall be phased out. This is an ambitious, but realistic goal that follows up one of the measures regarding the national climate goals. A survey of all buildings in the municipality with oil-fired heating should be carried out. The municipality should actively contribute to all of these facilities being offered assistance to install alternative heating systems based on pellets or heat pumps.

Recommendation 4:
The idea of a regional cooperation with other municipalities in the region has been launched through the planning process. Such collaboration could be crystallised around comparable local energy and climate plans for the other municipalities, which can be elevated to the level of a regional energy and climate plan.

Recommendation 5:
Establish a routine for all relevant development projects to study how different alternatives affect energy consumption and emission of greenhouse gases.

5 How to proceed from plan to action

5.1 Organisation and continuous improvement

Energy and climate planning is not just about euros and dollars, but is equally focused on organisation, competence, ability to make decisions, timing and common sense.

The timing aspect is important. Small steps should be taken, one at a time, in order to maintain the necessary enthusiasm over a longer time period. This makes it possible to see the results, and then proceed. It is also important to adapt the prevailing strategy to the relevant national framework conditions at any given time.

Therefore, an energy and climate plan should contain a simple analysis of the municipality's activities (management, policy, resources, processes, internal and external organisation, as well as measurement of results). In this way it is possible to determine whether the municipality is able to convert the measures proposed in the energy and climate plan into practical action.

Such an evaluation should focus on specific factors linked to sustainable development, and at the same time result in a number of concrete proposals for improvements in the municipality's activities in this area, and the various roles the municipality has in the work to reduce energy consumption and emission of greenhouse gases. Elements of the CAF model (Common Assessment Framework) or the Excellence mindset can be used in this context.

At the very start of the work on the energy and climate plan, an initial self-assessment should be made of the municipality's "ability to follow through", based on the nine main criteria in the CAF/Excellence model. The evaluation can be done simply in the form of interviews with key persons in the municipality. A new and somewhat more extensive self-assessment should be made when the energy and climate plan begins to take form, and the accumulated results can then be presented in an updated version of the energy and climate plan before it is subjected to political consideration in the municipality. Examples of how to use the CAF/Excellence model are found in Appendix (10).

6 Appendices

6.1 Appendix 1 References

[0] Storting White Paper No. 34 - Norwegian Climate Policy
[1] NOU 1998: 11 Energy and the electric power balance towards 2020
[2] NVE's wind atlas for the Norwegian coast http://www.nve.no/vindatlas/
[3] NVE's small hydro power station atlas http://www.arcus.nve.no/website/potensial%5Fsmaakrv/viewer.htm
[4] NVE's topical page on energy resources http://www.nve.no/module/module_109/publisher_view_productasp?iEntityId=8904&noscript=
[5] NGU's and NVE's cooperation on mapping background heating http://www.ngu.no/prosjekter/Grunnvarme/Gv1-1.htm
[6] NVE's information pages on the Building Directive http://www.bygningsenergidirektivet.no/
[7] Guide No. 2, Energy in the municipalities, NVE 2000 http://www.nve.no/FileArchive/161/veil2-00.pdf
[8] SSB's Memo on the quality of energy figures at the municipality level (Memo 2004/40)
[9] Finden, Per (2005): Guide to local/regional energy planning
[10] ELVA WP3 report "Multi Category Value Chain Assessment", Mydske, 2006
[11] "Klimadata M21" is a software tool that contains a lot of data for buildings and technical facilities from 175 weather stations all over Norway. The program was issued in 2007. For more info, see http://www.klimadatam21.no/>
[12] Overview of municipalities (SSB - Statistics Norway)
[13] NVE's topical pages on local energy studies: www.nve.no/leu

6.2 Appendices - Tables

A set of standard tables has been prepared to assist in the presentation of the survey work. The tables can be downloaded from Enova's website, and it is recommended that these tables be used.

6.2.1 Energy consumption

A template for presentation of collected consumption data with forecast consumption up to 2025. It is important to include the possible realisation of the energy conservation potential in all sectors.

The table is to be completed for each of the eight consumer sectors: primary industry, industry, services, households, road traffic, aircraft, ships and other transport.

Energy consumption [GWh]	1991	1995	2000	2004	2005	2010	2015	2020	2025
Electricity									
Coal, coke, petroleum coke									
Wood, waste wood, waste liquor									
Gas									
Petrol, kerosene									
Diesel, gas, light fuel oil									
Heavy oil, waste oil									
Waste									
Total	0	0	0	0	0	0	0	0	0

Building information	Area in m2			Consumption 2002	Estimated consumption 2002		Normative figures	Potential savings		
Name of building	Gross-area	Netto-areal	Vaske-areal	Total kWh/yr	Degree-day corr. kWh/yr	Spesifikt kWh/m²/år	Spesific kWh/m2/yr	Spesific kWh/m2/yr	Total kWh/yr	Percent %
FLOSTA PRIMARY SCHOOL incl. pool	015.2	2877.6	2391.0	419 714	407 403	170.4	188	0.0	0	0.0 %
NESHEIM SCHOOL	2347.0	2003.7	1570.8	253 725	246 283	156.8	168	0.0	0	0.0 %
NESHEIM SCHOOL. SFO building	220.9	193.0	107.6	21 361	20 734	192.7	168	24.7	2 657	12.8 %
STOKKEN PRIMARY SCHOOL	3471.3	2883.9	2522.5	367 803	357 015	141.5	168	0.0	0	0.0 %
MOLAND LOWER SECONDARY SCHOOL w/ pool	068.4	4233.0	4107.0	367 803	367 803	208.7	188	20.7	84 863	9.9 %
MOLAND LOWER SECONDARY SCHOOL w/ pool	068.4			514 318	489 176					
FABAKKEN DAY-CARE	432.0	381.9	370.0	92 043	89 343	241.5	186	55.5	20 523	23 %
NEDENES DAY-CARE	276.0	226.0	216.2	59 668	57 918	267.9	186	81.9	17 705	30.6 %
PUSNES DAY-CARE	146.0	126.9	117.8	24 995	24 262	206.0	186	20.0	2 351	9.7 %
RYKENE DAY-CARE	476.0	332.9	308.3	69 120	67 093	217.6	186	31.6	9 749	14.5 %
FAGERHEIM DAY-CARE	765.6	753.9	678.5	284 782	276 429	407.4	186	221.4	150 228	54.3 %
HISØYHALLEN	1887.2	1590.0	1485.0	216 954	210 591	141.8	250	0.0	0	
NEDENESHALLEN	2818.7	2606.5	1887.0	369 947	359 096	190.3	250	0.0	0	
STUENESHALLEN	3118.7	2016.6	1814.4	310 653	301 541	166.2	250	0.0	0	
TROMØYHALLEN	1754.3	1582.6	1475.0	206 348	200 296	135.8	250	0.0	0	
BIRKENLUNDHALLEN	2431.4	2020.0	1830.0	376 280	365 243	199.6	250	0.0	0	
ARENDAL TOWN HALL	2386.0	1823.0	884.4	335 800	325 951	368.6	190	178.6	157 915	48.4 %

A suggested template for how to illustrate energy consumption and potential savings in the municipality's own buildings.
Source: Arendal Municipality.

6.2.2 Greenhouse gas emissions

A template for presenting greenhouse gas emissions related to energy consumption. Separate tables are prepared for stationary combustion and for mobile combustion. Reference is made to Appendix 3 for conversion of emission volumes of the various greenhouse gases into CO2 equivalents.

Mobile combustion	CO_2	CH_4	N_2O
Light vehicles: petrol			
Heavy vehicles: petrol			
Light vehicles: diesel etc.			
Heavy vehicles: diesel etc.			
Motorcycle, moped			
Domestic aviation			
Ships and boats			
Other			
Total	0	0	0

Stationary combustion	CO_2	CH_4	N_2O
Oil and gas production			
Industry and mining			
Other industries			
Private households			
Combustion of waste and landfill gas			
Total	0	0	0

Process emission	CO_2	CH_4	N_2O
Oil and gas production			
Industry and mining			
Agriculture			
Waste and landfill gas			
Other process emissions			
Total	0	0	0

6.2.3 Energy resources

Template for presentation of data from resource surveys. Maximum output is indicated only where relevant:

Energy resources	Max. output [MW]	Potential [GWh/yr]
Hydro power, small-scale		
Wind power, large-scale		
Wind power		
Bioenergy		
Solar energy		
Heat pumps		
Total	0	0

6.2.4 Energy generation

Template for presentation of data from the survey of energy generation. Maximum output is indicated only where relevant:

Energy resources	Max. output [MW]	Potential [GWh/yr]
Hydro power, small-scale		
Wind power, large-scale		
Wind power		
Bioenergy		
Solar energy		
Heat pumps		
Total	0	0

6.3 Appendix 3 Energy and climate facts

Conversion tables for energy

Some suggested tables showing energy content and conversion factors, obtained from ssb.no.

Energy carrier	Theoretical energy content	Density	efficiency		
			Industry and mining	Transport	Other consump-tion
Coal coke	28.5 GJ/tonne	..	0.80	0.10	0.60
Petroleum coke	35.0 GJ/tonne	..	0.80	-	0.60
Crude oil	42.3 GJ/tonne = 36.0 GJ/m3	0.85 tonne/m3	0.80	-	-
Refinery gas	48.6 GJ/tonne	..	..	..	..
Natural gas (2004)2	40.1 GJ/1000 Sm3	0.85 kg/Sm3	0.95	..	0.95
Liquid propane and butane (LPG)	46.1 GJ/tonne = 24.4 GJ/m3	0.53 tonne/m3	0.95	..	0.95
Fuel gas	50.0 GJ/tonne	..	0.95	..	0.95
Petrol	43.9 GJ/tonne = 32.5 GJ/m3	0.74 tonne/m3	..	..	..
Kerosene	43.1 GJ/tonne = 34.9 GJ/m3	0.81 tonne/m3	0.20	0.20	0.20
Diesel, gas and light fuel oil	43.1 GJ/tonne = 36.2 GJ/m3	0.84 tonne/m3	0.80	0.30	0.75
Heavy distillate	43.1 GJ/tonne = 37.9 GJ/m3	0.88 tonne/m3	0.80	0.30	0.80
Heavy oil	40.6 GJ/tonne = 39.8 GJ/m3	0.98 tonne/m3	0.80	0.30	0.70
Methane/	50.2 GJ/tonne	..	0.90	0.30	0.75
Landfill gas	16.8 GJ/tonne = 8.4 GJ/fast m3	0.5 tonne/fm3	..	..	..
Wood	16.25-18 GJ/tonne = 6.5-7.2 GJ/fm3	0.4 tonne/fm3	0.65	-	0.65
Waste wood (solids)	10.5 GJ/tonne	..	..	..	..
Waste	3.6 GJ/MWh	..	..		
Electricity	430-688 TJ/tonne	..	1.00	1	1
Uranium	430–688 TJ/tonn		..		

	PJ	TWh	Mtoe	Mbbls	MSm3 o.e. oil	MSm3 o.e. gas	quad
1 PJ	1	0.278	0.024	0.18	0.028	0.025	0.00095
1 TWh	3.6	1	0.085	0.64	0.100	0.090	0.0034
1 Mtoe	42.3	11.75	1	7.49	1.18	1.055	0.040
1 Mfat	5.65	1.57	0.13	1	0.16	0.141	0.0054
1 MSm3 o.e.oil	36.0	10.0	0.9	6.4	1	0.90	0.034
1 MSm3 o.e. gas	40.1	11.1	0.9	7.1	1.12	1	0.038
quad	1053	292.5	24.9	186.4	29.29	26.33	1

[1] The theoretical energy content can vary for the respective energy commodities; therefore, the values are average values.

[2] Sm^3 = standard cubic metre (15 °C and 1 atmosphere pressure).

1 Mtoe = 1 million tonnes (crude) oil equivalents
1 Mbbls = 1 million barrels of crude oil (1 bbl = 0.159 m3)
1 MSm3 o.e. oil = 1 million Sm3 oil
1 MSm3 o.e. gas = 1 billion Sm3 natural gas
1 quad = 1015 Btu (British thermal units)
1 joule (J) = 1 watt x 1 second

Source: http://www.ssb.no/magasinet/miljo/tabell.html

Bioenergy, forms and energy content

Table of energy content in various bioenergy carriers

Energy carrier	Specification	Energy content
Wood	Untreated	2.33 MWh/fm3
Waste wood	Plain waste wood Logging waste Sawdust Wood chips/pieces Industry chips,dry	4.51-5.00 MWh/tonne 1.25 MWh/fm 2.13 MWh/fm3 2.31 MWh/fm3 2.00 MWh/fm3
Manure	60% methane	5.91 kWh/m3
Household waste	Residual waste	2.92 MWh/tonne

Source: “Bioenergy - environment, technology and market”, Erik Eid Hohle (ed.) and ssb.no (in Norwegian)

Greenhouse gases, conversion to CO2 equivalents. From IPCC 4AR scientific basis, page 212: http:/www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf:

Table 2.14. *Lifetimes, radiative efficiencies and direct (except for CH_4) GWPs relative to CO_2. For ozone-depleting substances and their replacements, data are taken from IPCC/TEAP (2005) unless otherwise indicated.*

Industrial Designation or Common Name (years)	Chemical Formula	Lifetime (years)	Radiative Efficiency ($W\,m^{-2}\,ppb^{-1}$)	Global Warming Potential for Given Time Horizon			
				SAR‡ (100-yr)	20-yr	100-yr	500-yr
Carbon dioxide	CO_2	See below[a]	[b]1.4×10^{-5}	1	1	1	1
Methane[c]	CH_4	12[c]	3.7×10^{-4}	21	72	25	7.6
Nitrous oxide	N_2O	114	3.03×10^{-3}	310	289	298	153

Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz and R. Van Dorland, 2007: Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007:
The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

6.4 Appendix 4 Value chains

Value chain considerations according to Michael Porter, which contain the following primary elements:

- Inbound logistics
- Operations/production
- Outbound logistics
- Marketing and sales
- Service

in addition to secondary/support activities such as upgrading skills, organisational development, etc. An energy and climate plan that is, for example, based on forestry and forest-related activity as the primary resource for increased generation of renewable energy will have mapped a certain unused potential. Furthermore, the plan's list of measures will highlight a number of activities and obvious value chains that can be further developed, including the following:

- Pellet production and development of a local heating market for the use of pellets, e.g. in hotels, rental cottages and private buildings, including private households
- Transition to biofuel in the municipal fleet of vehicles

The examples outlined in the table focus on the first point, which can actually be broken down into three different value chains, i.e. pellet production, development of a local heating market to utilise pellets, as well as a value chain that specifically deals with energy consumption in tourist facilities. The purpose of this division is to highlight some points of contact between different value chains that may be located in very different sectors, but that can have an impact on each other to a greater or lesser degree.

For example, it can be envisaged that the tourism industry, represented by hotels, rental cottages and other tourist facilities, wants to strengthen its environmental image in the further development of a general destination program. Together with other environmental measures such as sustainable waste management, cleaning, purchasing routines and transport, it may have a separate intrinsic value to offer sustainable energy supply and consumption in tourist facilities. This is the natural first choice for facilities that lie inside the licence area for district heating, while facilities that lie outside the reach of the district heating plant could utilise stand-alone heating plants using pellets as a relevant alternative that would provide a very strong environmental image. If concrete plans are established for a certain minimum of such pellet plants in the municipality, this could form the basis for establishing a value chain consisting of a number of services linked to building, operating, servicing and maintaining such buildings. This in turn requires a safe and efficient supply of pellets, and locally produced pellets can give an even more attractive environmental image.

Product Based Value Chains

Level 1	Level 2	Level 3	Value Chain	Activity potential
	Building products	Sawn wood	Building modules	Local+export
			Export	Local+export
		Wallboard	Export	Local+export
		Parquets	Export	Local+export
		Sawdust	Wallboard	Local+export
	Energy products	Sawdust	Pelletizing	Local
			Briqueting	Local
			Direct use in district heating	Local
		Wood Chips	Direct use in district heating	Local
			Pyrolysis (Biodiesel)	Local+export
		Log wood	Export	Local+export
		Scrap wood	Direct use in district heating	Local+export
			Pyrolysis (Biodiesel)	Local+export
	Ecology & Tourism products	Natural environment	Hunting, fishing, skiing and other outdoor activities and recreation	Local+export

Technology Based Value Chains

Level 1	Level 2	Level 3	Value Chain	Activity potential
	Mini-grids, District Heating, Cogeneration	Renewable heat/power production	Boiler systems, installation	Import
			Fuel purchase and storage systems, local assembly and installation	Local+export
		Heat generation	Trenching, Piping,, welding,	Local+export
		Control systems	Systems for process optimisation, metering and sales accounts	Import
	Domestic Heating	Small-scale heating plants	Domestic boilers - local manufacturing, sales and installation	Import+local
			Storage and Feeding - local manufacturing, sales and installation	Local+export
			Control systems - sales and inst.	Import
		Domestic fuel logistics	Pellet sales and distribution	Local+export
			Log wood sales and distribution	Local
	Transport	Biodiesel production and logistics	Pyrolysis from wood chips, local production, sales and distribution	Local+export
			Pyrolysis from scrap wood, local production, sales and distribution	Local+export

Service/Communication Based Value Chains

Level 1	Level 2	Level 3	Value Chain	Activity potential
	Unorganised activities (year-round)	Outdoor-life	Hiking	Local+export
			Fishing/Hunting	Import
	Sustainable tourism (seasonal)	Accommod. and restaurants	Private cottages, chalets	Local+export
			Apartments, restaurants	Local+export
			Cottages for hire	Local+export
		Activities	Ski activities	Local+export
			Water park facilities	Local+export
		In/outbound transport	Buses and Coaches to/from airports	
			Other road transport	Local
		Local transport	Shuttle buses to/from ski facilities	Local+export
			Taxis	Local+export

Example from Trysil: mapping a Multi-Category Value Chain

6.5 Appendix 5 Goals and secondary goals

Example - An excerpt from the Skedsmo municipal plan - Energy consumption in buildings

1. Challenges and goals
Questions related to energy consumption and energy supply in Skedsmo have been dealt with in several reports in recent years: a climate and energy action plan (2001), a strategic energy plan for alternative energy (2003) and local energy studies in 2004 and 2004 developed by Hafslund as the area licensee. There are also several earlier plans primarily addressing district heating in Lillestrøm and Strømmen. The municipality has also worked actively on energy conservation measures in its own buildings and is now participating in an EU project with the goal of becoming a "Sustainable Energy Community".

All of these reports are based on the premise that energy and environment issues are two sides of the same coin. This is gradually also becoming more relevant in Norway, the domain of hydro power. We know that future development of power to meet the steadily increasing energy demand will, to a significant degree, have to be based on fossil fuel. We also know that the price of electricity will continue to increase substantially in the years to come. Consideration for the population's private economy/electric bills and environmental considerations, not least the need to reduce emissions of greenhouse gases, therefore indicates that the municipality should actively involve itself in controlling these developments in the best way possible, using the available means.

Briefly stated, this entails a municipal involvement aimed at two mail goals: **a solid reduction in the use of electricity for heating and, to a great extent, the elimination of oil-based heating systems in the municipality. Various energy conservation measures will also have a role in this picture.**

Through these plans, the municipality of Skedsmo will proceed towards implementing growth during the period covered by the plan, without increasing the overall environmental consequences associated with using energy.

2. Elements in the continued work
Achieving an objective such as the one outlined herein will require the determined efforts of an established energy group, developing plans to implement the various phases of the work in cooperation with the municipality's own technical departments, suppliers of systems and other relevant partners. The plans should, if possible, be drawn up in an understanding or cooperation with Enova and Innovation Norway. Other important partners can include developers, housing cooperatives, etc.

It is important that the energy group carries out planned information activities, which will naturally fall into two main target groups: the general public and developments/property owners/property managers. A successful result depends on informing these groups from the very first day about the municipality's plans and their purpose. The actual planning of the energy restructuring will in part be aimed at existing residences and commercial buildings, and in part at those engaged in building new structures, including both individual houses and developers of large residential areas or industrial buildings. As regards the existing buildings, the alternatives will include installing heat pumps in buildings with only electric heating systems, or heat pumps/biofuel in buildings with water-based heating. The latter category of buildings often obtains heat from an oil boiler. For existing buildings with oil stoves, installing heat pumps will be a reasonable replacement.

The municipality should require a study of the possibility of using alternative energy sources and systems for planned new buildings. In any event, it is important that the municipality can prevent the installation of electric heaters or oil-based heating systems in new buildings.

Otherwise, it is obvious that the municipality should employ the Planning and Building Act insofar as possible in order to achieve the desired development.

3. Strategies for goal achievement
1. Work to ensure that new buildings in the munici pality are built in an energy-efficient manner, and with energy consumption based on other renewable energy sources than hydro power, such as low-energy residences.
2. Contribute to expanding delivery of and connection to district heating.
3. Work to implement measures to improve energy effi ciency and promote transition to other renewable energy sources than hydro power in existing buildings.

When implementing these strategies the municipality will:
- Revise the municipality's Strategic Energy Plan at least every four years.
- Together with other players, make sure that the district heating grid in the municipality is expanded and introduce mandatory connection within the relevant areas.
- Seek to exploit the landfill gas at Bøler and Brånås for local energy supply.
- Evaluate requirements for energy solutions, such as the use of water-based hearing, in development agreements and land use plans.
- Consider measures to improve energy efficiency and use of water-based heating/ alternative energy sources in the municipality's own buildings.
- Work to promote energy efficiency measures and con version from oil to biofuel in existing private buildings.
- Follow up government requirements for energy efficiency measures in new buildings and promote the use of low-energy residences.
- Work to establish pilot projects for energy-efficient buildings, preferably in cooperation with the energy technology community at Kjeller.
- Make sure that all incineration for heating takes place within the applicable emission requirements.
- Participate in the EU project 3-NITY (3-fold initiative for energy planning and sustainable development at local level), and work to implement relevant measures.
- Exert influence through information, such as govern ment subsidy schemes and work to promote positive attitudes.
- Facilitate local and regional production of biofuel.
- Establish a local energy group.
- Set targets for greenhouse gas emissions linked to energy consumption. The targets should reflect Skedsmo's desire to be a low-emission municipality.

Set goals for a transition to stationary energy consumption based on new renewable energy sources.

Larvik municipality also has energy guidelines

Energy
1. The municipality's adopted climate and energy strat egy is used as a basis as regards energy issues in cases under the Planning and Building Act.
2. Prior to the initial consideration of municipal plans, land use and building plans in excess of 15 units, there must be a heating plan for the area based on the possibility of using new, renewable energy. The possibilities of using mini-grids or connection to dis trict heating plants must be explored in the heating plan.
3. Together with the building application for areas in excess of 15 units, documentation must be provided showing the energy account for the development, and discussing alternative heating plants. Within the building area, the general rule for new development and/or major renovation involving a total floor space more than 1000 square metres is installation of heating plants that are ready for connection to district heating or some other environmentally-friendly source of energy, cf. Building Technology Regulations TEK 07.
4. Energy consumption and energy efficiency in new buildings and in connection with renovation shall conform with the norms set in the Building Technology Regulations TEK 07, effective 1 July 2007. In cases where there is a licence for delivery of district heating based on new, renewable energy, and there is a decision under Section 66a of the Planning and Building Act, buildings must be equipped with a heating plant enabling the use of district heating.

Secondary Goal 1 - Business development, enhancing expertise and communication

Here are a few examples from the secondary goal spreadsheet, Energy and Climate Plan, Skedsmo - 2007

Measure	Description	Activity	Description
T1.1	Establish a general municipal program for efficient energy consumption and increased use of renewable energy, and link this to other internal plans/processes and county/national support schemes.	A1.1.2 A1.1.2 A1.1.3 A1.1.4	Develop a sub-plan for program structure, establish steering committee/ local energy group. Meet with Enova, discuss structure, how to build up and implement Plan, kick-off, new program. Program implementation, follow-up, evaluation.
T1.2	Enter into strategic alliances with like-minded municipalities at home and abroad, preferably in the form of externally financed projects	A1.1.2.1 A1.2.2 A1.2.3 A1.2.4	Participate in EU-financed energy projects under the direction of Interreg, Intelligent Energy Europe, etc. Establish local/regional energy offices in cooperation with the EU, the County Council, other local/regional stakeholders. Start regional energy plan project with the municipalities in the region. Establish membership in CEMR (Council for European Municipalities and Regions) or ICLEI (Local Governments for Sustainability) as well as EFQM Communities of Practice.
T1.3	Establish practical cooperation bodies with local business and industry stakeholders, clarify roles and expectations	A1.3.1 A1.3.2 A1.3.3	Initial meeting with local commercial interests to discuss interest in and willingness to participate in the efforts Hold 2-day gatherings (theory/practice) with local energy stakeholders and external experts on cluster formation, business development and public-private partnerships Get all local primary schools in the municipality to become "Rainmaker Schools" under Enova's direction
T1.4	Initiate/implement a number of information activities during the first half of 2008 to achieve a signal effect in the local community.	A1.4.1 A1.4.2 A1.4.3 A1.4.4	Prepare a local "Energia scenario" for the municipality, based on figures from the REAM model. Plan and implement information campaign/energy day/brochure targeting municipal enterprises (nursing homes, daycares, schools). Plan and implement information campaign/energy day/brochure targeting business and industry. Plan and implement information campaign/energy day/brochure t argeting the household sector

Secondary Goal 2 - Efficient energy consumption - municipal buildings

Measure	Description	Activity	Description
T2.1	Establish separate program structure for energy efficiency work in municipal buildings, and link this to Enova's support schemes. Organise applications for Enova funding for larger groups of municipal buildings.	A2.1.1 A2.1.2 A2.1.3 A2.1.4 A2.1.5	Develop a sub-plan for program structure, establish steering committee / local energy group. Meet with Enova, discuss structure, how to build up and implement. Apply to Enova for project preparation support for energy efficiency analyses in all municipal buildings not already analysed. Group 10-15 municipal buildings per application for support for energy efficiency measures. Coordinate implementation, follow-up and reporting of the building groups.
T2.2	Energy efficiency analyses must be implemented and action plans and energy efficiency measures developed for all municipal buildings by 2008. All realistic/economical measures shall be implemented in municipal buildings in accordance with the action plans by 2012.	A2.2.1 A2.2.2 A2.2.3	Implement pre-project for energy efficiency analyses in all municipal buildings (A2.1.5). Implement energy efficiency analyses in all municipal buildings. Prioritise and implement recommended measures during the period 2008-2012. Purchase of services is financed by programs.
T2.3	Survey all municipal buildings that use oil/kerosene for heating, explore alternatives for conversion to bio/heat pumps in individual buildings that cannot/should not be connected.	A2.3.1 A2.3.2 A.2.3.3	Meet with the district heating company to clarify strategy, roles and progress. Explore conversion to bio/heat pumps in relevant buildings. Implement conversion to bio/heat pumps in relevant buildings.
T2.4	Study and possibly implement energy labelling of all municipal buildings	A2.4.1 A2.4.2	Study energy labelling of all municipal buildings. Implement energy labelling of all municipal buildings.

Secondary Goal 3 - Efficient energy consumption - private buildings

Measure	Description	Activity	Description
T3.1	Establish separate program structure for energy efficiency work in private buildings (commercial buildings and residential buildings/housing cooperatives), and link this to Enova's support schemes. Organise applications for Enova funding for larger groups of private commercial buildings and homeowners/housing cooperatives.	A3.1.1 A3.1.2 A3.1.3 A3.1.4 A3.1.5	Develop a sub-plan for program structure, establish steering committee / local energy group. Meet with Enova, discuss structure, how to build up and implement Group 10-20 selected private commercial buildings per application for support for energy efficiency measures Group 40-50 residential buildings/ housing cooperatives per application for support for energy efficiency measures. Coordinate implementation, follow-up and reporting of the building groups.
T3.2	Private commercial buildings shall be informed about public support schemes for energy efficiency work, and shall be motivated to actively implement measures.	A3.2.1	Follow up the general information campaign with more specific information about technology and measures in commercial buildings.
T3.3	Private homeowners/ housing cooperatives shall be informed about public support schemes for energy efficiency work, and shall be motivated to actively implement simple measures.	A3.3.1	Follow up the general information campaign with more specific information about technology and measures in residential buildings.
T3.4	Survey all private buildings that use oil/kerosene for heating, recommend alternatives for conversion of individual buildings that cannot/should not be connected to district heating/ mini-grids.	A3.4.1 A3.4.2 A3.4.3 A3.4.4	Meet with the district heating company to clarify strategy, roles and progress. Explore conversion to bio/heat pumps in relevant commercial buildings Explore conversion to bio/heat pumps in relevant residential buildings Implement conversion to bio/heat pumps in relevant buildings.

Secondary Goal 4 - Energy supply using district heating, local heating (mini-grids) and other renewable energy

Measure	Description	Activity	Description
T4.1	Establish internal program structure for increased use of local, renewable energy sources and link this to Enova's support schemes.	A4.1.2 A4.1.2 A4.1.3 A4.1.4	Develop a sub-plan for program structure, establish steering committee/ local energy group. Meet with Enova, discuss structure, how to build up and implement Plan, kick off new program. Program implementation, follow-up and evaluation.
T4.2	The district heating plant must be expanded to supply all relevant (financially prudent) buildings in the licensing area by 2012. Other buildings in the licensing area shall receive an offer of alternative energy supply from renewable energy (D4).	A4.2.1 A4.2.2 A4.2.3 A4.2.4	Preliminary study to identify all buildings that fire with oil/kerosene Contact all building owners that currently heat with oil/kerosene, inform about alternative heating . Negotiate framework agreements with local suppliers of goods and services for conversion to alternative heating systems. Monitor/stimulate conversion of heating plants.
T4.3	Establish one/multiple pilot projects to highlight opportunities and limitations associated with mini-grids/ local heating.	A4.3.1 A4.3.2	Study/detail plans for exploiting landfill gas for local heating. Study/detail plans for bio/pellet-based mini-grids in a new demo area.
T4.4	Study, negotiate development agreements and build mini-grids/ local heating areas based on pellets/chip plants, with the district heating company as "heat supplier" outside the license area.	A4.4.1 A4.4.2	Meet with larger developers to ensure that their future projects in the municipality facilitate use of renewable energy. Study use of EnergyCabins or similar installations, together with long-term delivery contracts for pellets, service agreements, etc.
T4.5	Establish local market structures for sale, logistics, service and operation of larger and smaller heating plants.	A4.5.1 A4.5.2 A4.5.3 A4.5.4 A4.5.5 A4.5.6	Study (initiate) establishment of subsidiary "Local Heating Inc." Offer course packages in renewable energy to architects, installers, plumbers, construction principals, etc. Enter into strategy alliances with equipment suppliers (pellet stoves, etc.) Marketing campaign for simple pellet stoves and pellet deliveries to individual buildings (existing and new) Marketing campaign for more advanced pellet facilities and total packages in individual buildings (existing and new) Mini energy exhibitions in building material outlets and through other sales channels for relevant equipment.

Secondary Goal 5 - Renewable energy in local transport solutions

Measure	Description	Activity	Description
T5.1	Establish separate program structure for use of renewable energy in local transport solutions.	A5.1.1 A5.1.2 A5.1.3 A5.1.4	Develop a sub-plan for program structure, establish steering committee / local energy group Meet with Enova, discuss structure, how to build up and implement Plan, kick off new program Program implementation, follow-up, evaluation
T5.2	Establish at least two filling stations for alternative fuel in the municipality.	A5.2.1 A5.2.2 A5.2.3	Work actively to establish a hydrogen filling station in the municipality. Establish cooperation with fuel suppliers to establish a filling station with 100% biodiesel in the municipality by 2008 Study and position the municipality/region for possible production of alternative fuels
T5.3	Convert the entire municipal fleet of vehicles to alternative energy by 2010	A5.3.1 A5.3.2	Chart the replacement schedule for municipal vehicles. Preliminary project involving THINK (electric cars). Implement cooperative project with relevant car suppliers.
T5.4	Make road/street lighting in the municipality more efficient.	A5.4.1 A5.4.2	Study how to improve efficiency of street/road lighting in the municipality. Initiate rebuilding/replacement of street lighting.

6.6 Appendix 6 Historical development and projection of greenhouse gas emissions

Information about local climate work can be found on the SFT's website http://www.sft.no. This information includes:

- **Climate measures:** An important part of the municipality's work is to implement measures that reduce emissions of greenhouse gases and energy consumption in the municipality. Here you can find good examples of various types of climate measures that the municipality and other local stakeholders can implement.
- **Climate tools:** A compilation of tools that may be useful for the municipalities in their energy and climate work.

The **climate tools** pages provide information about greenhouse gas emissions in a municipality, broken down by the various gases and the following main sources:

- Stationary combustion
- Process emissions (non-combustion) in industry, agriculture and waste (landfills)
- Transport on land, sea and in the air

Emissions are shown in 1991 and 2005, thus giving an indication of development.

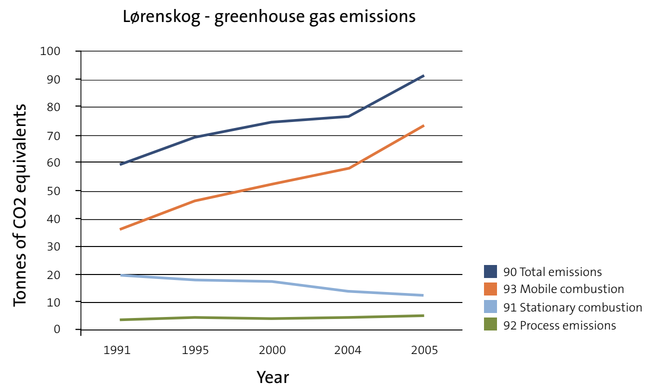
If more detailed information is desired, such as emissions distributed over more years and/or sources/commercial sectors, please refer to the **"State of the Environment Norway" website (http://www.environment.no), and check under "Maps and data".**

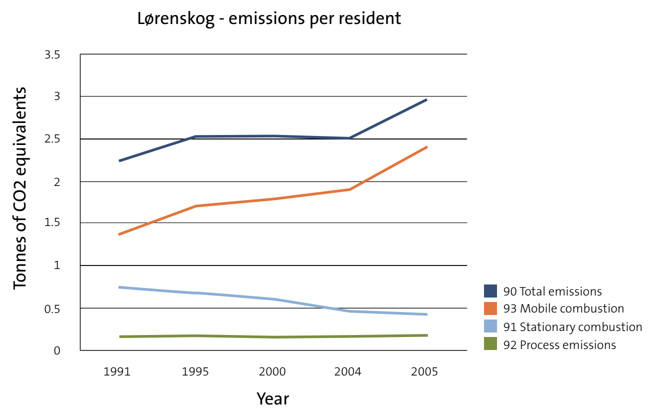
Historical trends in greenhouse gas emissions and distribution by sources, industries and municipalities are among the useful information that can be found on State of the Environment Norway:

Miljøstatus http://www.miljostatus.no - Norwegian website
State of the Environment Norway http://www.environment.no - English website

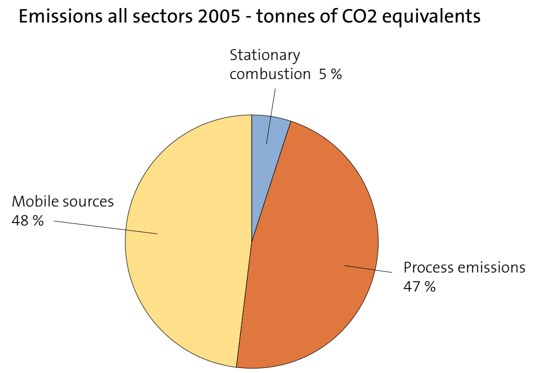
- Climate information
- Objectives and targets
- Key figures
- Maps
- Environmental data
- Norway's climate accounts
- Divided by municipalities and industries

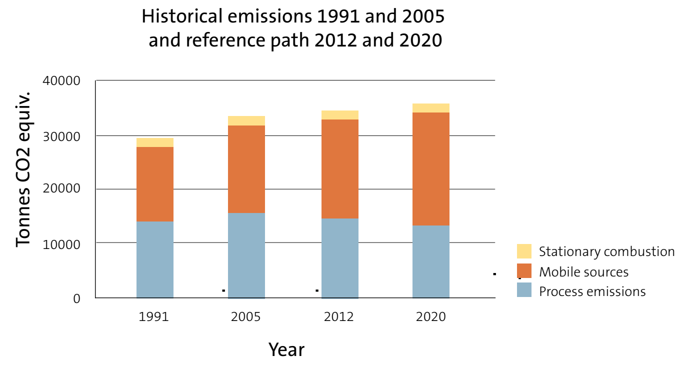
The numerical data can be compiled into figures that show the development of emissions divided by different criteria over time; although this does require some work.





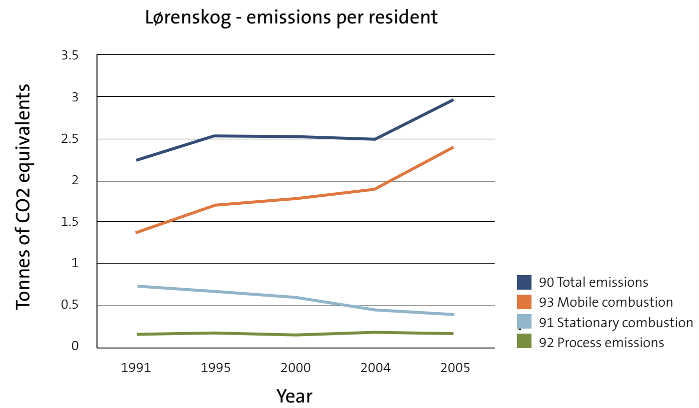
There is a web page dedicated to local climate work on www.sft.no. It can be used to prepare a somewhat simpler presentation of the municipality's greenhouse gas emissions, as well as a projection and appropriate figures.





www.sft.no also contains pages outlining measures, including examples. Below is an example of a measures page dealing with transport:

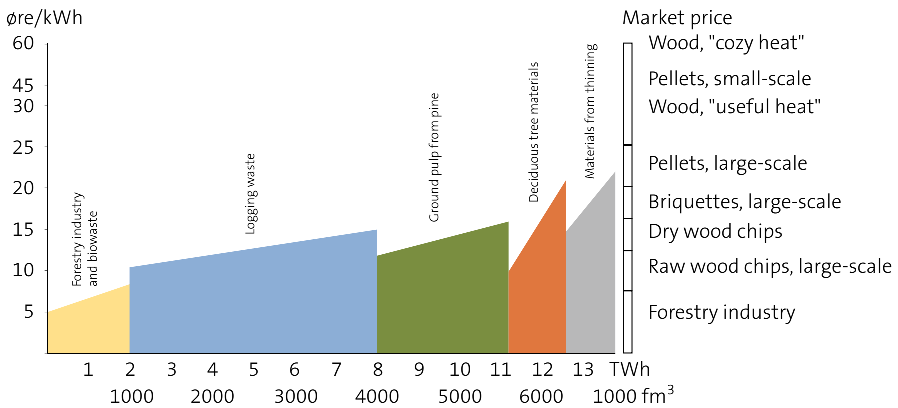
- Compact urban development and localisation
- Public transportation
- Bike paths
- Parking restrictions
- Fuel-efficient vehicles
- Increased commitment to biofuels
- Zero emission cars
- Efficient transport of goods
- Road pricing
- Mobility campaign



6.7 Appendix 7 Resources and costs associated with bioenergy

The figures and tables that appear here have been obtained from “Handlingsplan for bioenergisatsingen innenfor jordbruksavtalen” (Action plan for bioenergy commitment within the agriculture agreement). They were prepared for the parties to the agreement by a working group appointed by the Norwegian Industrial and Regional Development Fund in November 2002

Production costs of extracting forest material for fuel purposes



Forest resources and current and potential use of wood for industrial and energy purposes, million fm³

Million fm³				Industrial timber, million fm³				Energy material, million fm³					
	Standing volume	Annual growth	Bal. quant	Saw timber		Pulp wood		Wood				Logging waste	
				Use	Pot.	Use	Pot.	Use	Pot.	Use	Pot.	Use	Pot.
Spruce	292,0	11,2	10,0	3,1	5,3	2,7	4,7	0,6	0,6	1,1	0,3	0,0	1,0
Pine	216,1	5,8	4,4	1,0	2,8	0,6	1,6	0,2	0,2	6,0	0,1	0,0	0,5
Deciduous	140,6	4,9	3,2			0,1	0,1	2,4	2,7		0,2		0,2
Total	648,7	21,9	17,6	4,1	8,1	3,4	6,4	3,2[1]	3,5	0,0	0,6[2]	0,0[3]	1,7[4]

[1]Norway’s annual consumption of wood is approx. 7 TWh, equivalent to 3.5 million fm³ (1 fm³ = 2,000 kWh) fuel wood. Some of the wood is imported or is cut ends from industry. Annual consumption of wood as energy material is estimated here at 3.2 million fm³.
[2]Estimate based on calculations made by Gullbrandsen (1979), Lunnan, Moen & Risholt (1990) and Saur (1996) which estimate the potential to be from 0.3-0.6 million fm³.
[3]18,750 lm³ (approx. 7,500 fm³) wood chips from logging waste were delivered under the ”Wood chips to Gardermoen Fjernvarme AS” project.
[4]Logging waste accounts for approx. 30% of the entire tree.

Costs associated with large-scale production of wood (excl. VAT)

	NOK/cord	Øre/Wh
Material price (NOK 250/fm³)	400	11.8
Road transport	95	2.8
Work - cutting, splitting and bagging	375	11.0
Power/fuel	10	0.3
Depreciation/interest plant and inventory	75	2.2
Administration	20	0.6
Total costs, excl. VAT	975	28.7

Source: "Bioenergy - Environment, technology and market" 2001

Production costs for straw for fuel purposes (excl. VAT)

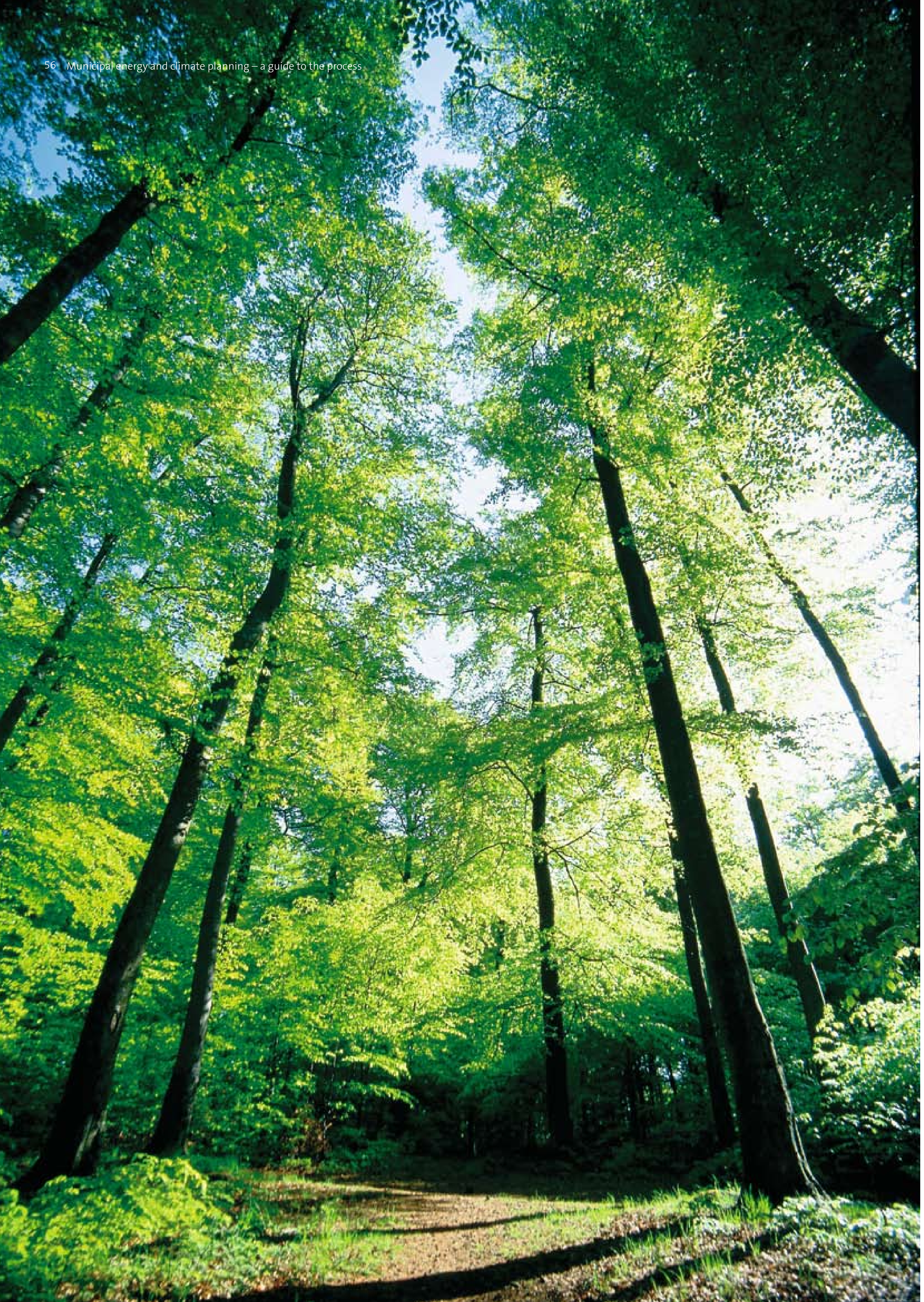
	Large-scale 1)		Small-scale 2)	
	NOK/ tonne	Øre/kWh	NOK/ tonne	Øre/kWh
Pressing, cutting the straw	110	2.8	180	4.5
Field to farm transport	40	1.0	45	1.1
Transport to heating plant 3)	135	3.4	240	6.0
Administration	30	0.8	30	0.8
Total costs 4), excl. VAT	315	8.0	495	12.4

1) Large-scale straw production is based on large bales, weight approx. 520 kg (140 kg/m3)
2) Small-scale straw production is based on round bales, weight approx. 240 kg (110 kg/m3)
3) Average transport distance here is 30 km
4) Storage costs are not included in the total costs here.

Costs associated with large-scale production of pellets and briquettes (excl. VAT)

	Pellets		Briquettes	
	NOK/ tonne	Øre/kWh	NOK/ tonne	Øre/kWh
Raw material wood chips	300	6.4	300	7.0
Production costs	200	4.3	100	2.3
Capital costs	150	3.2	100	2.3
Transport	150	3.2	150	3.5
Administration	30	0.6	30	0.7
Total costs, excl. VAT	830	17.7	975	15.8

Source: "Bioenergy - Environment, technology and market" 2001



6.8 Appendix 8 Statutes, regulations, directives and national policy guidelines

The Norwegian Planning and Building Act (PBL)

PBL is the municipality's most important tool in the energy and climate work, as it governs the municipality's planning work. This Act assigns responsibility for land use planning and facilitating transport systems to the municipality. In its work on a new Planning and Building Act, the Government has emphasised that the Act must be a more efficient tool for climate work in municipalities and counties. The intention is for the municipalities to be able to require specific solutions for energy supply and transport in an area where development is planned [0]. The new Act is expected to take effect from 2009. The municipality has the opportunity to check whether new and renovated buildings actually fulfil current energy consumption requirements, thus enabling the municipality to assume an important monitoring role. This is not currently done to any great extent, but it may become more important in the future, in step with greater emphasis on energy and climate issues.

Land use planning under the Planning and Building Act is important for energy and climate plans because this is a an endeavour which makes it possible to see the location of households, schools, day care centres, jobs and various services in connection with the possibility of transport between these places, such as bicycling, walking, public transportation, etc. In this context, initiatives such as city bicycles and ride-share schemes can also be considered. The land use plan also allows for planning stationary energy consumption through evaluating the options for utilising district heating and extracting biomass, to mention just a few. It is also important to take local climate conditions into account. Zoning/development plans can also be used to ensure favourable climate orientation and mutual localisation of the buildings. Several surveys have been done showing that variations between various draft plans can entail a difference of 15-25 per cent in future energy consumption.

The proposed new planning section of the Planning and Building Act aims to strengthen the legal authority for such planning, in part by ensuring that the municipalities can require specific solutions for energy supply and transport in an area where development is planned. An important goal is to restrict the scope of local transportation and stimulate environmentally friendly forms of transportations to reduce greenhouse gas emissions. Improvements and concentration within the building zone, locating businesses and activities in close proximity to public transportation and restricting parking options are important tools the municipality can utilise.

The Government has signalled its intention to strengthen the follow-up of such plans through more binding agreements with local and regional authorities on measures that can reduce the use of private automobiles in urban areas. A similar statutory basis will be continued in the proposed new planning section of the Planning and Building Act.

The energy requirements in the building regulations have now been intensified by about 30 per cent. The building regulations also include a separate provision requiring the use of renewable energy where this is profitable in a life-cycle perspective. These new requirements apply to all types of buildings, including holiday cottages larger than 80 m2. Calculations show that this could result in a reduction in the annual national energy consumption in the range of 0.5 TWh over time, which is equivalent to the annual energy consumption of approx. 25,000 homes. Overall, this is modest, as energy consumption for heating buildings (including the waste heat from electrical appliances and lighting) is currently 45 TWh per year. A desire has also been expressed to revise these requirements at five-year intervals. However, it should not be forgotten that what is done in existing buildings, both for the short and medium terms, will have a greater impact on energy and climate than revised requirements for the far smaller number of new buildings. This in turn means that, in spite of the fact that the municipality wields the greatest power over new buildings, and could choose to prioritise this area based on the criteria of efficient management, it must not lose sight of what takes place in the buildings that already exist. In the absence of legal authority, it is important that the municipalities utilise all avenues of creativity and cooperation to positively impact the development in existing buildings in the municipality.

The Norwegian State Housing Bank (Husbanken) and Enova provide support for the building of low-energy homes. This has contributed to the construction of at least 3,000 homes in recent years with individual energy needs of approx. 100 kWh/m2/year. Interest in low-energy houses continues to increase sharply among home-builders.

Agriculture and forestry

The "Act relating to Land", with its regulations, is the most important statute in terms of energy and climate. Section 1 Purpose states: Ensuring that resources are used in a manner beneficial to society entails taking into account the fact that the resources shall be disposed of with a view to the needs of future generations. Land resource management shall be environmentally sound and, among other things, take into consideration protection of the soil as a production factor and preservation of land and cultural landscapes as a basis for life, health and well-being for human beings, animals and plants.

The regulations are often tied to financial support schemes such as production subsidies, area subsidies, etc., which will not be discussed in detail here.

Cultivation of marshlands, fertilization, method and timing of cultivation such as autumn plowing/not plowing, catch crops and grass versus grain are examples of activities that affect greenhouse gas emissions, soil loss and loss of nutrients to watercourses, which are covered under statutes, regulations and subsidy schemes. Changes in land use such as logging, planting forests and transition from crop land to residential and commercial area or roads also changes the emissions of greenhouse gases from these areas. Some of the above elements affect the emissions of N2O, particularly new cultivation and intensity of fertilization with nitrogen (with a modification that follows below). This is affected by a number of policy instruments, including the requirement for an environment plan including fertilization plan and subsidies for organic agriculture (since organic consumers have less N available). How plant residues are handled also has a certain bearing on both N2O and CH4, and the design of fertilizer storage, as well as for CH4. The dominant source of CH4 - the digestion process of ruminants - can mainly only be affected by changes in the number of animals or the feeding system, which is in turn affected more by the financial instruments in the agriculture agreements (relative prices of livestock products and feed) than by regulations.

The administration of the above-mentioned statutes, regulations and the financial subsidy schemes takes place in part on the regional and national level, but also on the municipal level. Forestry and agriculture will also supply the raw materials for bioenergy. In many rural municipalities, greenhouse gas emissions from agriculture will account for a substantial part of the municipality's greenhouse gas emissions. Therefore, it is important in many municipalities to include this sector in an energy and climate plan.

The Pollution Act and the Pollution Regulations

The Act and the Pollution Regulations are administered by the Norwegian Pollution Control Authority (SFT), the County Governor, and also by the municipality. As a point of departure, the Pollution Act prohibits pollution without special permission, and this also applies to greenhouse gas emissions. However, emissions from a number of sectors, such as road transport and agriculture, are partially or completely excluded from the Pollution Act. Emissions from such sectors may be governed by sector legislation.

Restrictions of greenhouse gas emissions can otherwise take place through policy instruments such as the CO2 tax, emission quotas and voluntary agreements with the industry.

Emissions of greenhouse gases often come from sources/activities that also bring air pollution and sometimes water pollution; such as road transport, oil-fired plants and industrial activities.

These emissions are partly covered by the Pollution Act and the Pollution Regulations. Agriculture leads to emissions of the greenhouse gases nitrous oxide and methane, as well as ammonia (acidification and over-fertilisation) and nitrates and phosphates to water.

Measures that reduce greenhouse gas emissions will often also reduce other emissions to air, and in some cases, also to water. Examples are less oil-firing, transport and fertilizing measures. Sometimes, however, measures can lead to increased (local) air pollution, such as replacing electricity with bioenergy. Such increases and/or changes in emission source fall under the jurisdiction of the Pollution Act/Pollution Regulations.

Use and emission of ozone-depleting substances (which are also strong greenhouse gases) are also governed by the Pollution Regulations.

When drawing up an energy and climate plan, consideration must be given to the potential effects of pollution associated with energy and/or climate measures, and that the Pollution Act may pose an obstacle for certain measures. Furthermore, any required processing of applications will take time. One example of this could be development of a district heating grid with heating plants based on combustion, regardless of whether this is based on fossil fuels or biomass/waste.

The Road Traffic Act

The Road Traffic Act gives the municipalities the opportunity to utilize road pricing as a policy instrument to change transport patterns. The County is responsible for the local public transportation and can demand the use of alternative fuels or more efficient means of transportation.

The Energy Act

The Energy Act requires all power grid companies (area licensees) to prepare local energy studies for all municipalities in their licence area. The studies are to deal with stationary energy consumption and they are a good starting point for an energy and climate plan. The Energy Act also authorizes the NVE to order the power grid company to report energy consumption statistics in the licensee's area. This is an important underlying basis for municipal statistics.

A proposed new chapter in the Energy Act would include a requirement for energy labeling of buildings as a follow-up of the EU's Building Energy Directive. The obligation to introduce energy labeling for all buildings and homes in connection with construction, sale and leasing will presumably apply from 2009. As regards public buildings larger than 1000 m2, there will be a requirement for visible labeling, regardless of sale and leasing. The municipality can actively utilize the energy label to set requirements such as that all new municipal buildings shall be Class A, existing buildings of specific types must be Class C, etc. The municipality can also apply this to all development in its land areas. More information about the upcoming energy label scheme can be found on the NVE's topical pages [6].

National policy guidelines

The Government will consider national policy guidelines for municipal climate work [0]. This is supported by Section 17-1 of the Planning and Building Act, national policy provisions for coordinated land use and transport planning. An important objective here is to reduce transportation needs and to facilitate environmentally friendly forms of transportation. The guidelines discuss the principles that shall form the basis for planning.

6.9 Appendix 9 Models

REAM

Large municipalities that need solutions to meet increasing energy consumption sustainably and efficiently can opt to use the computer tool REAM - Regional Energy Analysing Model. Smaller municipalities that want to clarify their options regarding restructuring of energy consumption and/or generation will also benefit from this program. REAM is a multi-scenario tool for modeling the stationary energy systems in a geographical area, along with associated emissions. REAM is based on a cost-minimizing equation, i.e. the cheapest energy carriers and technologies are selected.

However, the world is not always cost-optimal, and we consumers do not always choose the solutions that are most inexpensive in the long term. Therefore, users have the option of introducing limitations and boundary conditions for the various technologies so that the model can form a realistic picture of the development. By setting minimum requirements and/or maximum limits, municipalities can prevent certain technologies from achieving excessive latitude or from being phased out too quickly. This can also be used to reduce emissions of greenhouse gases in the model. In other words, REAM is not a forecasting tool, even though the simulations can approximate forecasts through active use of limitations and boundary conditions in the model. In this way, REAM can be a useful tool when staking out the course ahead.

Technical/financial data must be gathered in addition to consumer data and prices of energy carriers for all technologies included in the model, from pellet stoves and oil boilers to large production facilities and distribution networks. Reference is made to the REAM user manual for a more detailed description. It is assumed that those municipalities that want to use data models to make projections will have access to both up-to-date data sets for prices on the relevant technologies and energy carriers. It may also be relevant for smaller municipalities to use experts in the area to make these projections, but then in close cooperation with the municipality. This is a new program, developed by PROFU and the Institute for Energy Technology in the 3-NITY project..

eTransport - new model for local energy planning

Investments in alternative infrastructures for energy supply (electricity, district heating, biomass/waste, etc.) are extremely capital-intensive, and it is important to avoid making decisions on a faulty or deficient basis. Over a period of several years, SINTEF Energiforskning AS has developed a new analysis tool for planning local energy systems in which the interplay and competition between several different energy carriers are incorporated. Development of the model, called "eTransport", has been financed by the Research Council of Norway and Norwegian energy companies through a number of case studies. Today, eTransport is a fully operative prototype, but further development continues with SINTEF/NTNU.

eTransport was developed in order to combine two important topics that are normally examined separately in traditional system analyses: investment analysis over a long time horizon and relatively complex representation of geographical infrastructure. The model can combine many different technical components and energy forms in a single analysis. The current model finds the best development plan for local infrastructure over a given time horizon (10-30 years) by minimizing operational investments and environmental costs. Both socio-economic and commercial profitability can be assessed.

Since the model takes the entire infrastructure into consideration, investments in transmission networks, pipelines and cables can all be evaluated on an equal basis with investments in energy generation units (such as hydro/wind power and gas power), conversion (such as heating plants, boilers) and end use sorted by purpose. This makes the model very suitable for planning (investments in) local energy supply systems such as electricity, district heating or gas. The model is also relevant in the preparation and documentation of municipal energy studies/energy plans. A fully graphical Windows user interface provides the user with a good overview of a given energy system (e.g. municipality, city, neighborhood) and makes it easier to communicate the solution to complex problems to people and decision-makers without a technical background.

The model is divided into an operations model (energy system model) and an investment model. The operations model contains a library of sub-models for all the energy carriers and technologies among which the user can choose. The time horizon for the operations planning is relatively short (1-3 days) with typical time units of one hour. The operations module is run repeatedly for different seasons (such as heavy load, light load, medium load), different periods (e.g. every fifth year) and relevant system designs.

The investment module is separated from the operations analysis. Annual operations and environmental costs from the operations module are delivered to the investment module, which identifies which investment strategy yields the minimum total present value over the planning horizon. During 2008, eTransport will be able to take into account the uncertainty associated with energy prices and demand over time, and will provide different investment strategies with different probability/risk.

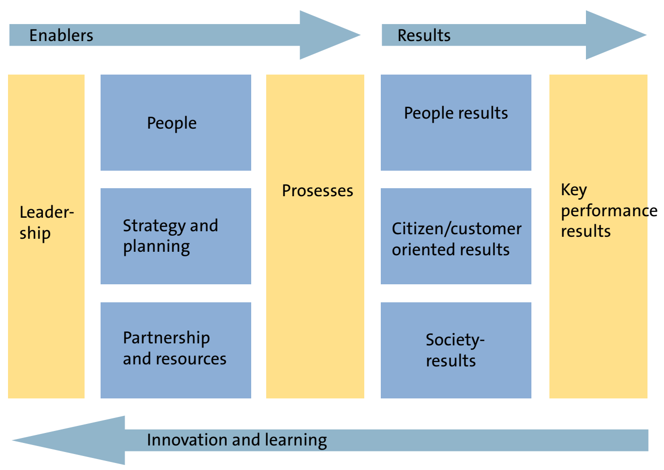
6.10 Appendix 10 Common Assessment Framework (CAF)

There is increasing interest in the public sector for working with quality and comprehensive management models to improve individual enterprises. Various national and international models are available, and it is difficult to say which of these models is best. However, we have provided a description here of the CAF model (Common Assessment Framework), which is a quality model specially developed for the public sector. CAF was developed under the direction of the EU and is based on the Excellence model, which was previously used by the European automotive industry, the EU Commission and EFQM (European Foundation for Quality Management). The model can be applied in public administration for self-evaluation of own activities and for benchmarking between comparable activities.

Statskonsult has found CAF to be a useful tool for public sector entities that wish to make a general "diagnosis" of their own condition. Such a self-evaluation may be of assistance in uncovering factors where there is room for improvement.

CAF can be used as a basis for a critical evaluation of an organisation. The model is simple, and can be used for self-evaluation of all types of public sector entities. CAF does not require a particular level of management, a particular type of task or a particular organisation size.

The CAF Model



The purpose of CAF:

- to capture the special characteristics that apply to public sector entities
- to be an introduction tool that can give public sector entities an impression of how such tools function
- to bridge the gaps between different models and methods used to develop quality
- to enable benchmarking between public sector entities

CAF consists of nine criteria; five enabler criteria and four results criteria, which cover the main areas of most organisations. Sub-criteria in the form of questions to be asked about the respective main areas of an organisation are listed under each of the main categories.

Among the benefits to be gained from such a review of the organisation are learning about one's own enterprise, assessment based on facts rather than assumptions, identification of areas where the enterprise can improve, and involvement of staff in improvement activities. It must also be emphasised that the CAF tool is much simpler and less detailed than, for example, more advanced quality tools using external assistance.

6.10.1 CAF in local energy planning

An EU-financed project (3-NITY) was initiated in 2006 for purposes such as tailoring a variant of the CAF model for use in local energy planning. Skedsmo municipality has participated as one of several European "test municipalities" in projects that also involve a number of European technical milieus in the fields of energy and quality management. In addition to the work on the CAF model, 3-NITY has also further developed an existing Swedish technical-economical simulation tool for local energy planning (KRAM), as well as extensive lists of measures that should be included in an energy and climate plan. The 3-NITY project has prepared an integrated system for all parts of an energy and climate plan, and the adapted CAF model "Sustainable Excellence" is a particularly good tool that municipalities can use to assess their own capability to convert the plan into action.

A simple spreadsheet has been prepared that can be used as a basis for the municipality's own self-evaluation. Municipalities are recommended to start the whole energy and climate plan process by having the municipality's energy and climate planning group ask itself nine questions related to energy and climate factors in the municipality, one for each of the CAF criteria. Each of the responses is scored using a simple scale, and most municipalities will find that there is considerable work to be done before they can earn a passing grade (this is presumably part of the explanation for why many energy and climate plans never become anything other than plans). In principle, the purpose of this first self-evaluation is to draw attention to some important factors that should be included in the ongoing work.

This self-evaluation must be repeated before the energy and climate plan is readied for political consideration, but this time the process must be more thorough, including three more detailed questions for each of the CAF criteria. The responses are scored in the same manner as previously, and some small progress can usually be measured in most cases. Discussions in the energy and climate planning group will normally reveal some internal factors that are not optimal for facilitating implementation of even several of the first, simple measures proposed in the energy and climate plan.

Attempts should therefore be made to concretise some proposed improvements. These are often qualitative/organisational improvements that should be included as part of the first, simple measures in the energy and climate plan, and which should be highlighted before the plan is submitted for political consideration.

The following is a recap of the main points from each of these nine criteria. For criteria 1-3, examples are also shown from Skedsmo municipality's initial self-evaluation:

Criterion 1: Municipal leadership
To what extent has the municipal management initiated measures to carry out the municipality's desire to achieve better energy efficiency, a higher percentage of renewable energy resources in the local energy supply and reduction of greenhouse gases?

2005:
- Energy was not a strategic element of the municipal plan, and was therefore not established in the municipality's management

2007:
- Both the mayor and city manager seem genuinely interested in energy and climate issues, and the may or has publicly supported sustainable energy devel opment in the municipality. The mayor also led the efforts to adopt a dedicated energy chapter in the municipal plan for 2006-2017.

Criterion 2: The municipality's policy and strategy
Has the municipality framed and communicated a clear energy and climate strategy, and is this strategy firmly anchored in a philosophy that includes sustainable energy management?

2005:
- Energy was not mentioned in the previous municipal plan. The municipality has commissioned 2-3 more or less politically-based reports and studies on energy and climate in the municipality since 1995.

2007:
- The municipality adopted its first dedicated energy chapter in the municipal master plan for 2006-2017. This chapter contains concrete goals of eliminat ing oil heating, increasing use of bioenergy, improv ing energy efficiency, raising public awareness, etc.
- The work on an energy and climate plan is to result in a municipal plan with clear political leadership for energy and climate in the municipality.

Criterion 3: Staffing in the municipality
How has the municipality contributed to ensuring that its own employees have a good awareness regarding sustainable energy and climate management throughout all areas where the municipality has activities?

2005:
- The energy area is handled by the municipality's environment coordinator.
- Substantial energy efficiency activity in the building department in connection with the municipality's own buildings. No specific energy competence.

2007:
- Proposal to hire a full-time energy coordinator.

Criterion 4: The municipality's partnerships and resources
How is the municipality developing so-called partnerships with other local stakeholders, and how does the municipality cooperate with energy suppliers to increase exploitation of local energy resources while simultaneously increasing focus on efficient energy consumption and greenhouse gas emissions? How are financial and human resources allocated for this purpose?

Criterion 5: The municipality's processes
How does the municipality define, implement and revise its internal processes to ensure that they are in line with the municipality's energy and climate strategies in the short, medium and long terms? Are processes in place that have sustainable energy and climate management as their primary focus?

Criterion 6: Measuring results at the customer/citizen level
How does the municipality measure the results achieved in sustainable energy and climate management from the citizens'/customers' perspective?

Criterion 7: Measuring results among own employees
How does the municipality measure the results achieved in sustainable energy and climate management from the perspective of its own employees?

Criterion 8: Measuring results at the society level
How does the municipality measure the results achieved in sustainable energy and climate management at the society level? This includes general society results such as reduced energy consumption, reduced greenhouse gas emissions, jobs, increase in prosperity and environmental consequences at the local, national and global levels.

Criterion 9: Key performance results
What key results has the municipality achieved as regards implementing its policy and strategy to achieve sustainable energy and climate management in the municipality?

After the municipality is well into the implementation phase of its energy and climate plan (for example, after about one year), a third self-evaluation is done using the same three questions linked to each of the CAF criteria. Assuming that the municipality has followed up the first, simple measures in the energy and climate plan, in most cases a higher score will emerge on all criteria at this point, while the list of possible improvements continues to grow.

This indicates that the municipality is at least close to fulfilling one of the critical success criteria discussed earlier in this guidebook.

6.11 Appendix 11 Enova's support programs

The built environment

Background
This program is based on Enova's objective of reduced energy consumption and more use of renewable energy. It is to contribute to lasting changes in the residential and commercial buildings market sector. The projects covered under the program include both existing and new commercial and residential buildings, as well as construction projects such as water supply and sewage systems, road lighting and sports facilities. Enova prioritises projects that yield a high kWh result.

Target group
The target group is people who make decisions and investments in projects with energy goals. Advisors, architects, contractors, manufacturers and suppliers of goods are important drivers for developing and implementing the projects. Advisors and other competent actors can apply on behalf of a project owner when the application is sufficiently established with the project owner.

Support and funding amounts
- Enova's support is intended to be a trigger for the projects. This means that Enova can provide support up to a level where the project achieves a normal return in its sector. Projects compete with each other, and projects that have a high energy dividend in relation to the funding level will be prioritised. The main rule is that Enova provides investment support for physical measures, i.e. investments that are listed on the company's balance sheet.
- The funding level is normally from 0.2 to 0.5 NOK/kWh of reduced energy consumption and/or generated renewable heat per year.
- The sum of the reduced energy consumption and use/generation of renewable heat make up the en ergy goal.
- Disbursement of funds is made in relation to the progress made in the project and the results achieved.

Common factors for prioritised projects
- Projects with documentation showing the possibility of indirect energy results.
- Large project agreement that encompasses a signifi cant number of building projects and a number of areas for measures, with approx. five-year duration.
- Projects that encompass large building areas linked to a single project owner.
- Projects that have a plan for implementing concrete measures to reduce the need for electric heating and/or a transition to renewable energy sources.
- Projects that have firm management support in the project activities.
- Sub-programs

Support criteria for the various sub-programs
- Projects with energy goals of more than 2 GWh/year
- Investment support is provided for the additional costs associated with achieving the project's energy goal.

- Relevant projects are buildings, building portfolios, major development projects and outdoor facilities such as water supply and sewage systems, road lighting and sports facilities.
- Minimum energy goal of 10 per cent.

Projects with energy goals between 0.5-2 GWh/year
- Investment support is provided for the additional costs associated with achieving the project's energy goal.
- Relevant projects are buildings, building portfolios, development projects and outdoor facilities.
- Minimum energy goal of 10 per cent.

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Best practice project
- Investment support is provided for the additional costs associated with achieving the project's energy goal.
- Relevant projects are rehabilitation and new con struction of commercial and residential buildings.
- The minimum energy goal shall be 50 per cent, in relation to current practice.
- The projects shall be well-suited for publicity and demonstration.
- The project type shall have the potential to be followed as an example, as well as have potential additional effects.
- Private individuals building for themselves are not allowed to apply.

6.12 Appendix 12 Enova's support programs

Infrastructure for district heating

Increasing the availability of district heating from renewable energy sources requires a long-term build-up of the infrastructure for district heating.

This program provides compensation to actors who want to develop the district heating infrastructure. Infrastructure for district cooling in connection with district heating can also receive compensation under the program. The program does not provide support for energy generation.

Objective of the program
The district heating infrastructure program is intended to promote development of capacity for increased deliveries of district heating to the end users. This means that the program shall:
- Offset lack of profitability, i.e. enable realisation of infrastructure projects that are not initially profitable
- Compensate for the uncertain development in the demand for heating

The infrastructure for district heating includes transmission and distribution facilities up to the metering point for delivery of district heating and cooling, including any heat exchangers, branch lines and customer centres.

Target group
The program targets stakeholders who want to develop their business activities within the district heating infrastructure. Only registered companies are allowed to participate in the program.

Covered facilities:
- Have a defined extent and delivery area
- Have minimum 30 year economic lifetime
- Have a district heating licence where this is required or assumed by the developer
- Are based on realistic economic assumptions
- Infrastructure for district cooling in connection with district heating
- Are based on, or can present a plan for future exploitation of renewable energy sources

Service commitment
- The facility shall deliver energy to external customers.
- The facility pledges to offer connection of end users in the specified delivery area for a minimum of five years after completion, as long as a base-load is requested
- The facility pledges to meet the customers' total needs for heat through the entire year (delivery quality)

- Determining compensation
- The program is conducted as a tender process for purchase of services of general economic interest (www.regjeringen.no/nb/dep/fad). This means that the tender is announced as a competition with nego tiation, in which bidders will be selected and com pensation determined on a competitive basis.
- The most economically advantageous bid will be selected, in accordance with the ranking criteria listed below

Ranking criteria

The following ranking criteria, listed in order of priority, will be used as a basis:

- High delivery capacity per monetary unit (compensation)
- High future growth potential beyond the specified delivery area
- Low total district heating costs delivered to the end user
- Delivery capacity means the facility's capacity to deliver district heating and district cooling to end users in accordance with the specified extent and delivery area, i.e. the facility's technical delivery capacity (GWh/year) based on output and service life. When calculating the cost of district heating deliv ered to the end user, the cost of the heat delivered to the grid covered under the bid (heat generation and existing transmission grid) shall be included.

Contacts

Enova's telephone/web-based help line: svartjenesten@ enova.no, tel. (in Norway) 08049
Program coordinators:
Trude Tokle, Senior Advisor, tel. +47 73 19 04 54
Boy Kåre Kristoffersen, Senior Advisor,
tel. +47 73 19 04 42

Notices and closing date

The tender competition, with the tender documents, is announced on Doffin - the database for public procure- ment - with a closing data for submitting bids of at least one month after the announcement (www.doffin.no). At least two tender competitions will be held each year, with tentative notices in January and August.

Bid requirements

Suppliers, deliveries (the delivery capacity offered and the facility to be built) and bids must satisfy the require- ments stipulated in the tender documents.

All bid information is kept confidential. Information may be published for facilities that receive compensation, such as the name of the contract party, project title, the delivery capacity of the facility and compensation.

Contract terms

Delivery contracts for the specified service commitment will be established with the selected suppliers.

Other contract terms

- Development of the facility must be initiated within 18 months and completed within three years after the contract is signed with Enova.
- Quarterly reporting is required during the construc tion period, and annual reporting of energy deliveries divided by energy carrier for up to ten years after completion.
- Requirements may be stipulated regarding neces sary permits, binding financial plans including financial guarantees, etc. prior to payment.
- Compensation is paid based on incurred costs and in accordance with the plan specified in the contract with Enova.

6.13 Appendix 13 Enova's support programs

Local heating plants

Enova's program for local heating plants provides support to actors who want to establish new heat generation based on renewable energy sources. Relevant applicants include stakeholders from the energy, forestry and con- struction sectors.

Objective of the program

The aim of the local heating plants program is to pro- mote increased installation of local heating plants based on renewable energy sources such as solid biofuel, ther- mal solar heat or heat pumps.

Target group

This program targets stakeholders who want to establish local heating plants for multi-unit residences, commer- cial buildings, public buildings, sports facilities and indus- trial buildings, as well as smaller combinations of these.

Heat generation must be based on renewable energy sources.
Only registered companies are eligible to apply.

Investments in heating plants and distribution systems between different buildings and facilities are eligible to receive support. This includes necessary equipment and facilities for energy supply and distribution, peak loads, back-up, ash handling, flue gas facilities, transmission pipes, control systems, operation and necessary building and construction work.

Support amount

The program for local heating plants is an investment subsidy scheme with streamlined evaluation of applica- tions. The need for support must be documented by an investment analysis based in part on pre-defined values, including economic lifetime, discount rate and alterna- tive energy price, ref. electronic application form. The analysis shall illustrate the project's economy both with and without Enova subsidies.

The support is limited to a real return of 8 per cent (before tax), and/or a renewable energy dividend per sup- port unit (e.g. euro) of at least 2 kWh/support unit.

Eligible projects

- Projects with a renewable energy dividend per unit of support of at least 2 kWh/support unit
- Facilities with a minimum economic lifetime of 15 years
- Projects based on realistic economic assumptions

Excluded projects

- Projects that are commercially profitable without support
- Projects that have already been initiated or where a decision has already been made to implement the project
- Air to air heat pumps
- Internal distribution systems in buildings
- Projects that have previously received public funding for conversion or renewable heat
- Local heating plants within an area with plans for district heating with the following timeframes:
  - For areas where a district heating licence has been granted: up to three years after the licence date
  - For areas where a district heating licence has been sought: up to three years after the licence date, with the addition of processing time
  - For facilities that are not subject to licensing, and which fall inside areas where energy studies or energy and climate plans state concrete plans for realising district heating: up to three years after the plan is adopted
  - Projects within mandatory connection areas

Projects that can produce written acceptance from rel- evant district heating actors in areas that are disqualified from receiving support via the program can nevertheless receive support.

Contacts

Enova's telephone/web-based help line:
svartjenesten@enova.no, tel. (in Norway) 08049
Program coordinators:
Boy Kåre Kristoffersen, Senior Advisor,
tel. +47 73 19 04 42
Trude Tokle, Senior Advisor, tel. +47 73 19 04 54

Application requirements

Electronic application forms for the local heating plants program can be found on the following website: www. enova.no/soknad. After the application is submitted via our website and recorded by Enova, the application will be assigned a project number that will be the applica- tion's/project's reference in connection with all subse- quent contact with Enova.

The application must contain:

- Brief description of the project, participants and reference projects, including
  - Technical data for the facility
  - Heat energy budget for relevant buildings and facilities, with an overview of previous years' energy consumption (kWh) divided by energy carriers and heated area
- Investment analysis, ref. electronic application form and investment calculator
- Documentation of project costs and financing plan. As a minimum, a binding price offer for the heating plant, i.e. the heat generation unit, must be included.
- Progress plan with milestones

Other commitment conditions

- The facility must be completed within 12 months after the commitment is received.
- A final report is required upon completion.
- Annual reports on energy deliveries are required for up to three years after completion.

- The support is disbursed as a portion of incurred costs upon submission of the final report and invoice or final accounts certified by an authorised public accountant.

Application deadlines
The program processes received applications on a continuous basis. Enova aims to process the applications within six weeks, assuming that it has received all requested project data.

All applications to Enova are kept confidential. Projects that have received funding commitments may be announced, including information such as the name of the contract partner, project title/objective and amount of support.

Guidelines
More detailed guidelines regarding this support program can be downloaded in pdf format from http://www.enova.no/?itemid=5099.

Investment calculator
One of the steps involved in completing the application will be filling out Enova's investment calculation for local heating plants. This calculator will determine how much support the specific project is eligible to receive. The calculator is downloaded via the electronic application form, and is filled out and uploaded via the same form.

6.14 Appendix 14 Enova's support programs

New district heating business

Enova's program for new district heating business provides support to actors who want to establish new infrastructure for district heating and associated generation of renewable energy. District cooling in connection with district heating can also receive support under this program. Stakeholders from both the energy and waste sectors are eligible to receive support. Conversion of existing heating plants to renewable base load production in facilities established prior to 1 January 2008 is also covered under the program.

Objective of the program
This program is intended to promote the establishment of new district heating business. This entails start-up of district heating where both infrastructure and associated heating plants based on renewable energy sources must be established.
Infrastructure for district heating and cooling includes transmission and distribution facilities up to the metering point for delivery of heat, including any heat exchangers, branch lines and customer centres.

Target group
This program targets stakeholders who want to establish and further develop their business activities in the delivery of district heating and district cooling.
Only registered companies are eligible to apply.

Eligible projects
- District heating and district cooling plants that deliver energy to external customers
- District heating plants with combined power and heat generation. Until the electricity support scheme is in place, the power delivery will be included in the energy dividend in addition to the heat delivery.
- Conversion of existing heating plants to renewable base load generation in facilities established prior to 1 January 2008, and which have not previously received support for the applicable contractual energy delivery with Enova.
- Have a minimum economic lifetime of 20 years.
- Are based on renewable energy and/or waste heat as base load.
- Have a defined extent and delivery area.
- Have a district heating licence, where this is required or assumed by the developer.
- Are based on realistic economic assumptions

Support amount
The program for new district heating business is an investment support scheme. Enova can provide support to projects up to an amount equivalent to a normal return for the heating sector, i.e. a real discount rate of 8 % (before/after tax). The need for support must be documented by a cash flow analysis, ref. electronic application form. The final amount of support is determined on the basis of competition between the eligible projects.

Ranking criteria
The following ranking criteria will be used as a basis:
- High renewable and total energy dividend per unit of support (e.g. euro)
- High delivery capacity per unit of support (e.g. euro)
- High future growth potential beyond the specified delivery area
- Low total district heating costs delivered to the end user
- Energy dividend means heating and cooling delivered to the end user, as well as any power generation, at the time when the plant is completed. Delivery capacity means the facility's capacity to deliver heating and cooling to end users in accordance with the specified extent and delivery area.

Excluded projects
- Internal distribution systems in buildings
- Projects that only comprise heat generation, with the exception of conversion to renewable base load pro duction in facilities established prior to 1 January 2008, and that have not previously received support from and contractual energy deliveries with Enova.
- Projects that are commercially profitable without support
- Projects that have already been initiated or where a decision has already been made to implement the project

Contacts
Enova's telephone/web-based help line: svartjenesten@enova.no, tel. (in Norway) 08049
Program coordinators:
Trude Tokle, Senior Advisor, tel. +47 73 19 04 54
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Application requirements
Electronic application forms for the new district heating business program, as well as guidelines for completing the application, can be found on www.enova.no. After the application is submitted and recorded, the application will be assigned a project number that will serve at the reference in connection with all subsequent contact with Enova.

The application must contain:
- Brief description of the project, participants and reference projects
- Technical description of heating plants, infrastructure and customer centres
- Map of the delivery area with the facility sketched/drawn in
- Description of the market base, expected delivery of district heating and cooling for at least ten years
- Overview of planned fuel for at least ten years
- Municipal plan for energy, etc., where available
- Documentation of project costs, including invest ment and operating costs
- Documentation of expected district heating price delivered to end user and power price (long-term power price to be used as the basis)
- Cash flow analysis, ref. electronic application form. The analysis must show the project's profitability and document the economic assumptions
- Progress plan with milestones
- Financing plan (sources and amounts)
- Copy of any district heating licences
- Copy of relevant agreements with customers and partners
- Status regarding obtaining necessary permits
- Municipal land use plan and zoning plan may be requested.

Other award criteria
- The project must be initiated within 18 months and completed within five years after the contract is signed with Enova
- The developer must have liability insurance and property damage insurance
- Quarterly reporting is required during the building period, and annual reporting of energy deliveries divided between energy carriers for up to ten years after completion.
- Requirements may be stipulated for presenting necessary permits, binding financing plans, including financial guarantees, etc. prior to disbursement
- The support is paid in arrears as a percentage of incurred costs
- Final accounts certified by an authorised public ac countant and a final report must be submitted be fore the final disbursement.

Application deadlines

Enova has four regular application deadlines each year: 15 January, 15 April, 15 July and 15 October.

Enova's intention is to process the applications within eight weeks. We invite applicants to contact Enova directly by telephone or e-mail prior to finalising their applications. All application information is kept confidential. Projects that receive funding commitments will be announced, including the name of the project owner, project title, targets for delivered energy and support amount.

Enova's objective is to inspire and motivate private and public sector enterprises to choose energy-efficient solutions. We will accomplish this by providing information and increasing awareness about the opportunities that exist, and by supporting well-founded projects aimed at alternative energy generation, energy conservation or energy restructuring.

Enova's work is organised in the form of programs and tasks. We invite enterprises to present their activities and to apply for subsidies within the respective program areas. Enova manages the Energy Fund and provides support for various types of projects based on a specific set of criteria.

On our website www.enova.no you will find more information about Enova, our programs and the work we do to promote a more energy-efficient and environmentally friendly Norway.

Contact us: www.enova.no
Enova's help line: tel. 08049 (in Norway)

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