

## Markets for Short Rotation Crops – European experience

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### 1. ABSTRACT

Sweden is situated in the northern part of Europe and is because of the rough climate depending on heat and electricity especially in the winter period from September to May. There are no natural resources of oil or coal so the development of biofuel has been an important subject for about twenty years. Because of this Sweden is the country in Europe that has taken a leading part in the development of biofuel and SRC. Now the European Union has decided to promote renewable energy and to force each country to develop their renewable industry and the use of renewable energy. The market for SRC is very big in the European countries but will the countries succeed to reach the goals that have been decided by the politicians.

### 2. BACKGROUND

The European Union has taken three major decisions concerning renewable fuels.

- Kyoto Protocol
- White paper regarding energy from Renewable Sources (RES)
- Security of Supply

These three decisions strongly indicate the directions and give targets for renewable energy and put targets for each member state how to fulfill the goals.

From these decisions everybody can see that there is a big demand in the near future to find ways to increase the use of bioenergy.

To put numbers on the targets we have to know that today bioenergy use is about.

<b>EU's White Paper on RES</b>	<b>1995</b>	<b>2010</b>
Total energy demand (Mtoe)	1366	1583
RES (Mtoe)	74.3	182
RES %	5.4 (6)	11.5 (12)

<b>Kyoto</b>		-8% CO <sub>2</sub>
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<b>Decrease the energy import to EU</b>		
<b>Biomass (%)</b>	3.3	8.5
<b>Biomass (Mtoe)</b>	44.8	135

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All decisions are ending up with the same demand at about 90 Mtoe. To be able to reach this there is made an estimation about how much biofuel that can be produced within this period.

- Biogas exploitation 15 Mtoe
- Agricultural and Forest Residues 30 Mtoe
- SRC 45 Mtoe

The existing European Union there is today about 9,5 Mha of surplus cropland. The normal growth of Salix is about 4 toe per ha and year. If this set aside land is used for SRC Europe should reach the demand of 45 Mtoe within the stated time schedule.

The rate of growth is about 30% per year. How do you make the market increase by this rate. To be able to reach it there is three different prerequisites required.

- Material
- Capital
- Labour

On material side there is used standard materials so generally there will be no problem to fulfill the demand from material side.

On capital side the conclusion is the same. But to find the amount of people with the right skills will be the big challenge to fulfill the decisions that is already taken.

### 3. EUROPEAN MARKET

How to encourage the European market to change from fossil fuel to bioenergy according to the decisions taken by the politicians is a difficult subject.

#### 3.1 Electricity market

The European electricity production is today based on coal fired power stations. If biofuel is mixed in at a rate of only 10% in units bigger than 50 MW the need should be about 500 TWh per year or about 45 Mtoe.

#### 3.2 Transport market

If 5% of the fuel needed for transport market within EU is replaced by biofuel the yearly demand should be about 150 TWh or 13,5 Mtoe.

#### 3.3 Heat market

The small scale heat market below 10 MW represent 2000TWh per year or 180 Mtoe.

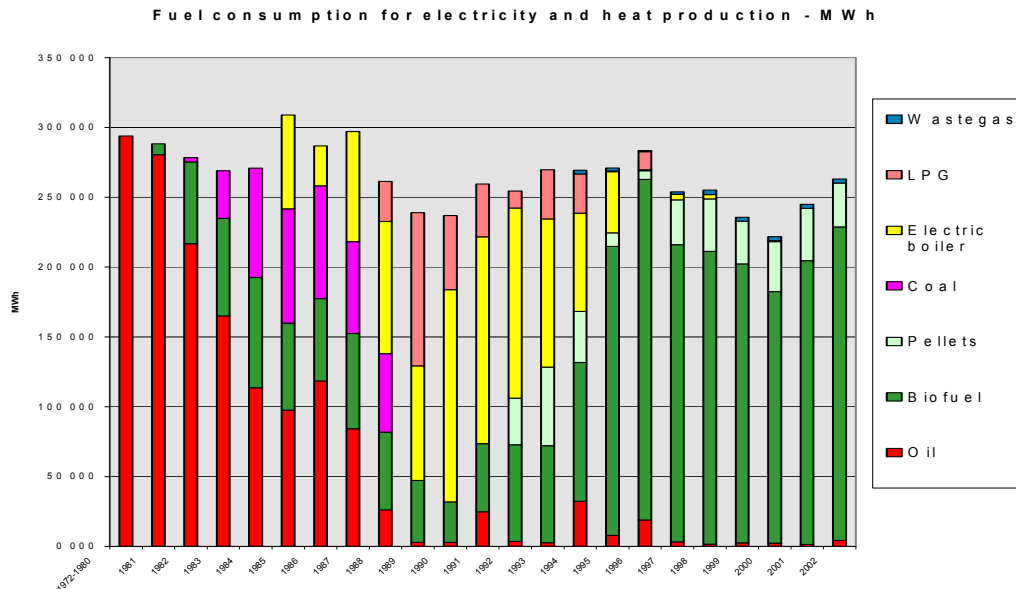
Generally speaking over the markets is that there is a very big market that could be supplied by biofuel.

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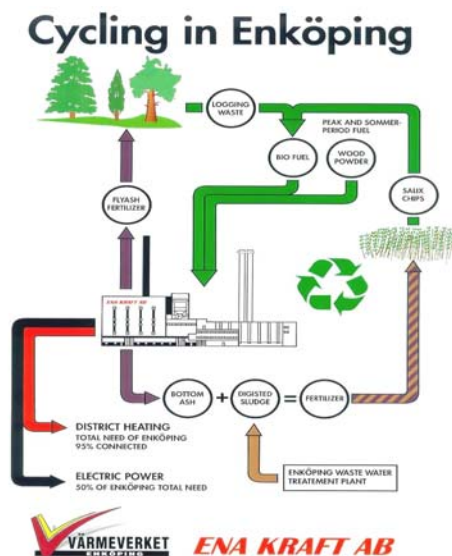
## 4. ENKÖPING APPROACH

Up to 1980 the energy demand in Enköping was supplied by oil only. 1981 a small scale biofuelled boiler was introduced and supplied about 25 % of the heat demand from biofuel. In 1994 a CHP-plant was built and then about 85% of the heat demand and about 50% of the electricity demand was supplied by biofuel.

In 1997 a district heating boiler was converted to woodpowder firing and since then nearly 100% of the heat demand is supplied from biofuel.



After 1995 we have worked with the increase of SRC because we are belonging to a region in Sweden where we mostly have farming land.



## 4.1 Project

The project suggested that if the plantations were done in the correct way and if the farmers used the rest products from the firing and the municipality the economics could be acceptable. The demands from the project was:

- Transport distance to the CHP plant max. 30 km
- Plantation area min. 10 ha
- Plantation shall be well done using pesticides
- Plantation shall be using a mixture of bottom ash and digested sludge as fertilizer.

So far this project has only resulted in approximately 150 ha of new plantations so that part of the project is not very successful. The part of the project that is successful is that we can spread all the bottom ash that is produced and a major amount of the digested sludge that is produced in the municipality.

## 4.2 Spin off project

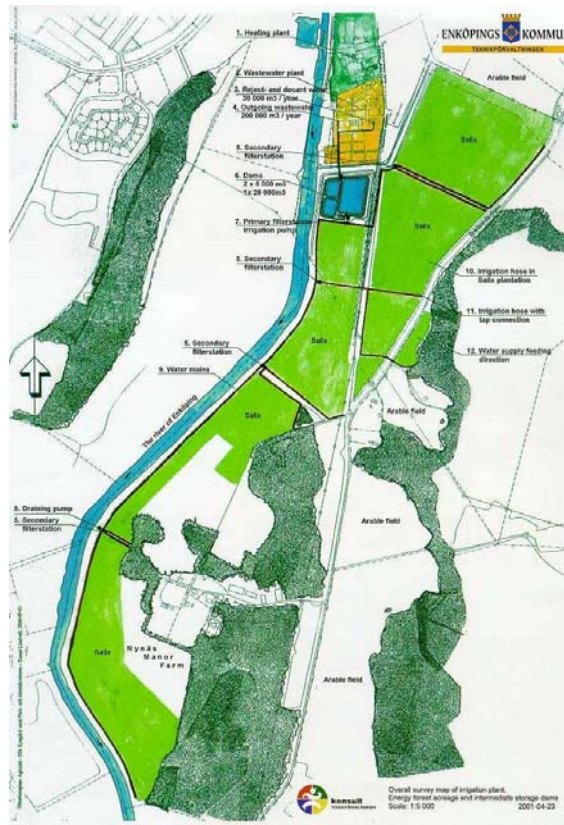
During the initial part of the project there was discussions in the municipality how to fulfill the Baltic See agreement. This agreement is that each country shall lower the nitrogen leakage to the Baltic See. Each municipality in Sweden that sends water to the Baltic See has to lower the amount of nitrogen by 50%. Enköping wastewater cleaning facility sends the clean water to lake Mälaren that flow out in Baltic See. There was taken a preliminary decision to install a traditional nitrogen cleaning facility to a total cost of 27 Million SEK.

Just before the decision should be taken the municipality decided to investigate that instead of traditional cleaning try to use the nitrogen rich water to irrigate a Salix field. The calculations indicated that it was needed about 80ha of Salix plantations to be able to take care of enough amount of nitrogen. After discussions with the farmer that owns the land he agreed to sign a 15-year contract to use his land for nitrogen cleaning.

## 4.3 Irrigation project

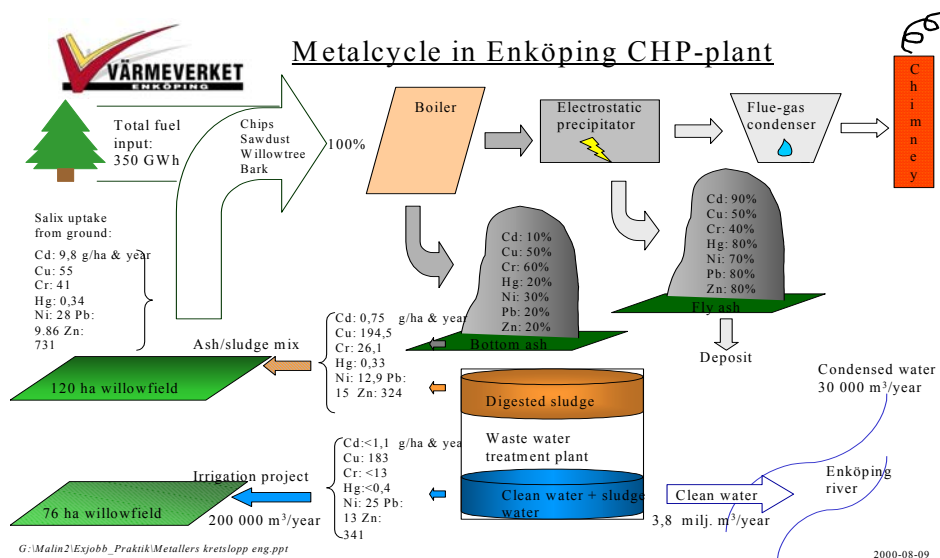
The advantages with the irrigation project compared with traditional nitrogen cleaning was obvious so the decision was taken to build the required ponds to store the nitrogen rich water before use and to build the irrigation of the 80 ha of Salix. The municipality made all the investments and the CHP plant agreed to burn all Salix that was produced in the fields. Additional ponds were built in tree different places to take care of local wastewater. This product is spread on local Salix fields. The total investment cost for this project is lower than the traditional nitrogen cleaning so the municipality has the main interest of this project. The farmer wins because the Salix grows much faster because of the fertilizing effect from the nitrogen and the water. The Energy Company is a winner because of the production of bio fuel only a few hundred meters from the CHP plant.

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## 4.4 Metal balance

The Swedish University of Agriculture has been involved in the projects from the beginning and is looking at the metal balance in the soil compared with the uptake in the Salix trees. They have found a very interesting result when looking at the different flows of metals. For cadmium the balance look very promising mainly because the CHP boiler is very good at separating the cadmium and concentrating it to the fly ash. The bottom ash contains very small amounts of cadmium because of this the metal balance for the field looks very promising.



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## 4.5 Future in Enköping

We are now planning and investigating the possibilities to use the unused capacity in the CHP-plant to produce fuel for small scale heat market and for transport market. The concept is to use low pressure steam to evaporate ethanol and flue gases to dry sawdust to pellets.

