

Renewable Energy Policy Review

Sweden

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SWEDEN

1. General information

Population and geography

Area: 450,000 km² third largest country in Western Europe. Forests represent 53% of the land area, mountains 17%, cultivated land 8%. Lakes and rivers cover 9% of the country. The longest distance north-south is 1,574 km (978 mi.) and the longest distance east-west is 499 km (310 mi.) Swedens population is 9 million and its capital city is Stockholm.

Forests:						53%
Mountains:						17%
Cultivated			land:			8%
Lakes					rivers:	9%
Longest	north-south	and	distance:	1,574	km	(978 mi.)
Longest east-west distance: 499 km (310 mi.)						
Capital Stockholm Population 9 million inhabitants						

With fewer than nine million people, Sweden is a small nation in terms of population - smaller than Belgium and only half as big as the Netherlands. Perhaps this is why foreigners are often surprised when they realize the geographic size of the country. Physically, Sweden is one of the largest countries in Western Europe - larger than California and nearly the same size as Spain or France. Because of its large area and limited number of inhabitants, Sweden is one of Europe's most sparsely populated countries. Yet it is worth noting that nearly 90 percent of the population lives in the southern part of the country. Fewer than a million people live in Norrland, which accounts for nearly 60 percent of Sweden's area.

Sweden is a constitutional monarchy, in which a King is head of state, but royal power has long been limited to official and ceremonial functions. Sweden is member of the European Union since 1995. The nation's legislature is the Swedish Parliament (Riksdag), with 349 members. Sweden has three democratically elected levels of government: the Riksdag (Swedish parliament) at the national level, the county councils at the regional level and the municipalities at the local level. They each have different duties and areas of responsibilities.

The main functions of the Riksdag are to enact laws and determine national expenditure and revenue. Another central task is to scrutinise and exercise control over the Government and the public administration. The Riksdag also influences foreign policy and has an insight into the work of the EU through regular consultations with the Government. County councils handle matters that are too comprehensive and costly for individual municipalities to manage. Sweden has 18 county councils, two regions and one municipality that does not have a county council (the island of Gotland).

Sweden has 289 municipalities. Municipalities are responsible for local issues that affect the immediate environment of citizens. The specially regulated tasks of municipalities include education, social services, care of the elderly, care of persons with physical or intellectual disabilities, physical planning and building, technical services, certain environmental tasks and rescue services. Municipalities also support cultural and recreational activities, for example, sports facilities, libraries, etc.

Aided by peace and neutrality for the whole 20th century, Sweden has achieved an enviable standard of living under a mixed system of high-tech capitalism and extensive welfare benefits. It has a modern distribution system, excellent internal and external communications, and a skilled labor force. Timber, hydropower, and iron ore constitute the resource base of an economy heavily oriented toward foreign trade. Privately owned firms account for about 90% of industrial output, of which the engineering sector accounts for 50% of output and exports. Agriculture accounts for only 2% of GDP and 2% of the jobs. The government's commitment to fiscal discipline resulted in a substantial budgetary surplus in 2001, which was cut by more than half in 2002, due to the global economic slowdown, revenue declines, and spending increases. The Swedish central bank (the Riksbank) is focusing on price stability with its inflation target of 2%. Growth remained sluggish in 2003.

2- Renewable energy policy

Renewable energy country profile

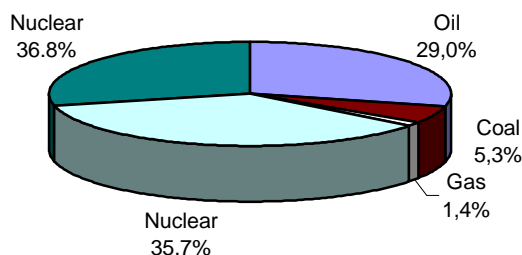
Energy Country Profile

Population	8.87	Millions
Area	449,964	km ²
Total Primary Energy Supply	50.31	Mtoe
Electricity Production	161.704	TWh
Electricity Prod. by source		
Fossil	4.07	%
Hydro	48.97	%
Nuclear	44.59	%

Other 2.37 %

Source: CIA World Factbook 2001

Primary Energy Share 2003



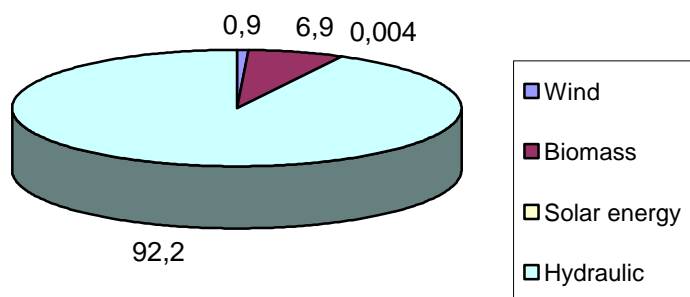
Source: EUROSTAT

In Sweden the electricity consumption per capita is one of the highest in Europe. This has been due to a policy to promote the use of electricity in heating for the commercial and residential areas. Hydro and nuclear plants dominate electricity generation capacity. Swedish energy imports account for nearly 70% of supplies, mainly in the form of oil. The majority of electricity generation (90% in 2000) is met by nuclear and hydropower.

Sweden has a national target of reducing carbon dioxide emissions by 4 per cent between 2008-2012, compared with their 1990 levels. In the context of the EU's burden sharing arrangements, Sweden has committed itself to only allowing its average emissions of greenhouse gases to increase by 4% per cent between 2008 and 2012 compared with their 1990 levels. (source IEA Energy Efficiency update 2003 Sweden)

The Swedish Parliament has since decided that Sweden's emissions should, taken as an average for 2008-2012, be at least 4% lower than its emissions in 1990. (source Analysis of Sweden's success in achieving its national indicative targets for RES electricity Drawn up pursuant to Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market, 2003)

Share of RES in the electricity production (%) 2003



Renewable Energy Sources

Renewable energy country profile

Renewable energy technology in 2003 in capacity

Sweden	
SPV (MWc)	
Grid connected	0.17
Off grid	3.40
Total	3.56
STH (square meter installed)	192.157 m2
Average surface for 1000 (2001 figure)	22 m2
SHP (2001 figure)	935 MW
Biogaz (Mtep) (2002 figure)	115
Wood (Mtep) (2002 figure)	7.86
Wind (MW)	399

Source Eurobserv'ER 2003/Sun in Action 2/EWEA

Renewable energy contributed 29.1% of Sweden's total energy supply and 51.3% of total electricity supply in 2001 compared to EU averages of 5.8% and 15.5% respectively. (IEA Renewables Information 2003) The currently available statistics on RES electricity eligible under the electricity certification scheme are not precise, but the Electricity Certification Inquiry Report (SOU 2001:77) put the total for 2002 at 6.1 TWh. This figure includes small-scale hydropower production (1.7 TWh), biofuel-based CHP and wind power. (source Analysis of Sweden's success in achieving its national indicative targets for RES electricity Drawn up pursuant to Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market, 2003)

Hydro

Sweden is the only Member State where Small Hydropower installed capacity has decreased by 3% between 1990 and 2001, from 964 MW in 1990 to 935 MW in 2001. About 3 807 GWh of electricity was generated by SHP in 2001, which represented about 5% of the electricity generated by Hydropower and about 2% of the total electricity generated in Sweden. Hydropower contributed 50% of the total electricity generation of the country in 2001. In last years, SHP is following a decreasing trend. Furthermore, public acceptance for building new hydropower in Sweden is extremely low, and considering this, the Swedish National Energy Administration estimates that potential will increase only 1 TWh from its 1996 value, when it reached its peak of 973 MW by 2005. Finally, the estimated installed capacity of small-scale hydropower plants in Sweden in 2000 was 1,062 MW and the installed capacity of low temperature geothermal heat (excluding heat pumps) was 47.0 MWth with total energy production of 507 PJ (141 GWh). This is a minor increase from 1999, where the installed capacity was 1,050 MW.

Biomass

Biomass produced 146-169 TWh by the year 2000, roughly two-thirds from wood and derived products, with the remainder from energy crops (agricultural fuels). However, this potential far exceeds the expected demand from the market. The majority of biomass, 5.1 Mtoe, is used directly, with the remainder being used to generate electricity and heat. Sweden and Finland rank in the top four for the use of wood energy. Their common point is the presence of vast expanses of wooded land on their territories (respectively 24 and 20 million hectares) and a real tradition in exploiting wood for energy. If primary energy production is considered in the context of the number of inhabitants, then Finland and Sweden move up to the first place positions. A technique for producing electricity from wood is gasification. Still in the development stage, this technology is the object of several research programs, notably that of Varnamö (Sweden). (source EurObserv'ER, Wood Energy Barometer 2003) Urban sewage plants are the main source of biogas that is used as fuel or injected into the public natural gas network (particularly in Sweden). Sweden is the most advanced country in Europe when it comes to using biogas as fuel, and counts approximately 1 500 vehicles that come mainly from professional fleets. (source EurObserv'ER, Biogas Barometer 2003)

Wind

Wind capacity and generation has been growing steadily since the beginning of the decade and by the beginning of 1998 there were 336 turbines in operation with a capacity of 123 MW. Wind production was 144 GWh in 1996, 440 GWh in 2000. This compares to an estimated 3-7 TWh on-shore potential (after considerations for e.g. the military, other national interests, nature preservation, environmental and institutional aspects have been taken into account) and an additional 20 TWh off-shore potential. The government aims to increase annual electricity production from land-based wind power by approximately 0.5 TWh over five years. The installed capacity of wind power was 399 MW at the end of 2003 (EWEA website)

Solar Thermal

The accumulated area of solar thermal collectors was 161,900 m² in 2000. The demonstration plant in Kungälv is currently the largest solar heating plant in Europe (March 2001). The market has been influenced negatively by shortsighted investment incentives, either in the form of market subsidies or support for demonstration projects. Since 1978 there have been about 10 different types of national incentive schemes. The present market situation is weak due to the low interest of installers and house owners and low energy prices, in combination with a relatively large number of small manufacturers with limited resources for rational manufacturing and marketing due to the low market penetration. Early development was focused on large plants, and 25% of the installed collector area is related to large plants (>500m²), e.g. one of the largest plants in Europe so far with 10.000m² of ground mounted collectors in Kungälv 20 km north of Göteborg. (source Sun in Action 2)

Solar PV

The PV power installed during 2002 in Sweden amounted to 265 kW, which is a slight increase compared to the past few years. This means, however, that the trend for the cumulative installed power still is best described as a linear increase. The exponential increase that can be observed when analyzing the installed power in all the IEA countries is not present in Sweden. This is probably due to the lack of government subsidies and long term PV goals. In 1996 the Swedish Energy Agency together with the Swedish Foundation for Strategic Environmental Research, MISTRA, decided to start a new and merged programme for R&D on PV. The programme is called Ångström Solar Center (ASC) and is located at Uppsala University. The first phase had a total financing of 70 000 000 SEK, (1 000 000 USD) and lasted until the end of year 2000. The second phase started in the beginning of year 2001 and will last until the end of year 2004, with a total financing of 80 000 000 SEK (1 200 000 USD).

The overall goal of the Ångström Solar Center programme is to contribute to a sustainable energy system in the future, preferably contributing to the economic competitiveness of Sweden. Furthermore, the Swedish national co-financed programme on PV systems and applications, PV 03-07 (SolEI 03-07) managed by Elforsk, started a new period during 2003 with financing for 2+2 years. It primarily involves the energy and building industry, but new participants from the manufacturing industry and property managers have also joined the programme.

This programme is complementary and to some extent linked to the Ångström Solar Center R&D programme. The main task is to perform development, objective analysis and information dissemination concerning technical and non-technical issues, costs and applications of PV systems.

RE Policy Outlook

Sweden's current energy policy is based on the 1991 Government Bill. This bill included investment support for wind, solar, CHP systems and biofuel production, and an energy conservation programme. Sweden also introduced energy taxes, which were originally intended to stimulate energy saving and renewable energy, and are now also intended to reduce the environmental impact of energy. These energy taxes consist of a general energy tax, a CO₂ tax and a sulphur tax. In 1991, this general energy tax on fuels and electricity was halved for fuels, to make way for a new CO₂ tax. In 1992, the government also introduced a NO_x tax. Sweden is implementing a "green tax exchange" whereby taxes on environmentally harmful activities are raised, while taxes on labour are reduced by a roughly equal amount. A step in the green tax exchange was performed in 2001, when taxation on energy products was increased by about SKr 3 billion⁸. The CO₂ tax rate was raised from SKr 370 per tonne to SKr 530 per tonne. The energy tax on diesel went up by SKr 0.1 per litre and the energy tax on electricity was raised by SKr 0.018 per kWh. In accordance with the principles of the green tax exchange, the bulk of this increase was offset by a higher tax-free allowance and a reduction in employer's levies. A further green tax exchange was carried out in 2002 when taxation on energy products was raised by about SKr 1.7 billion. The tax rate on CO₂ was raised from SKr 530 per tonne to SKr 630 per tonne, and the energy tax on electricity went up by SKr 0.012 per kWh; taxes on labour were reduced by a compensatory amount. The rises in the tax on CO₂ and electricity affect only consumers. Taxes on the transport sector have been left largely unchanged. The reductions in CO₂ tax that apply to the industries with exemptions i.e., manufacturing, agriculture, forestry and aquaculture) have been adjusted from 50% to 70%. This adjustment largely offsets the higher CO₂ tax and keeps the overall tax position of these sectors unchanged. (IEA Standard review Sweden 2002)

Sweden's energy policy, as decided by the Swedish parliament in 1997, is to provide secure short-term supplies of electricity or other energy on competitive terms. The country's energy policy is intended to create conditions for efficient use and cost-efficient supply of energy, with minimum adverse effect on health, the environment and climate, while at the same time assisting the move towards an ecologically sustainable society¹.

The Government programme running since July 1997 supports renewable energy investments in order to encourage increased production of renewable electricity, particularly from biomass and wind. The Parliamentary decision on energy policy in June 1997 Toward a Sustainable Energy Supply, included a strategy for reducing the energy sector's impact on climate. The strategy is based on the view that successful international co-operation requires an equitable distribution of commitments and mitigation costs, and that national circumstances should be taken into account when determining environmental commitments.

Grants available since July 1997 are:

- 25% for investments in CHP plants based on biomass (up to 3000 SEK/kWe), with a 5-year budget of 450 M SEK;
- 15% for wind turbines over 200 kW, with a 5-year budget of 300 M SEK;
- 15% for environmentally friendly, small-scale (<1.5 MW) hydro plants, with a 5-year budget of 150 M SEK.

This compares to similar grants for CHP and 35% grants for wind turbines > 60 kW under the previous investment support programme, initiated in July 1991. In addition to the 1997 investment support programme, the government set up a 5-year technology procurement programme for renewable electricity production from January 1998. Total funds for the procurement programme are 100 M SEK.

A seven-year programme aiming at an ecologically sustainable energy system was initiated in January 1998. Total programme funds of 5.28 billion SEK (on average in 1997, 1 US \$ = 7.635 SEK) are available over the seven-year period, including 2.73 billion SEK on energy research in Sweden. This reverses the previous downward trend in government R&D expenditure. An additional 1.61 billion SEK is dedicated to the support of commercial electricity production from renewables.

¹ In 1997 the Parliament decided to phase out all nuclear power plants and in 1999 one of the reactors at the Barsebäck plant was closed down. In order to fulfil the overall objective the Parliament has initiated a long-term research, development and demonstration programme (SEK 5.6 billion, €610 m) and a short-term subsidiary programme (SEK 3.5 billion, €382 m) to promote energy efficiency and electricity production from renewable energy sources. There is a plan to supply about 7% of total electricity consumption from wind power in a decade. Almost half of district heating consumption is accounted for by biofuels.

A new public authority, the Swedish National Energy Administration (STEM), was set up on 1st January 1998, with the responsibility for implementing most of the energy policy programmes and coordinating the work of restructuring the energy system. In addition, The Administration is also responsible for monitoring developments in the energy and environmental fields and for providing information on the current energy situation. This covers aspects such as changes in the structure and pattern of energy supply and use, energy prices and energy taxes and the effects of the energy system on the environment.

Electricity

Sweden has set a target of a 10 TWh increase for RES electricity between 2002 and 2010. According to the analysis, the increase will be 10.9 TWh. Including existing RES electricity production, Sweden's total production of RES electricity will be 80.4 TWh in 2010. This corresponds to 50.5% of gross national electricity consumption. (source Analysis of Sweden's success in achieving its national indicative targets for RES electricity Drawn up pursuant to Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market, 2003)

During the 1990's the Swedish electricity market has been reformed in several steps. Since 1 January 1996, Sweden has a liberalised electricity market. All consumers are free to choose their electricity supplier. The objectives of the reform have been to increase the freedom of choice for electricity consumers and to create conditions for greater pressure on prices and costs in the electricity supply.

The electricity networks throughout the country must be open to all players on the market who have paid a connection charge somewhere in the country. The Swedish National Energy Administration is responsible for monitoring the network operations on the reformed electricity market. The Swedish electricity system is connected with the electricity systems of other Nordic countries (exc. Iceland). As a result of the reformation process in the Nordic countries, there is nowadays a free access to the interconnections between Sweden, Finland and Norway. Thus, it is possible for Swedish, Norwegian and Finnish power generators and consumers to buy and sell electricity in the three countries. Also major Danish companies are active on the Nordic electricity market as well as companies from other neighbouring countries.

In Sweden electricity produced from renewable is supported by buy-back rates. The buy-back rates for 2002 for electricity produced in small hydropower plants and sold to the utilities or traders consist of the following.

- Price for electricity sold to an utility or a trader working on the deregulated market
- Price given by the local grid owner that is equivalent to the cost reduction in the net due to the locally produced power
- A state support at a fixed price per kWh

The Feed-in system (with support prices in the range 0.97 cents €/kWh to 1.95 cents €/kWh) was the main instrument used to promote RES-E. **until 2003**. As from May 1st 2003 a **TGC scheme is being** implemented in order to reach the ambitious targets set by the government (to increase RES-E consumption by 10 TWh from 2002 to 2010). TGCs apply to wind, solar, geothermal, hydro-electric, wave and biofuel power. The framework is a quota-based system, meaning that an obligation is placed on all electricity consumers to purchase an increasing proportion of their electricity consumption from renewable sources, starting from 7.4% in 2003 and reaching 16.9% in 2010. Consumers fulfill this obligation by buying from green generators enough certificates to cover such a quota and surrendering them to the Swedish Energy Agency. In practice, electricity distributing companies will take care of the obligation on behalf of their clients who do not give notice that they wish to manage their quota obligation themselves. Energy-intensive industries are exempted from the obligation in the initial phases of the scheme. Whether or not they will have an obligation in the future is under consideration. Any user/supplier who has surplus electricity certificates may sell them or save them for the needs of future years since green certificates have an unlimited life. The certificate price will be set on the market. However, there is a minimum price and a theoretical maximum price indicated by the penalty charge. The minimum price is the buy-out price at which the Swedish Energy Agency has to buy the certificates from the producers if they find no buyers for their certificates. This minimum price starts at 6.5 €/MWh in 2003 and will be thereafter gradually reduced and entirely phased out in 2008. There is also a penalty charge for those electricity consumers who do not fulfil their quota obligation by showing enough certificates. The penalty charge is 150 % of the average certificate price during the year, but with a maximum of 19.1 €/MWh for certificates to be surrendered during 2004 and 26.2 €/MWh for certificates for 2005 (plus taxes). The green certificates market is still extremely thin since most deals are closed bilaterally between the green generators and the buyers. There are two types of contracts in the market: the *fixed volume contract* in which the buyer is guaranteed a certain amount of electricity and the *falling contracts* based upon an estimation of how much the green generator expects to produce. The former is usually a bit more expensive.

Since it is doubtful if wind power is going to be deployed in large scale under the relative low level of TGC prices in Sweden, the Swedish government has proposed to give transitional subsidies for wind power production. This

bonus is given until a windmill has run for 25,000 equivalent full load hours from it started to produce power. This transitional subsidy will only be given for a five-year transitional period 2003-2007, in which the bonus will be gradually phased out.

Wind subsidies	2003	2004	2005	2006	2007
cent €/kWh	1.63	1.30	0.65	0.65	0.33

heating and Cooling

Biofuels for heat production are promoted via the taxes on fossil fuels. Biofuels in CHP are promoted via the investment aid described elsewhere. The investment aid to district heating indirectly reinforces the promotion of biofuels.

Transport

Biogas as a motor fuel is generally exempted from tax. The government has a right to apply exemptions or reductions in the rates of duty to fuels used in the field of pilot projects for the technological development of more environmentally friendly products and in particular in relation to fuels from renewable resources. With reference to this regulation, the government has given relief from excise duties to pure ethyl alcohol (ethanol) used as motor fuels in pilot projects and has set the energy tax rate for 1998 at 0,90 SEK (0,10 ECU) per litre and the carbon dioxide rate at 0 SEK for such alcohol used in mixtures with other fuel components, such as diesel oil or petrol. Further, the government has granted tax relief for rapeseed methyl ester (RME). Electrically powered rail transport is energy-efficient and has a very small impact on the environment. This was one of the reasons why the government adopted a ten-year investment plan for railway infrastructure amounting to SKr 36 billion in 1998. A new authority, *Rikstrafiken*, has been created to promote the long-distance public transport system. It will encourage the use of public transport and support unprofitable public transport considered socially desirable. Since 1991, the tax on petrol includes a carbon dioxide tax estimated to have generated about 11% of the state's revenues from road traffic-related taxes in 1996. VAT of 23.46% was imposed on petrol in 1990, and has since been raised to 25%. Up until October 1993, a tax was paid on diesel-powered trucks, cars and buses, based on distance driven (kilometre tax). This tax required border controls and was replaced by a diesel oil tax after Sweden joined the European Union. Sweden also levies sales tax, annual vehicle tax and user charges. Sales taxes are levied on light vehicles only. The annual vehicle tax is differentiated according to vehicle weight and fuel. Only heavy goods vehicles are charged so-called user charges (Eurovignette).

Rail transport is excluded from energy taxes, but there is a user fee system. Parliament reduced this fee in 1998 in order to increase the relative competitiveness of rail transport. Energy taxes do not apply to maritime and air transport. Shipping pays environmentally differentiated seaway charges, and aviation pays route charges according to the Eurocontrol procedure. (IEA Energy Efficiency Update 2003 Sweden)

Research and Development

In 2000, the Swedish government devoted about SKr 646 million to energy-related R&D, making its energy R&D budget one of the largest in Europe. Of the total budget, 36% was spent on conservation, 34% was spent on renewable energy technologies, and 10% on power and storage systems. (IEA Standard review Sweden 2002)

3. RE Highlights

Sweden — Biomass district heating

District heating systems are widespread in Sweden, with over one third of the total domestic heat market supplied from district heating. There are nearly 200 plants, and biomass is one of the main fuel sources. Biomass as a fuel source for district heating plants has been increasing steadily over the past two decades, particularly to replace electricity for heating. Biomass resources now meet more than 50 % of the fuel supply to district heating networks.

Success factors:

Political: Support for renewable energy use, especially biomass

The overall objective of Sweden's energy policy is to secure the long- and short-term energy supply on economically competitive terms, with an emphasis on sustainable development. Sweden has a policy to prevent an increase in carbon dioxide emissions, and it has also made commitments to phase out its nuclear generation capacity. Long-term support for research and development into new and renewable energy technologies, and a greater use of renewable energy, are two principal means of achieving these aims. Biomass especially plays a vital role. Sweden has a policy objective to replace electric domestic heating with combined heat and power or district heating systems, especially making use of biomass for fuel.

• Fiscal: Tax system benefits biomass use

Biomass is exempted from the energy tax, the carbon dioxide tax and the sulphur oxides tax. The increase in biomass district heating has been greatly helped by the introduction of carbon and energy taxes as their application made other options, in particular coal-fired district heating plants, more expensive.

• **Technological development: Active development and promotion of biomass technologies**

Swedish research and development actively supports technological developments in renewable energy. Biomass research, development and demonstration receive total funding of about SEK 400 million (EUR 35 million) per year from the government. Electricity companies and other industries also provide funds. The main areas of support are combustion and conversion technologies, demonstration of pre-competitive technologies, fuel production, harvesting supply programmes and ash recycling.

• **Administrative: Municipalities actively support the establishment of biomass district heating systems**

Development of biomass district heating systems is primarily the responsibility of each municipality. Most domestic district heating systems are owned and operated by municipalities, or by private companies on their behalf. Biomass-fuelled district heating provides economic and environmentally sustainable heating for domestic and industrial use, whilst at the same time providing economic benefits through employment of the local population and a disposal option for sawmill wastes. A number of municipalities have recognised the socio-economic and environmental benefits from biomass district heating and are proactively promoting biomass-fuelled systems. Forestry is one of the most important natural resources in Sweden, which has a long history of making use of this resource for fuel.

Regional or local best practice: 100% Renewable Energy Region Vaxjö

In 1996, the executive committee of Vaxjö municipality unanimously decided to stop using fossil fuels in the activities of the municipality. Furthermore, the aims set by the Climate Alliance, of which Vaxjö is a member, have been unanimously accepted

The initiative, fitting the Agenda 21 development scheme, was basically focusing an integral exploitation of biomass resources, maximum penetration of RE technologies and a change of attitude with regard to transport. Among the undertaken actions, the following are worth to be emphasised:

Since the beginning of 1980s Vaxjö Energy Ltd, VEAB, has worked towards replacing oil by bio-fuel and developing a combined heat and power plant in Vaxjö. Major parts of the city are served by district heating and new areas are continually added. for trade, culture and education in southern Sweden. It is located right in the middle of Southern Sweden, 250 km north of Copenhagen, in the province of Småland. The ambition of the Municipality of Vaxjö is to achieve a 100% RES supply for its city, by undertaking activities in the fields of biomass and solar energy and transport sector.

The municipal housing company, Varendshus, has had encouraging experience with solar panels. During 1998-2003, the municipality will press for the use of solar heating by means of a general subsidy to households for the installation of solar panels. At Vaxjö Public Transport Company, buses run on 50% RME (rape-methyl-ester). Vaxjö and a number of companies are co-operating to start production of DME (di-methyl- ether) and methanol, which can be extracted from biomass.

Overall evaluation: The city's accomplishments did not go without recognition. On June 29 of this year Vaxjö became the proud winner of the Local Initiatives Award for Excellence in Atmospheric Protection for setting aggressive greenhouse gas reduction targets and outstanding efforts to achieve them.

Success Factors:

Financial: Vaxjö has received an investment grant from the Swedish Ministry of Environment of approximately 9m Euro that generates total investments of 34m Euro, in a number of private and public organisations in order to reduce the use of fossil fuels by 32 000 tonnes.

Political: Another important factor to be considered is the political consensus concerning Fossil Fuel Free Vaxjö.

Challenges:

We are more known among other municipalities in Sweden and the world for our work, than we are at home. The main problem is to change peoples. Attitudes towards transports. Political decisions at national level can sometimes be problematic for our objectives, for example tax legislation. Many Swedish and European cities have declared they should be Fossil Fuel Free, Vaxjö was the first city to declare that. Vaxjös system for monitoring fossil CO2 has become a model for Swedish municipalities. Experience replication capacity Experience replication capacity has actually reached Japan, where the Iwate Prefecture will introduce bio-energy after studying Vaxjös experience.

In 2002, RES stands for 43% of the total energy supply to Vaxjö (this includes transport sector). If transport sector is excluded, the increase was 52%, and the RES stands for 67% 2002. Reduction of CO2: 795 kg or 17.2 %/capita (1993-2002). This can be split into a reduction of 59.3 %/capita for heating and an increase of 20.6 %/capita for transports.