

Fill up your tank

A new pilot plant producing ethanol from wood will open in 2003 to verify and optimise the process and technology. With a bioenergy combined installation, ethanol for cars together with electricity and heat could be provided in an integrated system.

In Sweden, as in many other countries Ethanol is the most widespread renewable alternative to gasoline and diesel. Sweden has more than 400 busses running on neat ethanol, about 4000 Ford FFV running on e85* and about 600 000 cars running on e5*.

The development of ethanol production from cellulose raw material has been going on for 15 to 20 years in the universities. We are now

taking the next step in the development to build a pilot plant for verifying and optimising the process and technology.

BIOENERGY COMBINES

Regional energy companies are the most committed stakeholders in ethanol development in Sweden at the moment. They have a vision to give energy support to the inhabi-

tants in all fields, electricity, district heating, and fuel for transport. This could be described in figure 1 representing a medium-sized municipality in Sweden with about 60 000 inhabitants. The byproducts from the ethanol production are directly used to produce electricity and district-heat or district-cooling.

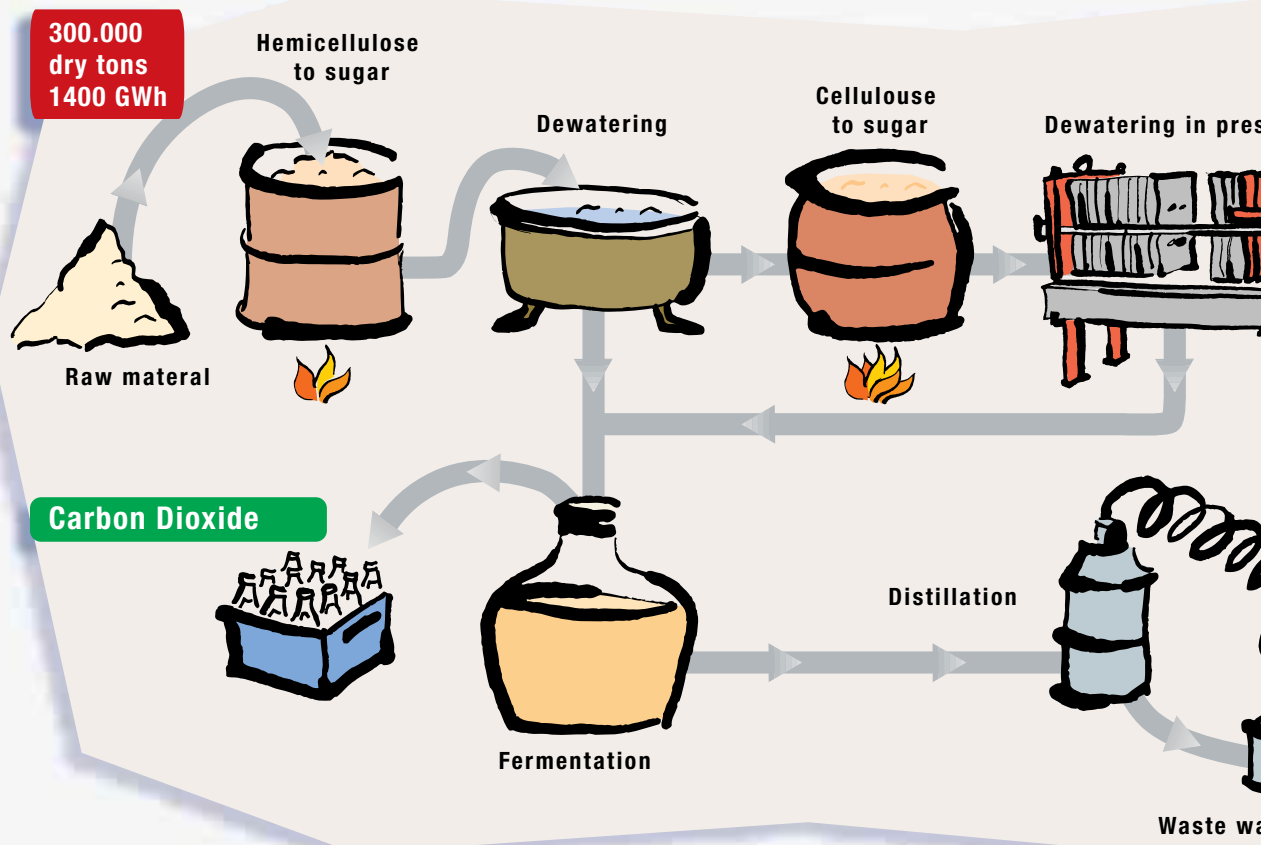
In this case most of the energy demand in the municipality for transport, electricity and heating of buildings and small and medium sized enterprises is supported from the refinery. The total energy efficiency in the bio-energy combined cycle is about 75%. This is almost the same as an oil refinery, in which about 85% of the energy input can be used as products. Another way to show the improvement is to say that you need to consume only one unit of fossil fuel to



* See insert page 38.

Figure 1: The energy efficiency of the process is close to 75%: inputs of 1650 GWh (=1400+250), outputs of 1195 GWh (=350+585+260) with recovery of energy as electricity, heat and ethanol.

(Source BioAlcohol Fuel Foundation Sweden)



with wood!

Jan Lindstedt, Etek Etanolteknik

obtain 15 units of renewable energy to use as ethanol, electricity or district heating. This is the upgrading of fossil fuels with renewables.

PILOT PLANT

To develop the technology for ethanol production from wood residues, some regional companies, five years ago, formed a new company Etek Etanolteknik AB (Ethanol Technology Ltd). Etek will be responsible for the construction and later on the operation of the pilot plant, located in the Northern part of Sweden, close to an existing sulphite pulp ethanol plant.

The pilot plant will have a capacity in feedstock input of about 2 tons/day of dry matter and will mainly produce process knowledge and experience. The plant is basically designed for development of

the two step continuously diluted acid hydrolysis process of softwood residues with a third step for enzymatic hydrolysis.

The plant is planned to be in operation by the end of 2003. To verify the process and technology and to get more accurate design data for future production plants we propose to operate and evaluate the pilot plant for about two years before a decision on a production plant is taken.

PRODUCTION PLANT

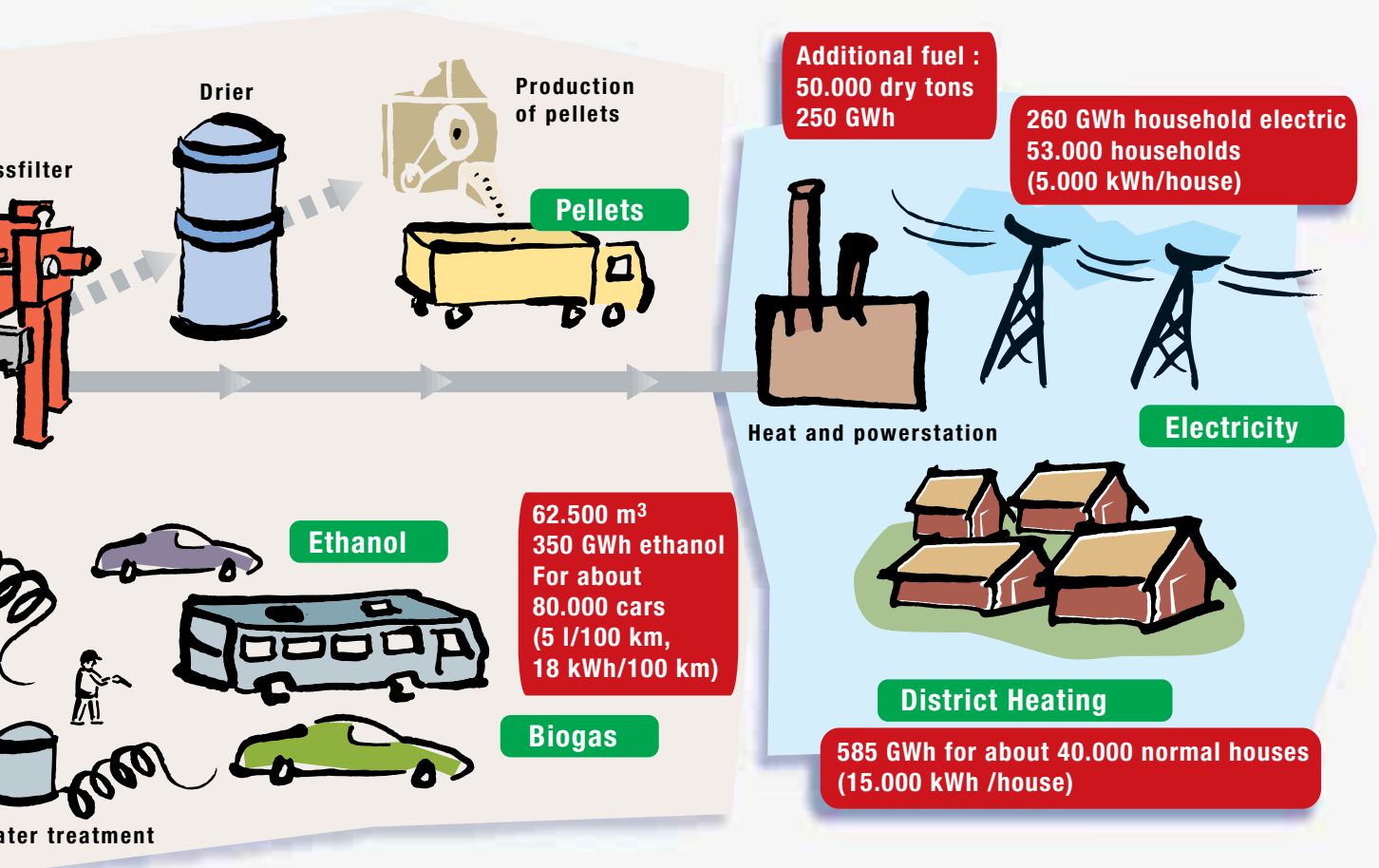
Most of the lignin in the wood remains as a solid product after the process. The lignin is used as a fuel in the bio energy combined plant, sold as additive for wood based bio-fuel pellets or as a biofuel for special purposes. The lignin fuel can be very suitable for gas turbines and as an incineration additive, because it

has low alkali content and high energy value, 6,2 MWh/odt (odt=own dry tons). In the future it may also be a raw material for "green chemicals".

Etek made a study of a production plant in combination with an existing combined heat, power and wood biofuel pellets plant in the North of Sweden. The production of ethanol was set at 75 million litres a year. The investment costs for the production plant were calculated to about 120 million Euros.

Feasibility studies with energy and material integration based on hydrolysis of wood residues, show that the price of the ethanol is estimated to be between 0.36-0.45 Euros / litre.

The investment cost in the pilot plant is about 16 million Euros and the annual running cost about 1 – 2 million Euros depending on the



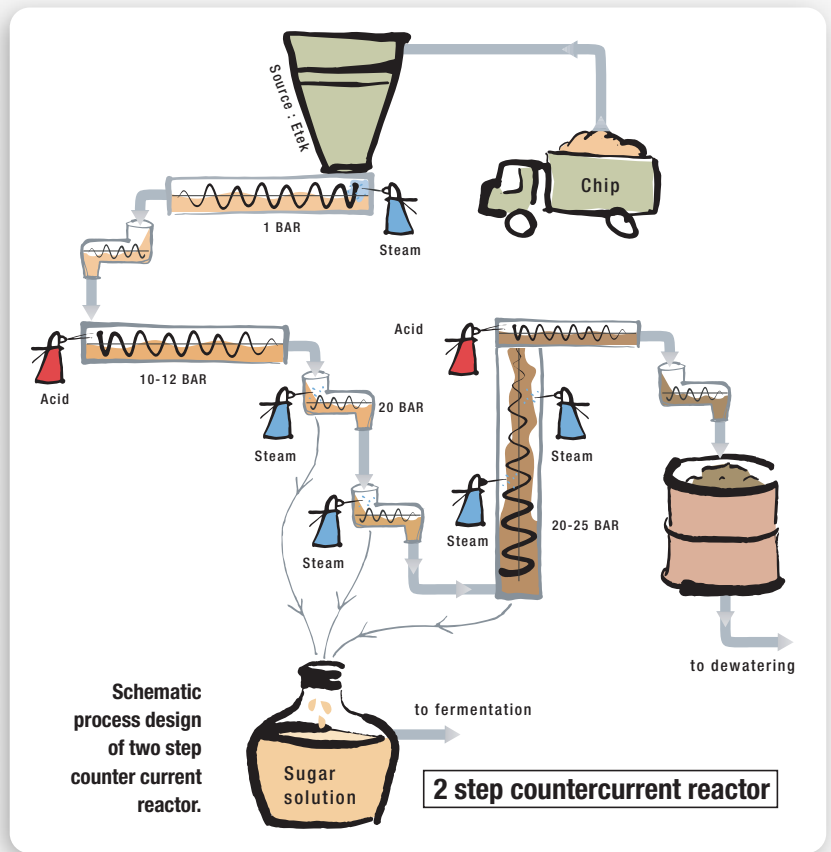
About Ethanol

Ethanol is a liquid fuel.

The low-level blend in gasoline (e5 to e10: from 5 to 10% ethanol) can be used in any gasoline vehicle. e85 (85% ethanol - 15% gasoline), with high octane, can be used also in light-duty vehicles thanks to a special equipment. It is stored, transferred and dispensed like gasoline. e85 requires precautions at sites to avoid water contamination. Only very limited selection of e85 vehicles is offered by original equipment manufacturers (OEMs).

The e85 vehicles have performance matching gasoline. Moreover, range of e85 vehicles matches gasoline vehicles with larger fuel tank.

From an environmental point of view, the greenhouse gas emissions from the use of ethanol from biomass can be lower; future wood-based ethanol will have much lower greenhouse gas emissions. On the other hand ozone production from e10-fueled vehicles is equal to gasoline. When using e10 or e85, carbon monoxide emissions are lower than gasoline. Air toxicity level of the production of e85 is similar to gasoline although components differ.



extent of the research program. The pilot plant will be open for cooperation with partners all over Europe and maybe other countries.

Different feed stocks like softwood, hardwood and annual crops like straw and reed canary grass can be tested in the pilot plant. □

FOR MORE INFORMATION:

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Schematic plan of the pilot plant.

