

# BIOMASS CHP

# VÄXJÖ (Sweden)

*If the share of renewable energy in Europe is to be increased by 12% by the year 2010, one has to consider an increase in the use of biomass, both for heat and electricity production. Wood and wooden waste are anything but rare, but they need rather heavy investments if they are to be fully exploited. That is why the use of wood as a real renewable energy source (keeping the sustainable use and growth in mind!) still is subordinate in comparison to other renewable energy sources. Nonetheless, some cities (many of them in Scandinavia) have had successful experiences, like in Växjö in Southern Sweden, where the biomass share is reaching quite high levels.*

## THE CITY

Växjö is "the city by the lakes where the roads meet". The municipality of Växjö is located right in the middle of Southern Sweden, being the capital of the county Kronoberg, placed in the province of Småland. The municipality of Växjö has 74,000 inhabitants, of whom approximately 52,000 live in the city of Växjö.

Today, Växjö and Kronoberg, are some of Sweden's most dynamic regions.

### Climatic data:

Degree days (Basis 17 °C): 3,653 °C

Annual mean temperature: 7.5 °C

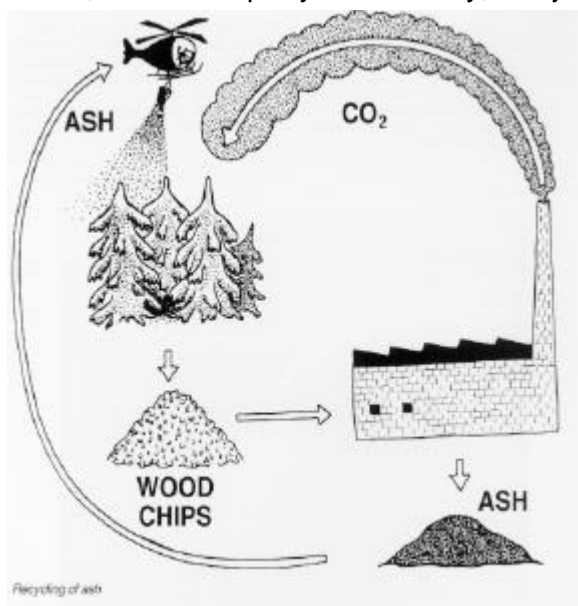


## CONTEXT

In 1980, Växjö was one of the first cities in Sweden to use biomass for co-generation of district heating and electricity. In 1996, the municipality decided to try to achieve a fixed goal: the emissions of CO<sub>2</sub> from fossil fuels in the municipality to be reduced by 50% per capita by 2010, compared with the 1993 level. To top this off, the municipality will stop using fossil fuels! Biomass and increased efficiency, both in the energy and transport sectors, will be used in large part to achieve this goal. In the year 2000, 64% of the energy supplies for heating were from biomass (peat not included). Of the total energy balance for the municipality (transports included), biomass stands for 26%. In 1996, the municipality of Växjö made a local energy plan. The aims of the energy plan can be shortened into two sentences: "to secure an efficient and safe energy supply on a competitive basis", and "to change to an energy system that works in co-operation with nature, based on sustainable energy sources". Renewable energy creates jobs in the municipality and, being independent of import of fossil fuels, improves the balance of payments for the country as a whole. Because of the progressive policy of the municipality, the city was elected to be a "member" of the "100 Communities" in Europe, monitoring good practice concerning renewably energy technologies. Being a part of the "100 Communities" gives Växjö the opportunity to participate in an extensive, European network.

## EXPERIENCE OF VÄXJÖ

Since the oil crisis in the early seventies, the municipality of Växjö has been progressive in energy and environmental concerns. Already in 1980, the municipality's own utility, Växjö Energi A/B (VEAB), converted the power plant "Sandvik" from pure oil burning to combined oil and biomass burning. In addition, the district heating system connected to "Sandvik" was expanded. In 1996, the construction of "Sandvik II" started. Today the Sandvik power plant is producing nearly all the heat consumed by the city of Växjö and approximately 35% of the needed electricity. More than 95% of the fuel is biomass (peat included). There is an environmental issue with disposal of ash produced when burning biomass. The ash should, in all cases, be returned to the forest because of nutrient recycling. VEAB is doing it on a trial basis. This is not done everywhere by people utilising biomass; instead, it is disposed on landfills. The principle of recycling is shown on the right.



### The new power plant

The high level of biomass based energy was achieved in 1997, by the commissioning of the new combined heat and power plant, Sandvik II, solely based on different types of biomass. Because of the type of furnace – the circulating fluidised bed principle – the system is quite flexible. It should be added that the low (800-900 °C) and even burning temperature in the fluidised bed furnace causes less NO<sub>x</sub>-emissions compared to conventional furnaces. Lastly, it should be mentioned that the chosen type of furnace is easy to regulate compared to other systems. It is possible to run the furnace down to 20% of the maximum output without additional oil firing. The small amounts of fuel that are in the combustion chamber at any time make it fast to adjust. Sandvik II has in great part been financed by the Swedish government (a total investment of 46.9 million Euro, 445.081 million Swedish Kroner). The reason for this is the aim of phasing out the nuclear power plants in Sweden. Something has to replace that. Without the support from the state it would not have been possible for the municipality to be that progressive.



Facts about the Sandvik II plant:

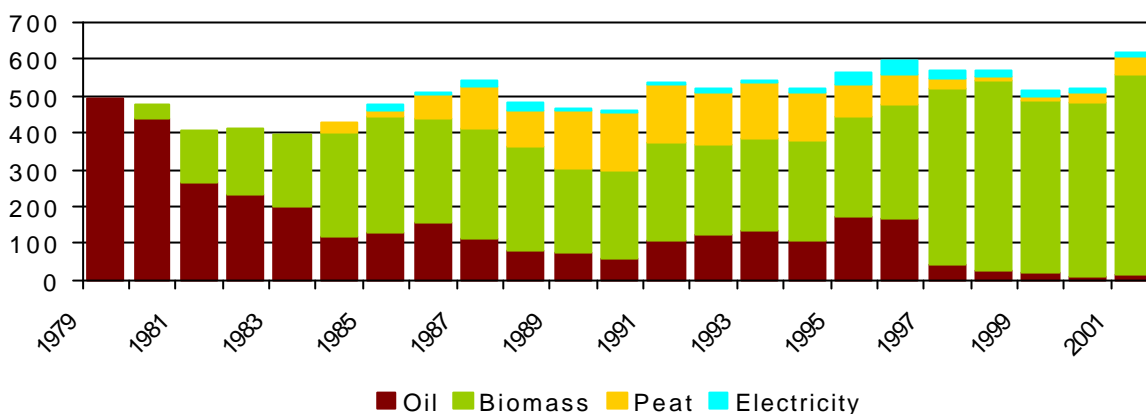
It runs solely on renewable biomass fuels like wood chips, bark, and peat.

- Total available power output is 37 MW; total available heat output is 63 MW.
- High output of electricity compared to conventional power generating processes. A bit less than one third of the total energy output is electricity. This is due to economical considerations. When the electricity price is low, the plant produces more heat and less electricity than it is capable of.

- A good environmental record. The Sandvik plant produces around 110 GWh of electricity and 450 GWh of heat yearly. This corresponds to savings of 55 000 m<sup>3</sup> on oil.

Below, the distribution of different types of fuel has been monitored over the last 20 years. It shows that in the last 20 years, the biomass part has grown remarkably. The blue part (electricity) represents the power used for district heating.

**Fuel supply 1979-2001 (GWh)**



### The district heating system

Most housing estates and many industries are heated with district heating from the Sandvik plants. The distribution network in Växjö is very well built out compared to other cities. Many residential houses are also connected to the district heating network. For the consumer, district heating means a comfortable heating alternative. The energy cost is both stable and very competitive compared to oil and electrical heating. The total of connected district heat consumers is approximately 3400 (700 larger consumers and 2700 one-family houses). The percentage of centrally located connectivity is greater than 90%.

At a local level, small-scale district heating (närvärme) in the surrounding villages, the municipality can offer a good alternative to fossil fuels and electrical heating, even for consumers living outside the central parts of Växjö. Närvärme is based on small furnaces established at the villages. At the moment, närvärme is present in Ingelstad, Rottne, Lammhult and Braås. Today, more than 85% of the heat demand in these villages is covered by biomass. This development of bioenergy is monitored and operated by the Bioenergy Research Group at Växjö University. The research group is presently managing a regional development project where 15-20 more systems are being planned in Växjö and other parts of the Kronoberg County.

### Local commitment

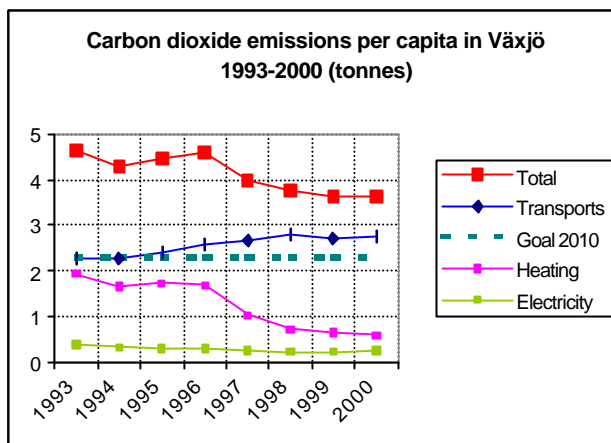
One very important parameter, which has been crucial to the making of the energy plan, has been the local commitment. In 1995, a case study on this subject showed that the local policy makers from the entire political spectrum were positive on the case of expansion of the Sandvik plant. The municipality of Växjö has been proactive in the sense that without the commitment from the policy makers and the employees in the municipality, the local energy plan would not have been attainable. The pre-election to be a part of the "100 communities" was a direct consequence of the energy plan and good work by the Agenda 21 committee in Växjö. The roundtable discussions have been valuable in the process of making the energy plan. It should be added as well, that a partnership (locally in Sweden) between Växjö, four

other cities, and The Swedish Society for Nature Conservation went on during three years. The aim of that partnership was to implement and spread the idea of fossil fuel free societies.

## EVALUATION AND OUTLOOK

With the aim of achieving a "fossil fuel free" city, the municipality of Växjö is continuously involved in projects getting the use of fossil fuel to decrease. Apart from using biomass to produce electricity and heat, the projects concerns things like: the use of bio-fuels in cars, different energy efficiency projects, implementation of solar panels on the roofs of private houses, education of citizens' communication and exchange of information with other progressive municipalities, and continuing round-table discussions with interest groups. In addition, the municipality offers free energy advice to the citizens. All municipal departments and companies calculate their emissions caused by fossil fuels from transport, electricity and heating. Statistics Sweden monitors the use of fossil fuels in the municipality. Total emissions of CO<sub>2</sub> from fossil fuels are diminishing due to great efforts in the energy sector to reduce the use of oil. Between 1993 and 2000, the CO<sub>2</sub> emissions decreased by 21.5% per capita. The total share of renewable energy in Växjö has increased, with regard to biomass only, from approximately 15% in 1993 to 26% in 2000, without the tax of peat. If the peat were included, the share would increase from 22% to 26%.

The CO<sub>2</sub> emissions from heating have decreased by 69% per capita between 1993 and 2000. However, CO<sub>2</sub> emissions from the transport sector have increased by 21% per capita in the same time. A task force is needed in this area, and becoming one of the "100 communities" is the first step.



## FURTHER INFORMATION

Växjö Kommun  
Henrik Jonhansson  
Planning Department  
BOX 1222  
S - 351 12 VÄXJÖ  
Tel: +46 470 413 30  
Fax: +46 470 415 80  
E-mail: [henrik.johansson@kommun.vaxjo.se](mailto:henrik.johansson@kommun.vaxjo.se)  
<http://www.vaxjo.se>

Växjö Energi AB  
Ulf Johnsson  
Kvarnvägen 35  
S - 352 41 VÄXJÖ  
Tel: +46 470 77 52 00  
Fax: +46 470 143 35  
E-mail: [info@veab.se](mailto:info@veab.se)  
<http://www.veab.se>

This case study was prepared by Energie-Cités in co-operation with the utility Växjö Energi A/B and the Municipality of Växjö. It received funding from the ALTENER Programme of DGXVII of the European Commission.

