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Bioenergy – traditional fuels traded into new markets

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ABSTRACT

Bioenergy is a strategic resource used in the work to fulfil the Kyoto agreement to replace fossil fuels and to mitigate green house gas emissions and the global climate change. Many countries already use a significant share of biofuels in their energy supply. The Nordic countries is one example of this. Production and use of biofuels have to be done in an environmentally sound way.

Biofuels are usually produced and used locally. In more recent years, this pattern has been changed in northern Europe by industrial and large scale-use of different forms of biofuels. The trade situation has come about as a result of means of control on waste and energy. Sea shipments allow bulk transports of biofuels over long distances at low cost.

Wood-fuel is the dominant biofuel in the European region and markets are established in some of the countries like Sweden, Austria, Finland and Denmark. Other countries like Germany, the Netherlands and the UK are very expensive areas for wood energy utilisation. In central parts of Europe traditional use of wood fuel is still dominant even if new trends with investments in industrial use is coming up.

Since trade has been established it is obvious that the customs statistics do not record trade in such a detail that the international trade of different biomass types could be identified. Today, solid biofuels like wood residues, pellets and wood chips are already traded in Europe and have reached in 1999 a level of almost 50 PJ/a. In some countries, there is a growing interest in the

international trade, because the trade can provide biofuels at lower prices, larger quantities and better quality than domestic alternatives.
The first signs of an European biofuel prices is shown. For the future both the use and the trade of wood-fuel is expected to increase in Europe.

Key words: Biofuel, green house gas mitigation, trade, biomass resources, economic aspects, wood-fuel markets.

INTRODUCTION

The use of bioenergy[1] is a strategic resource used in the work to fulfil the Kyoto agreement to replace fossil fuels at a large scale. Bioenergy and biomass in general could be used to mitigate green house gas emissions and the global climate change. In some countries the use of biofuels already hold a significant share of the energy supply to industrial processes, heat production and in some cases also electricity production. The Nordic countries are examples of this. A large scale production and use of biofuels have to be done in an environmentally sound way. New technology and system solutions gives the biofuels possibilities to compete in new markets.

Traditionally, biofuels are used in the same geographical region, in which they are produced [1]. In more recent years, this pattern has been changed in northern Europe by industrial and large scale-use of different forms of biomass for district heating like a vast supply of recycled wood and forest residues. The trade situation has come about as a result of means of control on waste and energy. Sea shipments allow bulk transports of biofuels over long distances at low cost.

The Scandinavian countries and Austria have been the pioneering countries in the modern use of bioenergy. The White Paper of the European Union *"Energy for the future: renewable energy sources"* recommends a use of biomass three times today's level in the member countries. The goals set also by the Kyoto agreement calls for a significant use of biomass in countries like Germany, the UK, the Netherlands and Spain. The prediction for the short term and medium term is an increase in trade in Europe.

SWEDISH EXPERIENCES

Sweden is one of the leading European countries in utilisation of biomass based mainly on the large forest resources. Biofuels are used in the forest products industry, the district heating sector and for traditional heating mainly of houses on the country side. Industrial use is 184 PJ [3] mainly wood fuel and black liquor most of this in internal use. The residential sector use 38 PJ also mainly internal use on farms or self supply among house owners.

[1] With "*biofuel*" means biomass which through one or more conversion steps (mechanical, chemical and/or biological) are used for energy purposes. "*Wood-fuel*" is fuel originating from biofuel, the origin of which was trees or parts of trees. "*Forest fuel*" is "wood fuel which has not been used previously" [2]. The term "*bioenergy*" is super ordinate to the terms "*biofuel*" and "*wood-fuel*".

Swedish experience of a commercial biofuel market is based on the development of the district heating sector over a period of at least 20 years, from a low level in the 1970s to a substantial market reaching 96 PJ in 2000 [3]. Wood-fuel counts for 55% of the biofuel supplied to the district heating sector, reaching 54 PJ in 2000. The average growth rate of supplied wood-fuel between 1990-2000 is around 10% per year. Wood-fuels compete on the market with other untaxed biofuels. The highly taxed fossil fuels are not competitively priced for heat production. Prices for biofuel peat etc. are reported by the Swedish National Energy Administration [4].

In the early 1990´s import of biofuels was established in the Swedish market [5].
Many different assortments and qualities of biofuels were traded still at rather low levels. Different projects were carried out to adapt fuels to existing technology. In some areas co-firing between different biofuels and biofuel and coal is established [6].

Later results from the import indicates a large activity [7] and import figures reaching as much as one third of the supply of biofuel to the district heating sector. No reliable figures are available later than 1997 but the estimated imports today is a stabilisation on the levels from the mid 1990s. One reason for that is the weaker Swedish currency which have made it more expensive to buy from other countries. An example of this is the strong US dollar which made it to expensive to continue with the import of wood pellets from North America.

For the nearest future Swedish currency is stronger and prices has increased due to a larger market. This gives ground conditions for an increased import.

Table 1 Imports of untaxed fuels (biofuels) to Sweden 1992, 1995 & 1997, PJ [5], [7]

	1992	**1995**	**1997**
Biofuels	2-4	11-15	29-36
Approximate share of wood-fuels	0.2 (estimated figure)	0.33-0.45	0.5-0.62

The imported fuels shows a spectrum of different assortments and qualities. Sometimes imports are double counting which gives a range of the import.

Table 2 Imports to Sweden of untaxed fuels in 1997. Combined results from telephone survey to fuel users and fuel dealers [7]

Assortment (Quality)	**PJ**	**Share provided by importers, %**
Tall oil	8.73	59
Wood pellets	4.35	74
Recovered wood chips	3.65	80
Green wood chips	2.70	58
Peat	1.48	0
Rubber and tyres	1.29	48
Railway sleepers	0.58	100
Round wood	0.21	100
Bark	0.19	100
Waste wood	0.17	100
Recycled paper	0.14	0
Saw dust	0.07	100
Total a	**23.56**	**(no double counting)**
Total b	**14.70**	**(only importers, i.e. maximum double counting)**

Note: Figures in the survey did not represent the total population of possible users and importers. To get an estimation of the total import figures above was multiplied with 1.36 [7].

Exports

In recent years the acceptance of the Kyoto protocol have started activities in many European countries as mentioned earlier. Interest in exporting projects has started due to the fact that Sweden and other Nordic countries have large forest resources. Importing countries in this future scenario are the densely populated European countries and some of the Mediterranean countries. No regular trade is carried out yet but there has been projects in this field.

EUROPEAN EXPERIENCES

Trade between countries has been established in different parts of Europe. In most countries, the customs statistics do not record trade in such a detail that the international trade of different biomass types could be identified. Today, solid biofuels like wood residues, pellets and wood chips are already traded in Europe. In some countries, there is a growing interest in the international trade, because the trade can provide biofuels at lower prices, larger quantities and better quality than domestic alternatives.

European trade

Solid biofuels like wood residues, pellets and wood chips are today traded in Europe and reached a level of almost 50 PJ/a [1] in 1999. Trade between European countries is a growing interest in biofuel trade, because the international trade can provide fuels at lower prices. In several cases, the national biomass market is not yet developed well enough for organised international trade. On the other hand projects may benefit in countries with unexploited biomass resources when fuels are available on an international market. Although there may be (even notable) cross-border trade of e.g. domestic firewood between neighbouring countries, this trade is more or less occasional and beyond official statistics [8].

In Fig. 1, known and estimated international biomass flows are presented. In some countries (e.g. Portugal), the statistics revealed the traded biomass amounts, but as the source/destination countries were not known, these flows cannot be included in the figure. On the other hand, in some cases the trading countries were known, but the traded biomass type was not [8].

The largest volumes of biofuel are traded from the Baltic countries (Estonia, Latvia, Lithuania) to the Nordic countries (especially Sweden and Denmark, but also Finland). Some volumes are also traded from Finland to other Nordic countries, and between neighbouring countries in Central Europe, especially the Netherlands, Germany, Austria, Slovenia and Italy. The traded biofuels include most often refined wood fuels (pellets and briquettes) and industrial by-products (sawdust, chips), in Central Europe also wood waste. The annual production of wood pellets in Europe is estimated to be about 1.2–1.3 million tonnes.

Some biofuels are also traded intercontinental. Sweden have imported biofuels from Canada, and Italy imports firewood from Northern Africa. In addition, Germany exports some firewood to the Middle and Far East [8].

Scandinavian biofuel markets have increased and national energy policies have contributed strongly to this trend. Taxes on energy with a clear environmental profile were introduced during the early 1990s in Scandinavian countries. Fossil fuels are heavily taxed in heat production, while biofuels are untaxed. In electricity production, all fuels are untaxed, while the consumers pay a tax. In Finland and Sweden, the investment supports called forth a growth in the capacities and also contributed to the demand of biofuels.

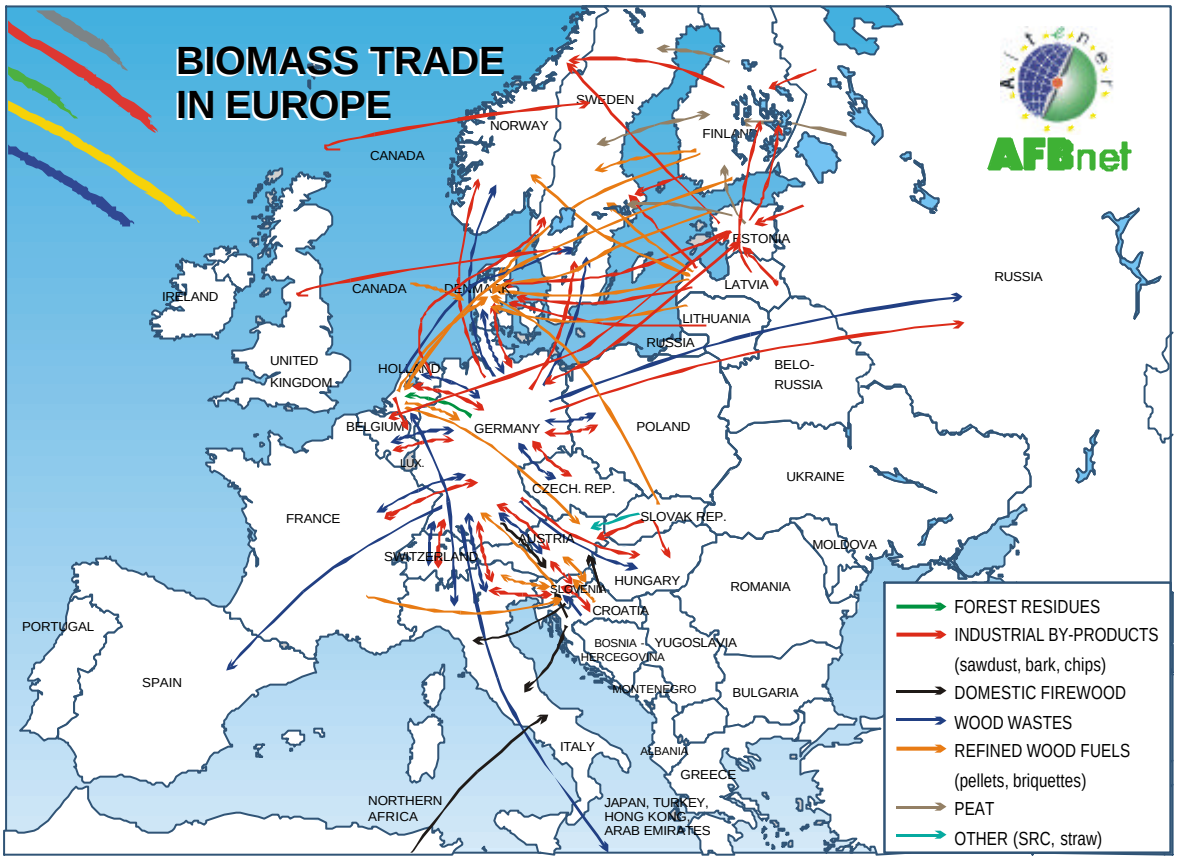

Figure 1. Import and export of solid biofuels in Europe, 1999 [8, 9].

Fuel prices

In a survey made in a AFB-net project prices of different fuels was collected in 1999. Since then oil prices have risen significantly which also might have influenced the prices for other fuels.

Table 3. Minimum, maximum and average fuel prices (including taxes) in the 18 selected European countries, 1999 [8, 9]

Fuel	Minimum, €/GJ Country	Maximum, €/GJ Country	Average, €/GJ
Forest residues	1.02, Germany	8.33, Italy	3.42
By-products, forest products industry	0.58, Romania	9.07, Poland	2.38
Firewood	1.01, Slovakia	14.00, UK	5.26
Wood waste	-4.00, Ireland	3.31, Poland	0.97
Refined wood fuels	3.24, Latvia	18.22, Germany	8.37
Other biomass	0.83, Slovakia	12.00, Poland	4.68
Peat	2.10,Finland & Latvia	3.75, Ireland	2.83
Heavy fuel oil	1.40, Slovakia	12.00, Ireland	6.74
Light Fuel oil	3.10, Slovakia	14.30, Denmark	6.74
Natural gas	1.10, Slovakia	16.21, Italy	5.80
Coal	1.19, Poland	12.78, Germany	4.53

European price level

The increase in trade between European countries have established international prices on wood fuels. In table 4 examples of prices are given. There is of course a range of prices set by the market situation, production cost and cost of competing fuels. By-products was traded around 3-4 €/GJ, wood chips around 3.5-4.5 €/GJ and wood pellets around 5-6 €/GJ.

Table 4 European prices of wood fuels for combustion plants in the size of 1–5 MW_{th} in 1999 (€/GJ including energy taxes, excl. VAT). [4 ,8, 10]

Country	Bark, sawdust, chips	Wood chips	Wood pellets
Denmark	4.2	4.5	5.0
Finland	1.6	3.0	7.5
Germany	3.1	3.7	6.1
Sweden	2.9	3.4	4.8
France	1.1	4.0	10.6
Latvia	0.8	1.6	3.3

CONCLUSION

The largest volumes of biofuels are traded from the Baltic countries (Estonia, Latvia, and Lithuania) to the Nordic countries (especially Sweden and Denmark, but also Finland). Some volumes are also traded from Finland to other Nordic countries, and between neighbouring countries in Central Europe, especially the Netherlands, Germany, Austria, Slovenia and Italy. The traded biofuel is most often of refined wood fuels (pellets and briquettes) and industrial by-products (sawdust, chips), in Central Europe also wood waste.

There are international market prices established in Europe, however volumes are still limited. For the future both the use and the trade of wood-fuel is expected to increase in Europe.

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