

## SPECIFIC OPPORTUNITIES FOR FOREST INDUSTRIES AND GREEN GASES

*In this info sheet the overall opportunities as well as the two green gas production units that already exist are briefly described. There are eight pulp and paper mills in the BA region and one biomass gasification plant. These all have different opportunities to extend their product portfolio with biofuel for vehicles by gasification or digestion. Two of the plants already produce green gas, Vaskiluodon Voima Oy and Domsjö Fabriker AB. The biogas produced at Domsjö Fabriker AB may easily be upgraded to biomethane, but the syngas at Vaskiluodon Voima is produced in such a way that upgrading would be too expensive. If the political environment for biofuel production changed, gasification of black liquor and forest residues would be a great potential for a fossil free vehicle fleet.*

### BACKGROUND

There are large volumes of forest biomass in the BA Region. Forest is used to produce both renewable products and energy. The market demand for renewable vehicle fuel is increasing, and 2nd generation vehicle fuel may add enough potential to waste and agricultural feedstock. Within the BA region there are 7 pulp and paper industries, 1 in Finland (Alholmen in Jakobstad) and 6 in Sweden (SCA Obbola, Husum, Domsjö Fabriker, Ortviken, Örstrand, and Väja). The plant in Domsjö is based on a sulphite process and is today producing biogas for internal use while the rest are based on a sulphate process. The world's largest biomass gasifier, Vaskiluodon Voima, is located in Vaasa and produces syngas for internal co-firing with coal.

At the pulp and paper industries there are two ways of producing renewable gases as a complement to their core process:

- 1.a Gasification of black liquor and fiber sludge (syngas)
- 1.b Gasification of forest residues or other material (syngas)
2. Digestion of fiber rich sewage sludge (biomethane)

If syngas (mainly hydrogen and carbon monoxide) is further refined to methane, methanol or DME (Dimethyl ether), there are synergies towards the market. Fiber rich sewage sludge from the sulphate process are today not as suitable for digestion into biogas as the environment is not suitable for bacteria.

### METHOD

The data has been collected through several years of stakeholder dialogues and study visits to the plants already producing green gas.

### VASKILUODON VOIMA OY, FINLAND<sup>1</sup>

Vaskiluodon Voima Oy produces 2-2.5 TWh power and 800 GWh heat each year. The capacity is 80 tons of coal per hour. Since the company aims for sustainability they have built a gasification plant for biomass, which came into operation in 2013. The process uses high temperature and is air-blown<sup>2</sup>. The total investment was 40 M€.

The syngas that is produced is co-fired with coal. The fuel mix today consists of 5% peat, 25% woody biomass (stumps and sawmill by-products) and 70% coal. The share of biomass can be increased to 40% but today it is more economical to burn coal. Biomass is delivered just-in-time, about 35 trucks per day, which has given some problems during bad weather when the forest machines are not able to work in the forest. The company has applied for an interim storage permit which has not yet been accepted. It is important that the biomass delivered has even fuel quality (contaminations, particle size and moisture content). The biomass is therefore pretreated and quality secured at the site by the company itself. The gasification produces 4 tonnes of ash each day. The gasification plant provides an input to the regional economy by 15 M€ /year and employs 100 people within the forestry sector.

### **DOMSJÖ FABRIKER AB, SWEDEN**

Domsjö Fabriker AB is a biorefinery with special cellulose as their main product which is used for the production of viscose. They also produce lignin, bioethanol and biofuels. The wastewater is digested at the bio treatment plant together with wastewater from SEKAB and AKZO Nobel. 70-80 GWh of biogas is produced each year. The biogas consists of 70% methane and is used to replace LPG and to produce power and heat.



The bio treatment plant was built in 1985 to meet environmental regulations and has been in operation and producing biogas ever since. Domsjö Fabriker is looking into other possible uses of biogas with higher returns. One alternative is to upgrade to biomethane and use it as biofuel and replace the biogas at the plant by forest fuels. In cooperation with an investor and off-taker of the biogas this could be realised by an investment of approximately 4 M€ and a pricing of the biogas good enough for all parties.

Domsjö Fabriker AB has investigated the possibility to gasify black liquor and produce DME in a full scale demonstration plant, 272 GWh/year, as was done on pilot scale at Chemrec/Luleå Technical University in Piteå. Swedish Energy Authorities did approve a financial development support of 50 M€. But due to vague national political guidelines and immature market the Indian owner Aditya Birla did not find the investment of 350 M€ safe enough.

### **CONCLUSIONS**

The large production of syngas, 500 GWh/year, at Vaskiluodon Voima is done with a cost efficient technology. They have the possibility to produce large volumes of green gases. But, since the process is air-blown it is not today cost efficient to refine the syngas to a biofuel. On the other hand it would be a very cost efficient way of producing 2nd generation biofuels from the biogas at Domsjö Fabriker AB. This would increase the available volume of biomethane in the region by 600%, from 14 GWh/year to 94 GWh/year. With long term energy policies in place, biofuel production through gasification of black liquor and forest biomass could increase significantly in the BA region.

### **Literature**

1. J. Osterback, Vaskoloiden Voima Oy, pers comm 2014
2. Simell ,Valmet pers comm 2014

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