BIOMASS
CHP-WOOD

VÄXJÖ
(Sweden)

If the share of renewable energy in Europe is to be increased to 12% by 2010, one has to consider an increase in the use of biomass, both for heat and for 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 has successful experiences, like in Växjö in Southern Sweden, where the biomass share is reaching quite high levels.

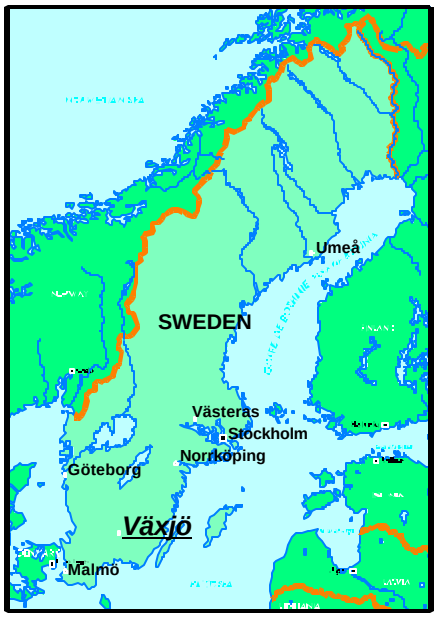
GENERAL ASPECTS

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, is one of Sweden's most dynamic regions.

Climatic data:

Degree Days (17 °C): 3653 °C
Annual Mean Temperature: 7.5 °C

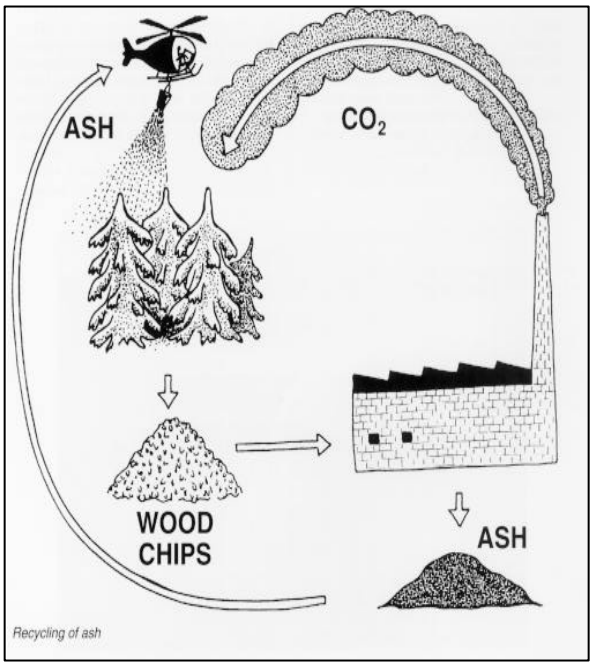


CONTEXT

Växjö was in 1980 one of the first cities in Sweden to utilise 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_2 from fossil fuels in the municipality must be reduced by 50% by 2010 compared with the level in 1993. As well, the municipality will stop using fossil fuels! The means of achieving that are due in large to part biomass and increased efficiency both in the energy and transport sectors. Approximately 5% of the biomass is peat. 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 locally 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 has currently been pre-elected to become a "member" of the "100 Communities" in Europe, monitoring good practice concerning renewably energy technologies. Being a part of "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 municipally owned 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 all the heat consumed by the city of Växjö and approximately 35 % of the needed electricity. More than 95 % of the fuel is biomass. 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 this 100 %. This is not done everywhere when people are utilising biomass, instead it is disposed on landfills. The principle of recycling is shown at the right.



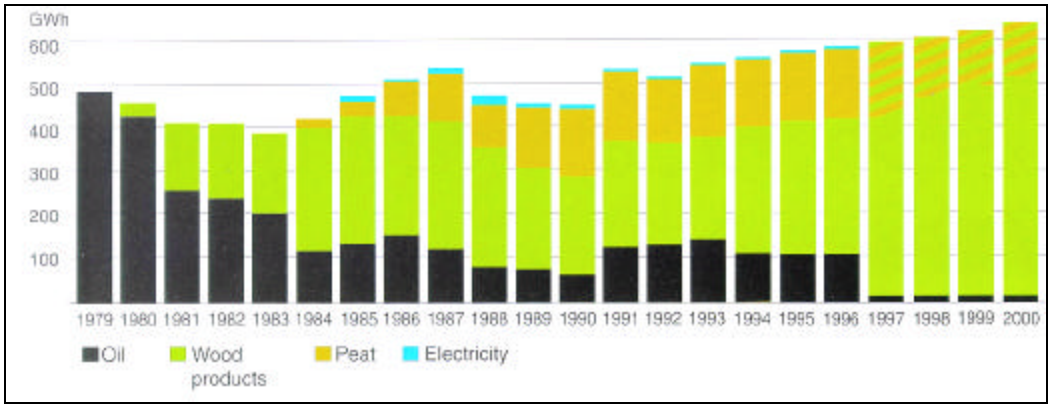
The new power plant

The high level of biomass based energy was achieved in 1997, by the commissioning of the new combined heat and power plant, Sandvik II, which is 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_x-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. (Total investment: 46.9 million €[1]). 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:

[1] Here one € eguals 9.49 Swedish Kroner.

- It runs solely on renewable biomass fuels like wood chips, bark, and peat.
- Total available power output is 37 MW and the 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 160 GWh of electricity and 350 GWh of heat yearly. This corresponds to a saving of 50 000 m^3 oil.

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



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 customer, district heating means a comfortable heating alternative. The energy cost is both stable and very competitive compared to oil and electrical heating. The amount of total connected district heat customers is approximately 2,850 (650 larger customers and 2,200 one-family houses). The percentage of centrally located connectivity is greater than 90%.

With locally based, small-scale district heating (närvärme) in the surrounding villages, the municipality can offer a good alternative to fossil fuels and electrical heating, also for customers living outside the central parts of Växjö. Närvärme is based on small furnaces established at the villages. Currently närvärme is present in Ingelstad, Rottne 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, which at present is managing a regional development project where 15-20 more systems are being planned in Växjö and other parts of the Kronoberg County.

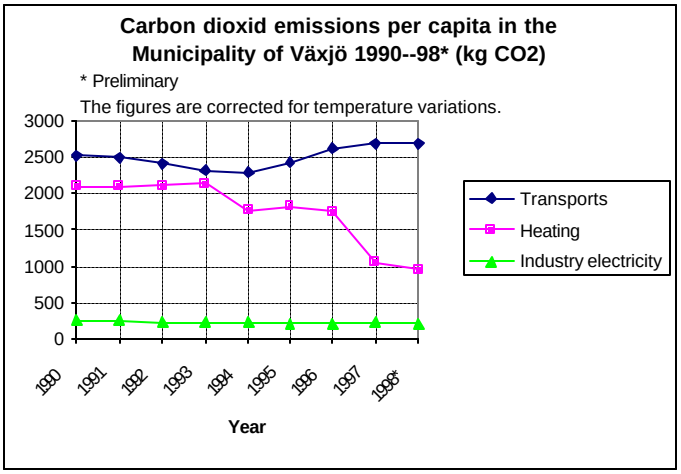
Local commitment

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, 4 other cities, and The Swedish Society for Nature Conservation currently is being implemented. The aim of that is to implement and spread the idea of fossil fuel free societies.

EVALUATION AND PERSPECTIVES

In 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 municipal buildings and private houses, communication and exchange of information with other progressive municipalities, and continuing roundtable 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 fuel from transport, electricity and heating. Statistics Sweden monitors the use of fossil fuels in the municipality. Total emissions of CO_2 from fossil fuels are diminishing due to great efforts in the energy sector to reduce the use of oil. The total share of renewable energy in Växjö has increased from about 20% in 1993 to about 30% in 1998[2], which means a reduction of the total CO_2-emissions with 16-17% over the last five years. However, CO_2 emissions from the transport sector are continuing to increase. A task force is needed in this area and becoming one of the "100 communities" is a first step.



FOR FURTHER INFORMATION

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[2] Peat is not included in these figures. The share of peat has gone down from 7 % to 1 % during the same period.