

TRADE OF SOLID BIOFUELS, AND FUEL PRICES IN EUROPE

Alakangas, E.¹, Hillring, B.² & Nikolaisen, L.S.³

¹VTT Processes
P.O. Box 1603
FIN-40101 Jyväskylä
Tel. +358 14 672 611
eija.alakangas@vtt.fi

²Swedish University of
Agricultural Sciences (SLU)
P.O. Box 7060, SE-75007 Uppsala
Tel. +46 18 673 548
bengt.hillring@sh.slu.se

³Centre for Biomass Technology
Danish Technological Institute (DTI)
Kongsvang Allé 29, DK-8000 Aarhus C
Tel. +45 7220 1200
sn@teknologisk.dk

ABSTRACT: Traditionally, biomass fuels are used in the same geographical region, in which they are produced. In more recent years, this pattern has been changed in Northern Europe by large-scale use of biomass for district heating and 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 biomass over long distances at low cost. 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 and have reached a level of almost 50 PJ/a. In some countries, there is a growing interest in the international biomass trade, because the trade can provide biofuels at lower prices. The largest volumes of biomass 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 biofuel is most often of refined wood fuels (pellets and briquettes) and industrial by-products (sawdust, chips), in Central Europe also wood waste.

Keywords: biomass trade, biomass resources, economic aspects

1 BACKGROUND

The most recent study [1] of European solid biofuel trade was carried out by the ALTENER bioenergy network - AFBnet (<http://afbnet.vtt.fi>). Network partners and also national bioenergy centres in Estonia, Latvia, Poland, Romania, Slovakia and Slovenia participated in collecting the data from their own countries in 1999 [1,9].

The heavy extension of district heating based on biomass in Denmark, Sweden and Finland during the last 10 years has resulted in the imports of biomass from Europe and of wood pellets from the United States and Canada. The Scandinavian countries and Austria have been the pioneering countries in using bioenergy. The European Union's White Paper of 1997 "Energy for the future: renewable energy sources" has turned the focus on the use of biomass in the energy supply, as the White Paper recommends a tripling in the consumption until 2010. Presently, UK, Germany and Spain are expanding their bioenergy sectors. The trade with biomass will continue, and the number of both importers and exporters will increase on the growing market [10].

In several replies, it was pointed out that the data sources have been very varying, and hence, part of information includes estimations and thus may be inaccurate. Based on the questionnaire, it can be estimated that the resources available in the 20 countries are close to 4500 PJ/a and the current use is about 1800 PJ/a – also 40% of the resources. [7]

2 IMPORTS AND EXPORTS OF SOLID BIOFUELS IN EUROPE

Solid biofuels like wood residues, pellets and wood chips are today traded in Europe and have reached a level of almost 50 PJ/a. In some countries there is a growing interest in international biomass trade, because the international trade can provide biomass fuels at lower prices. In several cases, the national biomass market is not yet

developed well enough for organised international trade. 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 [10].

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 [10].

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 production of wood pellets in Europe is estimated to be about 1.2–1.3 million tonnes.

Some biofuels are also traded intercontinentally. Sweden imports biofuels from Canada, and Italy imports firewood from Northern Africa. In addition, Germany exports some firewood to the Middle and Far East (Turkey, Arab Emirates, Japan and Hong Kong). [10]

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.

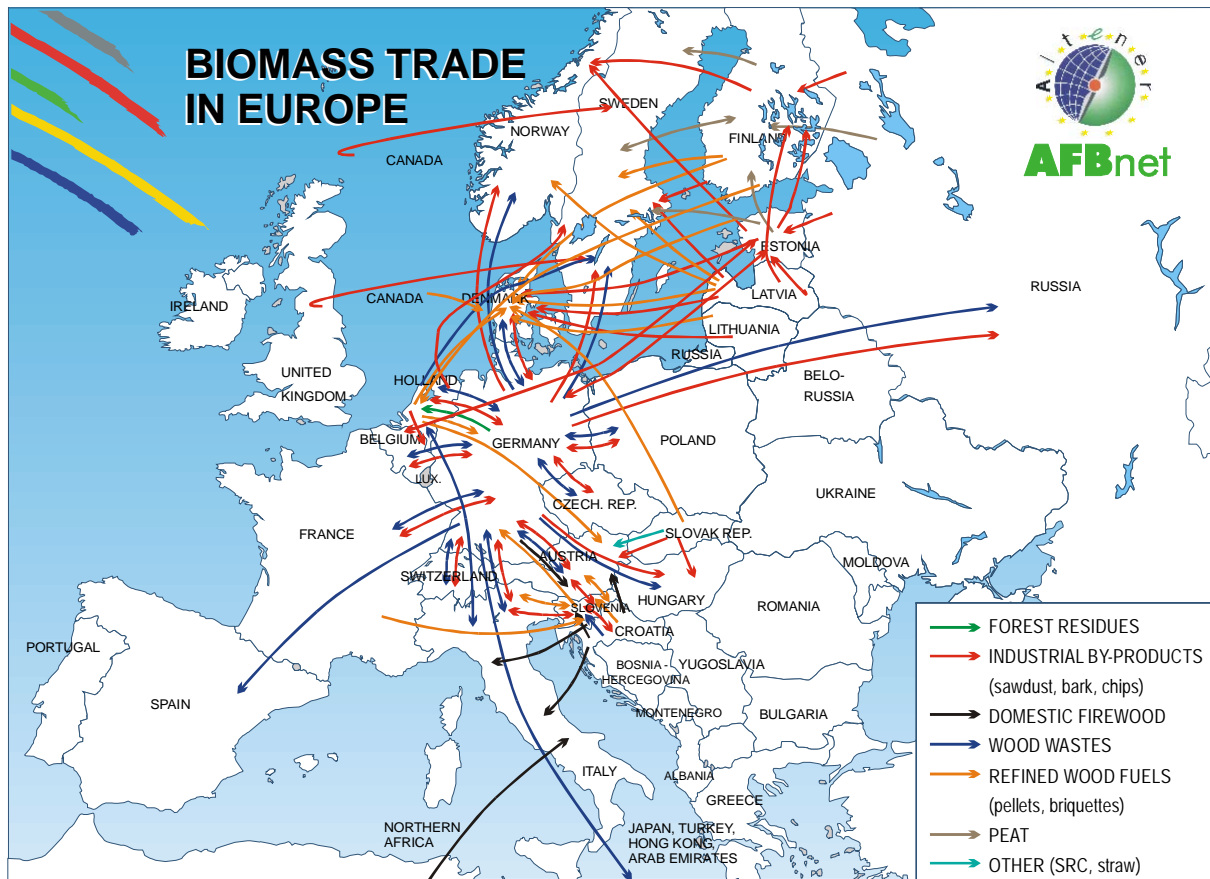


Figure 1. Import and export of solid biofuels in Europe [1,10].

3 TRADE OF SOLID BIOFUELS IN SCANDINAVIA

In **Finland** the annual use of solid wood fuels is 127 PJ, in Denmark 35 PJ and in Sweden 170 PJ. During the last five years over 100 district heating plants and 500 MW_e of new additional capacity for electricity production from wood-based fuels have been commissioned in Finland (total capacity 2 000 MW_e). Finland is exporting wood pellets about 80 000 t/A (1 PJ) to Denmark, Sweden and the Netherlands, and peat and wood chips to Sweden. The Finnish forest industry imports about 13 million solid m³ wood for raw material, mostly from the Russian Karelia. Of this, 11% is bark, which is used for energy production (11 PJ). This import of wood fuel as a separate fraction is equal to 1.3 PJ [1,2].

In Finland national solid biofuel trade is carried out by different kinds of organisations. There are bigger diversified companies working on energy, wood processing and also biofuels business. These companies can exploit industrial wood residues from their own mills for production of wood chips or pellets. They can integrate harvesting of logging residues into timber or pulp wood harvesting and by this way keep fuel prices competitive. In small-scale heating of municipal buildings like schools and small district heating plants, a special heating entrepreneurship model has been used in fuel procurement and also in the operation and maintenance of the boiler plants. Usually these entrepreneurs are co-operative, are harvesting small-sized wood of their own woodlots or are purchasing industrial wood chips or cutter shavings from local wood processing industry. The number of these en-

trepreneurs in Finland has increased into 130. In large scale wood fuel procurement, different kind of modern information technologies, like mobile telephones and internet are used in e.g. positioning of fuel storages and going sites or in ordering chippers or in the alarms of boiler plants malfunctions.

In Finland and Austria several electronic fire wood market places (e-trade) are established in Internet for local, national and even international consumers to select the log or pellet suppliers.

Denmark is a net importer of biofuels and imports trunks as well as wood chips and wood pellets. The import of wood chips covers approx. 25% of the Danish consumption of about 300 000 t. The Baltic States and Germany corresponded to almost 90% of this import, the rest coming from Poland. This import consists mainly of wood qualities originating from clear-cuttings and trunks, which are not chipped until after the arrival at a Danish harbour. Selling to the Danish market is competitive, as it may be difficult to sell wood chips in Germany, and furthermore, the prices in Denmark are a little higher than in Germany (table 1). In addition, an unknown amount of moist industrial by-products (bark, sawdust, chips) is imported. [7]

The international market for wood fuels can be compared with the trading of straw for energy purposes. Straw is a local commodity, and in Denmark there is a geographic fluctuation in the prices mainly because of bridge toll (Store Bælt) or ferry crossing which make the straw transport very expensive. Long-distance transport of straw bales is too expensive, but is not an environ-

mental problem as a truck loaded with 12 tonnes of straw must drive 17,000 km with the straw before its emission has compensated for the straw's CO₂ displacing effect in a heating plant.

In the past 10 years, a commercial market for wood fuels has developed in the district heating sector in **Sweden**, mainly as a result of energy policies, i.e., energy and carbon dioxide taxation on fossil fuels. The import of solid market biofuels has increased from a very low level in 1991 and was in 1997 some 15–24 PJ or 44–62 of the supply of biofuels for the district heating sector [4,5]. The use of wood-fuels in the Swedish district heating sector increased by 12 PJ between the years 1995 and 1997. In the same period, wood fuel imports increased by 5–13 PJ. This indicates that the major part of the wood fuel increase has been supplied by imports.

Swedish biofuel prices have been stable for a fairly long period. The market has grown by about 5% annually during the past decade. In the past winter, this trend was broken by different factors. For the first time, the demand exceeded the supply on different markets. This was most obvious on the pellet market for the household sector, where there were difficulties with deliveries to the customers. On the district heating market there also arose some problems with the supply, and the prices of marginal quantities increased significantly.

The general price level has not yet risen except for the price of upgraded wood fuels in the district heating sector that rose by 14% during the last quarter of 2001 compared to the average for the year [8].

Usually the energy companies operate with larger quantities contracted for several years, and smaller amounts of fuel are traded on the spot market. In the next years, the energy companies will contract larger quantities probably at higher prices than the year before.

The domestic supply from the forestry is fairly extensive, and in the ten-year period to come there will be large volumes of wood-fuel available from forests at prices below the present price levels, about 130 PJ of logging residues and small trees (after technical and environmental restrictions) at a price of 2.9-3.2 Euro for GJ [5, Fig.2]. This exceeds the 120 PJ of by-products from the forest industry that are today fairly completely exploited. The total consumption of wood fuels in the Swedish energy system was approximately 170 PJ in 2000 [9]. The production prices of new quantities exploited will rise.

There are also some other trends on the Swedish bio-energy market. The fuel supplying companies are centralized around about 10 large ones. This means a more rational production, but also a risk of lack of competition due to the geographical division of the supply areas. Another trend is that large Swedish and sometimes Finnish energy companies purchase smaller biofuel-fired district heating plants. This means that the buyers are also expanding and there is a clear concentration, not only in size but also in power on the market. In the pioneer days of the bioenergy market, the heating companies invested in fuel production capacity. One could expect that this trend will come back.

The household sector with pellet burners or pellet stoves has grown dramatically during the past year. So far, about 30 000 boilers have been converted to pellet burning and about 5 000 pellet stoves installed. The growth is dependent on the price development of com-

peting fuels like fuel oil, but also on the reliability of delivery systems and the price development of pellets.

The pellet production increased by 45% in 2000 - 2001 or to about 700 000 t in Sweden. There is still free capacity in the pellet industry, but also sharp competition for conventional raw materials, i.e. sawdust or shavings. It is expected that new raw materials, like bark from forest products industry, logging residues or stemwood, will be considered. This may involve a rise in production costs and change fuel qualities and may divide the market into one quality for industrial use and another for households that require a higher quality.

The import from North America is minimised due to the present high dollar rate. Trade within Europe will continue. Unfortunately, there are no good statistics available. Trade is expected to maintain a certain level in the future. New waste legislation and investments in a number of European countries will decrease imports to Sweden. However, there is a tendency to export from Sweden to some European countries, i.a., to the U.K.

4 PRICES OF SOLID BIOFUELS IN EUROPE

Table 1 shows a summary of fuel prices as minimum, maximum and average prices for each fuel. It should be borne in mind that since the AFBnet questionnaire the prices of fossil fuels, especially oil, have risen significantly. Hence, the results given in this report represent the lower oil price level. The prices of wood fuels are lowest in Finland, where the users are bigger stations.

Table 1. Minimum, maximum and average fuel prices in the 18 European countries in 1999 [1,10]

Fuel type	Min, €/GJ	Max. €/GJ	Average, €/GJ
Forest residues	1.02 Germany	8.33 Italy	3.42
Industrial by-products	0.58 Romania	9.07 Poland	2.38
Firewood	1.01 Slovakia	14.00 UK	5.26
Wood wastes	-4.00 Ireland	3.31 Poland	0.97
Refined wood fuels	3.24 Latvia	18.22 Germany	8.37
Other biomass resources	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	4.26
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

Within the Finnish Wood Energy Technology Programme, co-ordinated by VTT [2], the price development of forest chips over the years 1982–2000 in Finland was studied. The average price of forest chips decreased from 3.5 to 2.4 €/GJ (Fig 2). The price is higher for smaller

users, which use high-grade chips produced from delimited trees. The price for plants under 10 MW_{th} ranges from 2.8 to 3.8 €/GJ, and for bigger plants from 1.5 to 2.3 €/GJ. The prices of industrial wood residues like sawdust (1.8 €/GJ) are lowest. The price of wood chips for small-scale users in Denmark is 4.5 €/GJ (table 2). Wood chips are produced separately from delimited small-size trees, when the production costs are higher than for logging residues [1,2,4,7,10,11].

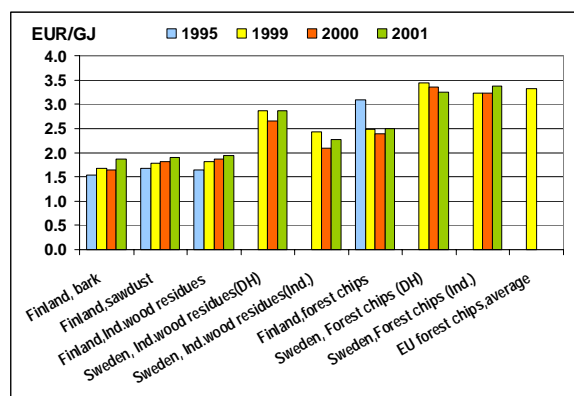


Figure 2. Prices of wood fuels in some European countries [1,10,11]

Table 2. European prices of wood fuels for combustion plants in the size of 1–5 MW_{th} in 1999 (€/GJ including energy taxes, excl. VAT). [1,2,8]

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

5 CONCLUSIONS

The special dynamics, which has characterised the trade with biofuels throughout the 1990s is reinforced by the political initiatives such as the EU's White Paper and the increase in CO₂ taxes. Simultaneously, the market is changing and as an example, it is very likely that Sweden will change status from net importer to net exporter because of the extensions in the use of biomass in Germany and other Central European countries [7].

With the German act "Gesetz für den Vorrang Erneuerbaren Energien" of 1 April 2000, a new large market for renewable energy has opened at which CHP based electricity (<20 MW_e) on biomass is subsidised with 86–100 €/MWh_e (depending on the size of the plant). German support means that the energy producer is capable to pay for biofuel as much as 4–9 €/GJ [3]. If the act turns out successfully, Germany will be a potential market for biofuels, and this will then certainly affect the prices and supply of fuels e.g in Denmark and other Baltic sea countries. In Sweden this could result in selection between Denmark or Germany in pellets export. Different subsidy schemes can also affect on the round wood supply for the forest industry increasing the competition between raw material and energy use. Also the new RES-E directive and green certificates will boost the interna-

tional biofuel trade. More comprehensive evaluation of the international biofuel trade and better customs statistics of biofuel trade is needed.

A very important work of standardising solid biofuels has started as the CEN co-operation in 2000. One reason for this is to stimulate good competition situation for companies in different countries and thus also enhance more effective work and cheaper energy. Nineteen countries are participating in the CEN, and the work is managed by Swedish standardisation organisation, SIS. The standardisation project TC335-Solid biofuels follows a mandate given by the European Union, which gives the frames for this specific TC is to work. Standardisation takes place in five working groups, of which Terminology is already ready for comments. Specifications and classes will be ready for comments in the end of June 2002. Other working group will continue their work at least until end of the year 2003.

REFERENCES

1. Export-import possibilities and fuel prices – Task 2. AFB-net V- Targeted actions in bioenergy network – Part 1. Country reports. VTT Energy & National coordinators and CEE subcontractors, Jyväskylä, November. 2000. 268 p.
2. HAKKILA, P. & NOUSIAINEN, I. & KALAJA, H. Use and prices of forest chips in Finland in 1999. AFBnet V Task 2 – Export and import possibilities and fuel prices, Wood Energy Technology Programme, VTT. 33 p. Jyväskylä 2001.
3. HELYNEN, S., FLYKTMAN, M., MÄKINEN, T., SIPILÄ, K. & VESTERINEN, P. Possibilities of bioenergy in reducing greenhouse gases. VTT Research Notes 2145, Espoo 2002, 109 p.+app. 6 p.
4. HILLRING, B. Regional prices in the Swedish wood-fuel market, Energy 24 (1999) 811-821.
5. HILLRING, B. Price formation of the Swedish woodfuel market. Biomass & Bioenergy 17(1999) 445-454.
6. LÖNNER, G., DANIELSSON, B-O., HEKTOR, B., NILSSON, P-O., PARIKKA, M., & VIKINGE, B. (1998). Costs and access of wood-fuel in the medium term. Uppsala: Swedish University of Agricultural Sciences, Department of Forest-Industry-Market Studies. Report No 51. In Swedish. Summary in English.
7. NIKOLAISEN, L.S; Trade with solid biomass, Proceedings of the conference, Bioenergy 2001, Aarhus, 25th – 28th September 2001. BioPress, Risskov, 77-80.
8. STEM 2002. Prices for biofuels, peat etc. Eskilstuna: Swedish Energy Agency. Periodical. In Swedish. 2 p (<http://www.stem.se/>)
9. STEM. 2001. Energy in Sweden. Facts and Figures 2001. Eskilstuna: Swedish Energy Agency (<http://www.stem.se/>).
10. VESTERINEN, P. & ALAKANGAS, E., Export-import possibilities and fuel prices in 20 European countries, Task 2, AFB-net V-Targeted actions in bioenergy network – Part 1. VTT Energy. Jyväskylä, January 2001. 48 p.
11. YLITALO, E. (ed.). Use of wood fuel for energy production in 2001. Forest statistic newsletter 2002:15 (620). Helsinki 2002, 8 p.