EUBIONET 3

Solutions for biomass fuel market barriers and raw material availability – IEE/07/777/SI2.499477

# Solutions to overcome barriers in bioenergy markets in Europe – D2.2

Resources, use and market analysis – VTT-R-01700-10

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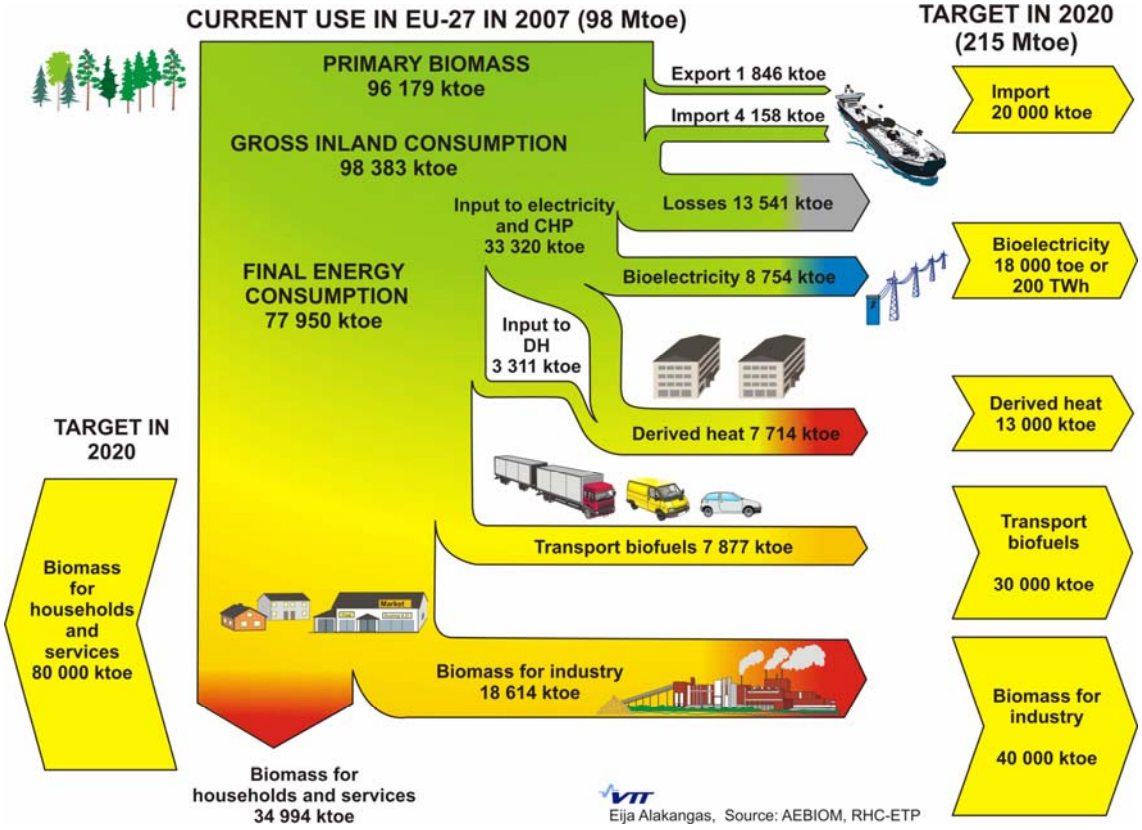


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Intelligent Energy Europe

# Content

# Preface

This publication is a part of the EUBIONET III Project (Solutions for biomass fuel market barriers and raw material availability - IEE/07/777/SI2.499477, www.eubionet.net) funded by the European Union's Intelligent Energy Programme. EUBIONET III is coordinated by VTT and other partners are Danish Technological Institute, DTI (Denmark), Energy Centre Bratislava, ECB (Slovakia), Ekodoma (Latvia), Fachagentur Nachwachsende Rohstoffe e.V., FNR (Germany), Swedish University of Agricultural Sciences, SLU (Sweden), Brno University of Technology, UPEI VUT (Czech), Norwegian University of Life Sciences, UMB (Norway), Centre Wallon de Recherches Agronomiques, CRA-W (Belgium), BLT-HBLuFA Francisco Josephinum, FJ-BLT (Austria), European Biomass Association, AEBIOM (Belgium), Centre for Renewable Energy Sources, CRES (Greece), Utrecht University, UU (Netherlands), University of Florence, UNIFI (Italy), Lithuanian Energy Institute, LEI (Lithuania), Imperial College of Science, Imperial (UK), Centro da Biomassa para a Energia, CBE (Portugal), Energy Restructuring Agency, ApE (Slovenia), Andalusian Energy Agency, AAE (Spain). EUBIONET III project will run 2008 – 2011.

The main objective of the project is to increase the use of biomass based fuels in the EU by finding ways to overcome the market barriers. The purpose is to promote international trade of biomass fuels to help demand and supply meet each other, while at the same time the availability of industrial raw material is to be secured at reasonable price. The EUBIONET III project will in the long run boost sustainable, transparent international biomass fuel trade, secure the most cost efficient and value-adding use of biomass for energy and industry, boost the investments on best practice technologies and new services on biomass heat sector and enhance sustainable and fair international trade of biomass fuels.

This summary report was written within the frame of the EUBIONET III project by Martin Junginger, Jinke van Dam (trade analysis), Eija Alakangas (resources and use) and Matti Virkkunen (calculation of resources and use). Also Kati Veijonen and Pirkko Vesterinen has participated in the planning and collecting data for the report.

We would like to acknowledge the contributions by all EUBIONET III consortium members for their efforts to collect data and conduct interviews for their national country reports and this report.

Jyväskylä, February 2010

Eija Alakangas and Martin Junginger

# Definitions

*Biomass fuel, biofuel:* fuel produced directly or indirectly from biomass. In this report term biofuel is used for all biomass fuels (solid, liquid or gaseous). In EUROSTAT and in the Commission papers biofuel usually means liquid transportation fuels.

*Black liquor*: liquor obtained from wood during the process of pulp production, in which the energy content is mainly originating from the content of lignin removed from the wood in the pulping process.

*Briquette:* densified biofuel made with or without additives in the form of cubiform, polyedric or cylindrical units, produced by compressing pulverised biomass. Briquettes are usually manufactured in a piston press. The total moisture of the biofuel briquette is usually less than 15% of mass.

*Chemical treatment:* any treatment with chemicals other than air, water or heat, e.g. glued, painted, coated, lacqued or otherwise treated wood.

*Energy crops:* woody or herbaceous crops grown specifically for their fuel value. Woody energy crops like willow and poplar is classified under woody biomass.

*Final energy consumption* includes all energy delivered to the final consumer's door (in the industry, transport, households and other sectors) for all energy uses. It excludes deliveries for transformation and/or own use of the energy producing industries, as well as network losses.

*Firewood:* cut and split oven-ready fuelwood used in household wood burning appliances like stoves, fireplaces and central heating systems. Firewood usually has a uniform length, typically in the range of 15 cm to 100 cm.

*Forest residues*: forest residue chips or hog fuel from final fellings (tops, branches, bark), thinnings (whole tree chips), delimbed small-sized trees (stem chips) or stumps.

*Forest, plantation and other virgin wood,* woody biomass from forests and/or tree plantations. Also segregated wood from gardens, parks, roadside maintenance, vineyards and fruit orchards is under this gategory.

*Fruit biomass*: the biomass from the parts of a plant which are from or hold seeds (e.g. olives).

*Gross inland consumption* is calculated as follows: primary production + recovered products + total imports + variations of stocks - total exports - bunkers. It corresponds to the addition of final consumption, distribution losses, transformation losses and statistical differences.

*Herbaceous biomass resources*: Herbaceous biomass is from plants that have a non-woody stem and which die back at the end of the growing season. It includes grains and their by-products such as cereals, energy grasses (reed canary grass, miscanthus, etc.).

*Hog fuel:* fuelwood in the form of pieces of varying size and shape, produced by crushing with blunt tools such as rollers, hammers, or flails.

*Industrial by-products and residues*, *solid:* Wood by-products and wood residues from industrial production. These solid biofuels can be chemically untreated (for example residues from debarking, sawing or size reduction, shaping, pressing) or chemically treated wood residues from wood processing and the production of panels and furniture (glued, painted, coated, lacquered or otherwise treated wood), as long as they do not contain heavy metals or halogenated organic compounds as a result of treatment with wood preservatives or coating. This classification is in accordance with the classification in the European Waste Catalogue including the waste code No. 03 01 (Wastes from wood processing and the production of panels and furniture).

*Net calorific value*: calculated value of the energy of combustion for unit of mass of a fuel burned in oxygen in calorimetric bomb under such conditions that all the water of the reaction products remains as water vapour at 0.1 MPa. The net calorific value can be

determined at constant pressure or at constant volume. The net calorific value at constant pressure is however the generally used. Net calorific value as received ($q_{net,ar}$) is calculated by the net calorific value of dry matter ($q_{net,d}$) and the total moisture as received (see formula in the end of this chapter).

*Pellet:* densified biofuel made from pulverised biomass with or without additives usually with a cylindrical form, random length typically 5 to 40 mm, and broken ends. They are usually manufactured in a die. The total moisture on wet basis of pellets is usually less than 10% of mass.

*Refined wood fuels*: pellets and briquettes

*Spent liquors*: mainly black liquor, but also pine and birch oil, soft soap, methanol, biosuspensions, and other liquid industrial by-products used for energy production.

*Used wood*: This group includes post consumer/post society wood waste; natural or merely mechanically processed wood, contaminated only to an insignificant extent during use by substances that are not normally found in wood in its natural state (for example pallets, transport cases, boxes, wood packages, cable reels, construction wood). This classification is in accordance with the classification in the European Waste Catalogue including the waste codes No. 15 01 03 (Wooden packaging), 17 02 01 (Construction and demolition wood wastes, but without the demolition wood wastes, which are excluded from EN14961-1 and 20 01 07 (Municipal wood wastes including separately collected fractions).

*Wood chips:* chipped *woody biomass* in the form of pieces with a defined *particle size* produced by mechanical treatment with sharp tools such as knives. Wood chips have a subrectangular shape with a typical length 5 to 50 mm and a low thickness compared to other dimensions.

*Wood fuels, wood-based fuels; wood-derived fuels;* all types of biomass fuels originating directly or indirectly from woody biomass

**Conversion of units**

| Unit | toe | MWh | GJ | Gcal |
|---|---|---|---|---|
| toe | 1 | 11.63 | 41.868 | 10 |
| MWh | 0.086 | 1 | 3.6 | 0.86 |
| GJ | 0.02388 | 0.2778 | 1 | 0.2388 |
| Gcal | 0.1 | 1.163 | 4.1868 | 1 |

For example: 1 toe = 41.868 GJ, 1 Mtoe = 41.868 PJ, 1 PJ = 0.02388 Mtoe

*The net calorific value (at constant pressure) on as received* (the moist biofuel) can be calculated on the net calorific value of the dry basis according to equation below (EN 14961-1).

$$q_{p,\mathrm{net,ar}} = q_{p,\mathrm{net,d}} \times \left(\frac{100 - M_{\mathrm{ar}}}{100}\right) - 0{,}02443 \times M_{\mathrm{ar}}$$

where

$q_{p,\mathrm{net,ar}}$ is the net calorific value (at constant pressure) as received (MJ/kg);

$q_{p,\mathrm{net,d}}$ is the net calorific value (at constant pressure) in dry matter (MJ/kg);

$M_{\mathrm{ar}}$ is the moisture content as received [w-%];

0,02443 is the correction factor of the enthalpy of vaporization (constant pressure) for water (moisture) at 25 °C (in MJ/kg per 1 w-% of moisture).

# 1 Background and aim

Large amounts of solid biomass are currently produced, traded and used for energy purposes in the European Union, but this trade is largely uncharted. Also, increasing volumes of unrefined and refined biomass are imported from outside the EU to several European countries. While the traded volumes are most likely in most cases relatively small compared to local production and consumption of solid biomass, biomass trade has shown strong growth in recent years, and there are good reasons to believe that this will continue in the years to come. Especially countries with little domestic biomass resources and high targets for renewable electricity, renewable heat and (eventually 2$^{nd}$ generation) liquid biofuels may increasingly depend on imported solid biomass. On the other hand, countries with ample solid biomass resources are increasingly discovering the international markets for solid biomass, and especially wood pellet plants are frequently built with the main (or sole) purpose of export.

However, these new markets are frail, and many barriers are still preventing the further growth. One of the aims of Work package 2 of the EUBIONET III project is to identify trade routes, quantify traded volumes and point out barriers & opportunities for trade. The aim of EUBIONET III was also to assess the economically and technically viable volume of solid biomass fuels (woody, herbaceous and fruit biomass).

For this aim, all EUBIONET III partners wrote individual country reports, which have been published on the EUBIONET III website. This report covers the main results from the individual country reports. Chapter 2 provides an overview of biomass resources and current use (2006 basic year) and Chapter 3 of the main trade routes and a rough estimation of traded volumes. Next, Chapter 4 shows a synthesis of the main barriers for solid biomass trade and possible solutions to overcome them. Finally, in Chapter 5 both the main trade routes and barriers are described in more detail for the EUBIONET III partner countries. These descriptions are mainly taken from the individual EUBIONET III country reports (see list in the end of the report). The final chapter of the report provides a short summary and conclusions.

# 2 Biomass resources and use in Europe

## 2.1 Method and limitations

EUBIONET III partners were asked to report not theoretical biomass resources but resources potentially available for harvesting, in other words national economical biomass resources in energy units (PJ). The definition of different potentials is according to the FP7 Project Biomass Energy Europe, BEE (www.eu-bee.info). BEE project is defining different potentials as the follows:

- *Theoretical potential*; the overall maximum amount of terrestrial biomass which can be considered theoretically available for bioenergy production within fundamental bio-physical limits.

- *Technical potential*; The fraction of the theoretical potential which is available under regarded techno-structural framework conditions and with the current technological possibilities, also taking into account spatial confinements due to competition with other land uses (food, feed and fibre production) as well as ecological (e.g. nature reserves) and other non-technical constraints.

- *Economic potential*; The share of the technical potential which meets criteria of economic profitability within the given framework conditions. EUBIONET III partners were asked to report this potential.

- *Implementation potential*; The fraction of the economic potential which can be implemented with certain time frame and under concrete socio-political framework conditions, including institutional and social constraints and policy incentives.

- *Environmental potential*; The environmental potential is the fraction of the theoretical potential with meets ecologic criteria related to biodiversity as well as to soil erosion. Also referred to as "ecologic potential".

- *Sustainable potential*; The fraction of the technical biomass potential which can be developed in a way which does not oppose the general principles of sustainable development, i.e. the fraction that can be tapped in an economically viable manner without causing social or ecological damage (includes e.g. nature, soil and water conservation). The sustainability goal can either decrease or increase biomass potential.

Also the sustainability criteria were taken into account especially in estimation of the forest biomass resources. In EU27 the total forest area is 155.7 million ha, of which 17.6% is protected, and 54% is certified according to PEFC (56.7 million ha) or FSC (26.9 million ha). Highest certification rate is in Austria 100% and Finland 95%. Annual round wood production was 427.8 million $m^3$ solid (excluding bark) in EU27, of which 80% is used as industrial raw material. Especially industrial use often requires raw material from certified forests. Industrial residues and by-products are very important bioenergy source.

The classification of resources in this report is based on standard EN 14961-1, which classifies biomass resources in the following main categories:

1 Woody biomass

1.1. Forest, plantation and other virgin wood
1.2. By-products and residues from wood processing industry
1.3. Used wood
1.4 Blends and mixtures

2 Herbaceous biomass

- 2.1 Herbaceous biomass from agriculture and horticulture
- 2.2 By-products and residues from herbaceous processing industry
- 2.3 Blends and mixtures

3 Fruit biomass

- 3.1 Orchard and horticulture fruit
- 3.2 By-products and residues from fruit processing industry
- 3.3 Blends and mixtures

All categories include also blends and mixtures. Blends and mixtures refer to material of various origins. Blends are intentionally mixed solid biofuels, whereas mixtures are unintentionally mixed solid biofuels.

Bioenergy use in EUBIONET III participant and subcontracting countries was asked to report for year 2006. It was also asked to use same biomass categories as for resources that current use and resources can be compared. All partners collected data by using specific data sheets. Bulgaria, Romania and Italy could not report woody biomass in different categories, only the total sum. The estimation of resources and use do not include biodegradable waste. The contribution of bioenergy in Malta, Cyprus, Luxembourg is very small so they are not included in this survey.

## 2.2 Biomass resources and use in 2006

### 2.2.1 Biomass resources

Figure 1 presents the reported availability of biomass resources in EUBIONET III partner and subcontractor countries. The total annual figure for reported biomass resources in 24 EU countries and Norway is around 6,577 PJ (157 Mtoe). Table 1 and Figures 1 and 2 present the total biomass resources according to different biomass types collected from EUBIONET partners and subcontractors.

The greatest potential (46%) to increase the use of biomass in energy production seems to lie in forest residues and herbaceous & fruit biomass. The utilisation of forest residues is often connected with round wood harvesting especially in Nordic countries, so the use of round wood by the forest industry impacts also the exploitation of the forest residue potential. Industrial by-products and residues (bark, sawdust, cutter chips, grinding dust, etc.) are quite well exploited in energy production and pellet or briquette production.

The availability and cost of forest biomass varies considerably between countries and within countries. The most common biomass fuel is forest wood (wood chips, firewood and hog fuel). In general, the availability of forest resources, the demand for forest fuels, and machine and labour costs are the defining factors behind prices. Usually, both the optimal harvesting technology and the availability of forest fuel must be studied on a local level for reliable results.

In the case of logging residues, the biological logging residue accumulation can be estimated by the total area of final fellings and stemwood biomass conversion tables. Asikainen et al. (2008) estimated that technically harvestable volume of forest energy potentials for the European Union is 187 million m³ (1,507 PJ, 36 Mtoe). Estimation is based on consistent forest statistics, which included estimation of the proportion of wood available for energy production in each EU member state. The theoretical forest fuel potential is 785 million solid m³ in EU27. EUBIONET III estimation of annual potential is only little lower 1,461 PJ (35 Mtoe) and it include also Norway.

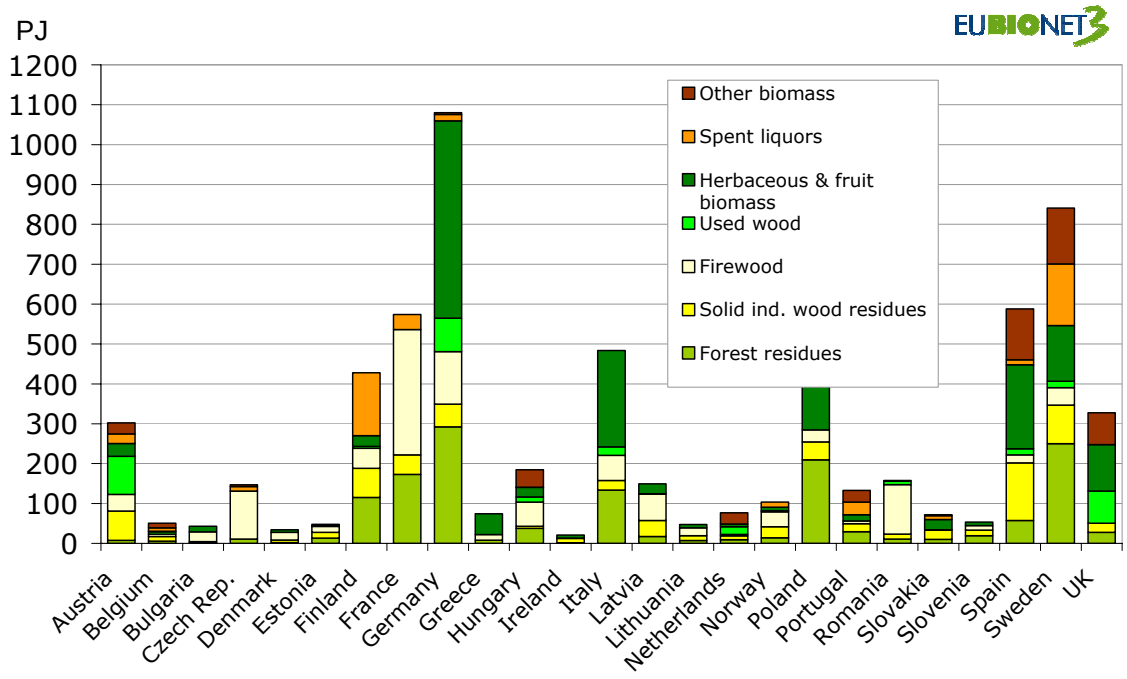


*Figure 1. Biomass resources by type in EU24 and Norway*.

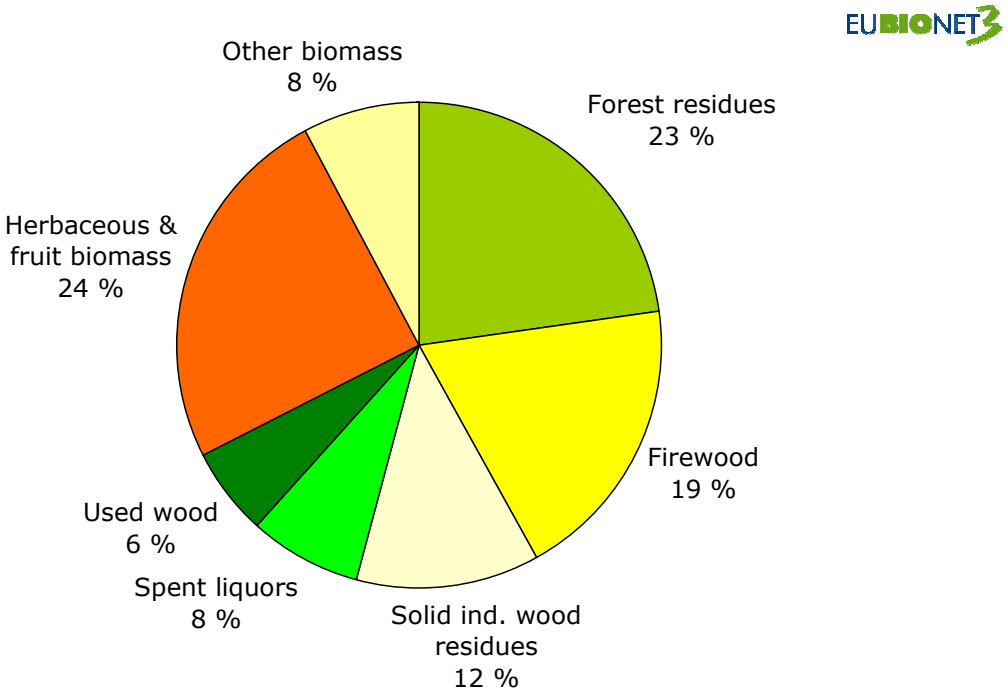


*Figure 2. Biomass resources by different sources in EU24 and Norway.*

The EUBIONET III partners have estimated that total potential is 6,577 PJ (Table 1), of which 67% is from woody biomass. According to reported data, following countries have the lowest total annual biomass resources (< 100 PJ): Bulgaria (42 PJ), Belgium (50 PJ), Denmark (34 PJ), Estonia, (48 PJ), Lithuania (47 PJ), Slovenia (53 PJ), Slovak Republic (72 PJ), the Netherlands (77 PJ) and Greece (74 PJ). In turn, Germany (1 080 PJ), Sweden (841 PJ), Spain (588 PJ), France (574 PJ), Italy (484 PJ) and Finland (428 PJ), are the most rich EU countries in biomass resources. Sweden, Finland, Germany and France have largest volumes of forest residues.

*Table 1. Summary of biomass resources by different biomass type (PJ and Mtoe). EU24+Norway. EUBIONET III project data*

| Biomass source | Annual biomass resources | |
|---|---|---|
| | PJ | Mtoe |
| 1 Forest residues | 1 461 | 35 |
| 2 Firewood | 1 224 | 29 |
| 3 Solid industrial wood residues and by-products[1] | 901 | 22 |
| 4 Spent liquor | 482 | 12 |
| 5 Used wood | 368 | 9 |
| 1+2+3+4+5 Woody biomass total | 4 436 | 106 |
| 6 Herbaceous & fruit biomass | 1 582 | 38 |
| 7 Other biomass | 559 | 13 |
| Total | 6 577 | 157 |

[1] includes raw material used for pellet production.

### 2.2.2 Biomass use in 2006

The solid biomass use in 2006 was 3 178 PJ (76 Mtoe) reported by EUBIONET III partners and subcontractors (Figure 3, 4, 5). This means that currently 48% of the estimated biomass potential is exploited (Table 2).

Figure 3 shows how different biomass sources are used in Europe and Figure 4 the use by categories in different countries. Figure 5 summarizes the use by different categories. Firewood is the most used biomass (30%), but figure of firewood is not so accurate, because most of the firewood is not traded officially. Industrial by-products and residues represent the next biggest biomass types contributing to the total figure: use of solid by-products covers 20% of the total consumption, whilst the share of spent liquors (mainly black liquor) is 15%. Forest residues comes next with 11% share of the total figure, and is followed by herbaceous and fruit biomass resources (7%), used wood (6%) and refined wood fuels (5%). Use of pellets has increased in many countries and it exceeds the production. Pellets are produced from wood industrial by-products and residues and there might some overlapping with solid industrial wood residue figures, so pellets are included in resources and use under industrial by-products and residues.

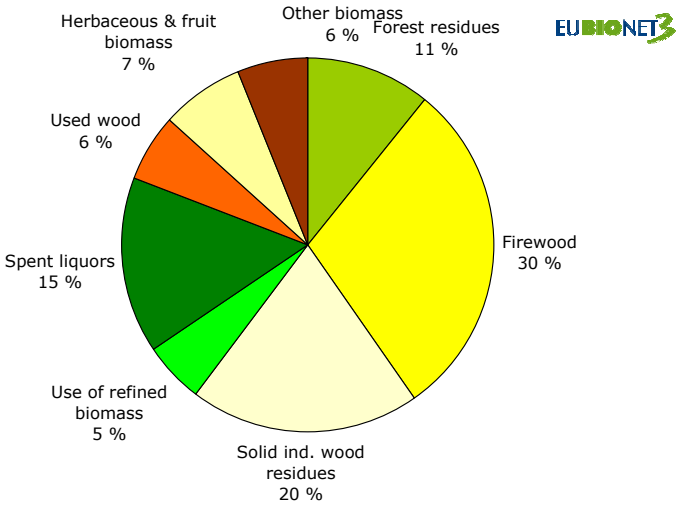


*Figure 3. Biomass use by different sources.*

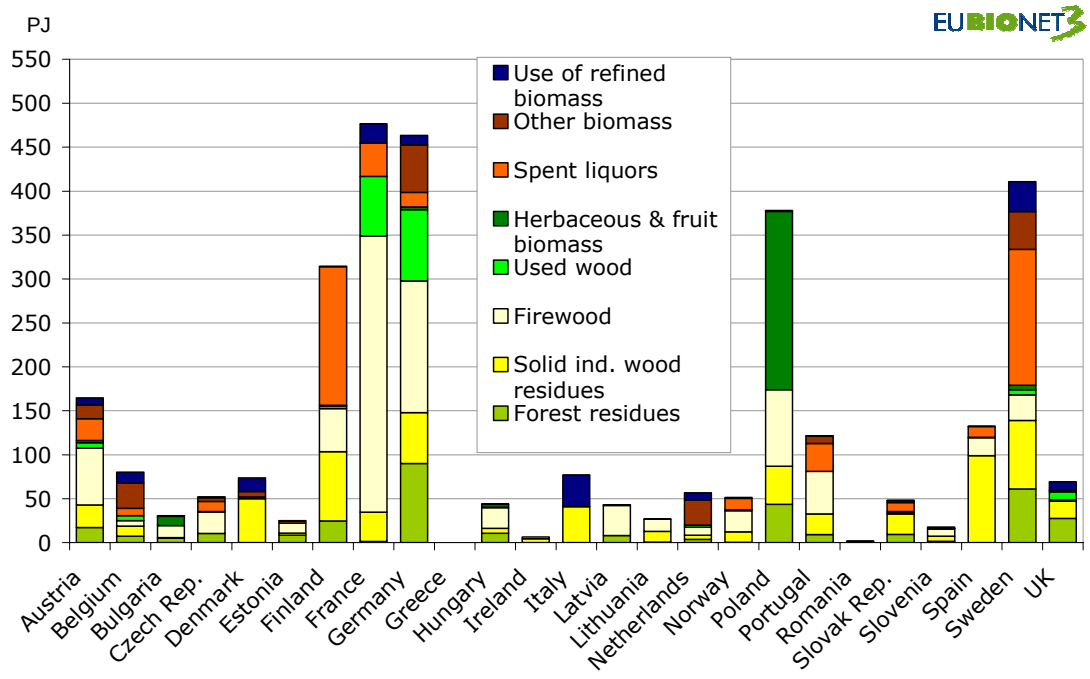


*Figure 4. Biomass use in 2006 in EU24 and Norway.*

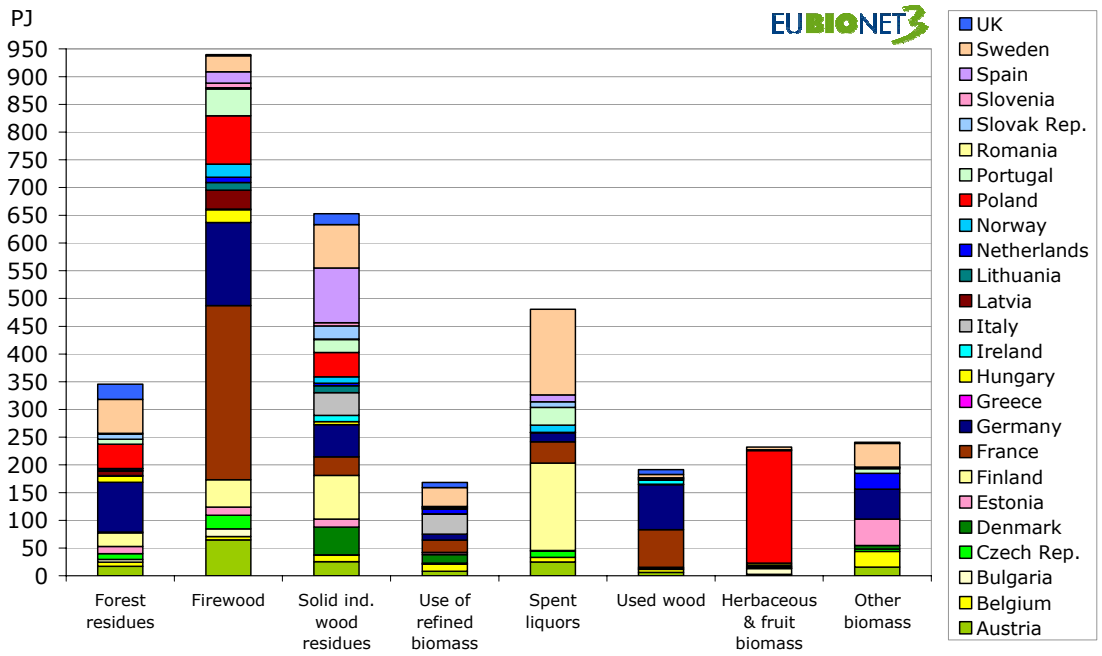


*Figure 5. Biomass use in 2006 by sources and countries.*

Firewood is the most used solid biomass fuel in Europe. France and Latvia are the biggest users. Herbaceous biomass, mainly straw is used in Denmark and Poland. Forest residues, industrial wood residues and spent liquors are the main biomass source in Finland, Slovenia and Spain.

EUBIONET III reported figures of biomass use for EU24 (excluding Norway) covers only solid virgin biofuels (3 115 PJ, 74.3 Mtoe). This is little higher than the EUROSTAT figures. According to the EUROSTAT, the total primary bioenergy in EU27 was 3,730 PJ (89.0 Mtoe) in 2006, which includes solid biofuels 3,052 PJ (72.9 Mtoe), biogas 200 PJ (5.0 Mtoe), waste 243 PJ (5.8 Mtoe) and liquid biofuels 221 PJ (5.3 Mtoe).

### 2.2.3 Comparison of potential and use

*Table 2. Summary of biomass resources and use in 2006 by different biomass type in EU24 and Norway (PJ and Mtoe). EUBIONET III data*

| Biomass source | Annual biomass resources | | Use in 2006 | | Use of resources |
|---|---|---|---|---|---|
| | PJ | Mtoe | PJ | Mtoe | % |
| Forest residues | 1 461 | 35 | 340 | 8 | 23 |
| Firewood | 1 224 | 29 | 937 | 22 | 77 |
| Solid industrial wood residues and by-products[1] | 901 | 22 | 809 | 19 | 90 |
| Spent liquor | 482 | 12 | 482 | 12 | 100 |
| Used wood | 368 | 9 | 183 | 4 | 50 |
| Woody biomass total | 4 436 | 106 | 2 742 | 66 | 62 |
| Herbaceous & fruit biomass | 1 582 | 38 | 232 | 6 | 15 |
| Other biomass | 559 | 13 | 193 | 5 | 35 |
| Total | 6 577 | 157 | 3 178 | 76 | 48 |

[1] includes pellet production and pellet use.

Figure 6 shows the current biomass use compared to resources.

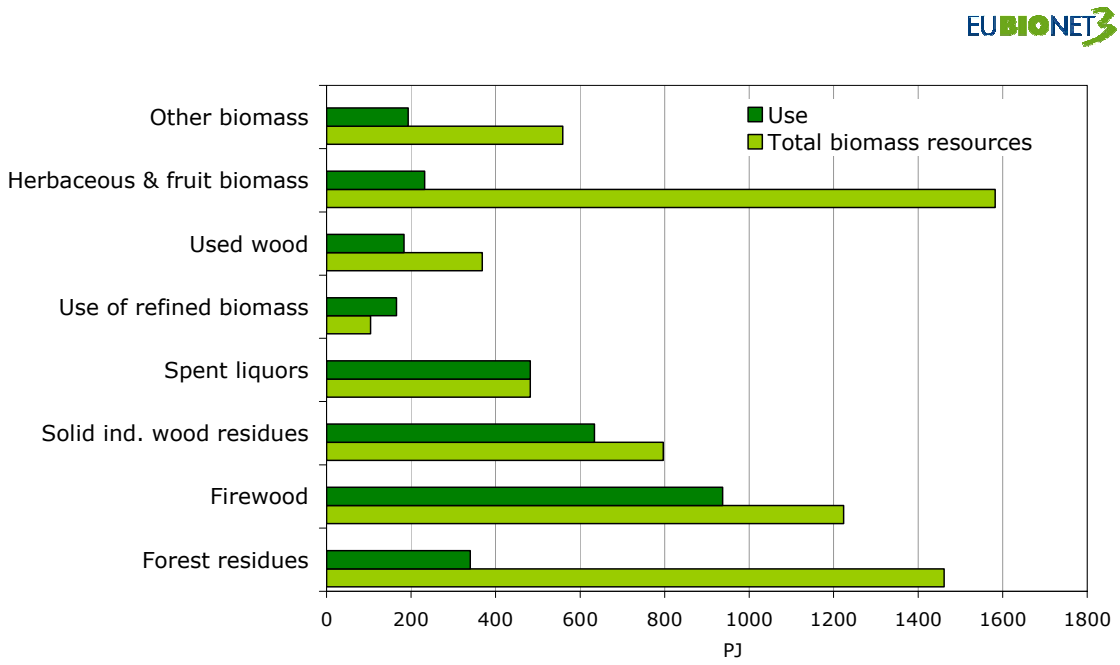


*Figure 6. Current biomass use in 2006 in EU24 and Norway compared to resources.*

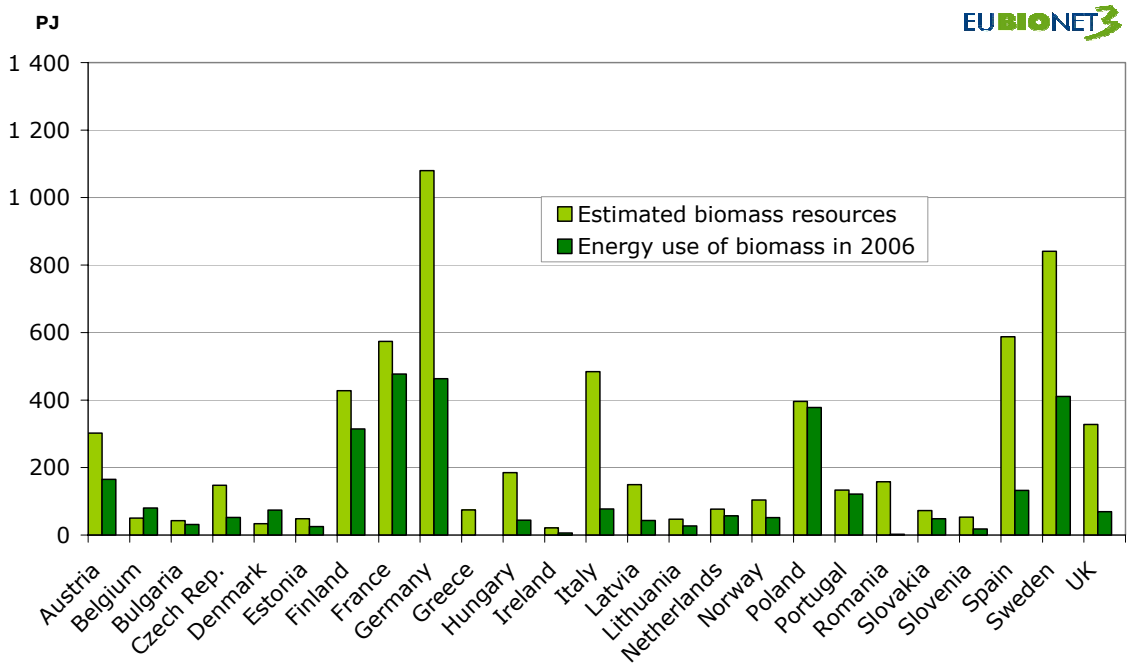


*Figure 7. Biomass use compared to resources in different countries.*

The BEE project has also analysed different biomass resource assessments studies (Table 3). Comparing the potentials in Table 3 to sum of sector-specific biomass potentials, it can be seen that the range for the latter one is even bigger than the range for total potential. This is obviously due to an overlap between biomass categories and/or system boundaries, particularly in the case when highly disaggregated data are summarised. There is a strong need to improve the accuracy and comparability of future biomass resource assessment for energy by reducing heterogeneity and by increasing the degree of harmonisation (Rettenmaier N. et al. 2008).

*Table 3. Summary of biomass energy potentials in EU27 reported in different studies (Rettenmaier N. et al. 2008) in PJ (Mtoe).*

| | | 2000 | 2010 | 2020 | 2030 | 2040 |
|---|---|---|---|---|---|---|
| Energy crops on agricultural and marginal land | Min.<br>Max. | 700<br>(17)<br>1 400<br>(33) | 800<br>(19)<br>6 100<br>(146) | 800<br>(19)<br>12 000<br>(287) | 6 000<br>(143)<br>8 000<br>(191) | 6 100<br>(146)<br>22 000<br>(525) |
| Forestry and forest residues | Min.<br>Max. | 1 000<br>(24)<br>3 900<br>(93) | 1 000<br>(24)<br>3 200<br>(76) | 900<br>(21)<br>3 900<br>(93) | 900<br>(21)<br>2 400<br>(57) | 2 400<br>(57) |
| Agricultural residues and organic waste | Min.<br>Max. | 2 000<br>(28)<br>2 800<br>(67) | 2 900<br>(69)<br>3 900<br>(93) | 1 500<br>(36)<br>4 300<br>(103) | 3 100<br>(74)<br>3 100<br>(74) | n.a. |
| Total | Min.<br>Max. | 3 700<br>(88)<br>8 100<br>(195) | 4 700<br>(112)<br>13 000<br>(310) | 3 200<br>(76)<br>20 000<br>(478) | 10 000<br>(239)<br>14 000<br>(334) | n.a. |

European Environmental Agency has estimated in 2006 that environmentally-compatible annual primary biomass potential is 7,950 PJ (190 Mtoe) in 2010, 9,880 PJ (236 Mtoe) in 2020 and 12,351 PJ (295 Mtoe) in 2030.

EUBIONET III figures for herbaceous and fruit biomass is much smaller than other assessment studies of resources. European Environmental Agency reported that the environmentally-compatible biomass potential comprises 3 350 PJ (80 Mtoe) from agriculture, and EUBIONET III project 1 582 PJ (38 Mtoe). EUBIONET III partners were asked to report potential of energy grasses (reed canary grass, miscanthus and other crops), straw potential, olive residues and other herbaceous and fruit biomass resources. Energy crops include the cultivation of energy grass, miscanthus and short rotation coppice (willow, poplar). In the Nordic countries reed canary grass is cultivated for solid biofuel, including around 20,000 hectares in Finland. At mid latitude in Europe miscanthus is cultivated in some thousands of hectares for solid biofuels. We do have to point out those assumptions for the potential of these energy crops may vary widely, depending amongst others on the assumptions on the availability of (abandoned) cropland. Thus, assumptions for the potentials of these energy crops may vary widely, as they were often derived from national studies, and not established using a common methodology.

The total arable land in the EU27 amounts to 108.9 million hectares, of which 7.2 million hectares represented set-aside land in 2005. It has estimated that circa 17 – 30 million hectares of arable land could be available for energy production, while the total area under energy crops in the EU is around 2.5 million hectares. Energy crops include the cultivation of energy grass, miscanthus and short rotation coppice (willow, poplar). In the Nordic countries reed canary grass is cultivated for energy purposes, including around 20,000 hectares in Finland. At mid latitude in Europe miscanthus is cultivated in some thousands of hectares for energy purposes.

EUBIONET III has collected data of used wood and potential was 368 PJ (9 Mtoe). On the other hand the COST 31E project has estimated that the potential of recovered wood (=used wood) is about 29.6 Million tons, of which about 444 PJ (10.6 Mtoe) could be used for energy production (Merl, A. et al. 2007). EUBIONET III data is little lower than the estimate of the COST 31E project.

The EUBIONET III solid biomass potential does not include solid municipal or industrial waste e.g. paper and board. In 2006, about 260 million tons of municipal waste (MSW) was produced in the EU27, of which 20% was incinerated producing 243 PJ (5.8 Mtoe) energy. If about 50% of the waste production was to be used for energy (instead of the current 243 PJ), it could yield 1,540 PJ (37 Mtoe) of energy. Typically, the biodegradable fraction is about 50% and average net calorific value in highly industrialized old EU member states is of the order of 10 MJ/kg [Vehlow J. et al, 2007). If this biomass waste potential is added to the EUBIONET III biomass potential, the total biomass and estimated biodradable fraction of waste potential would increase to a total of around 7,347 PJ (175 Mtoe). This potential is entirely needed to achieve targets of biomass use in 2020. The implementation of this potential is very much depending on regional potential and regional biomass demand. The analysis of regional potential is needed for better estimated on implementation potential.

The proposal for a Renewable Energy Directive aims to establish an overall binding target of a 20% share of renewable energy sources in final energy consumption and a 10% binding minimum target for renewable energy sources in transport to be achieved by each Member State, as well as binding national targets by 2020 in line with the overall EU target of 20%. The role of biomass fuels in achieving these targets is significant. Among the "20%" scenarios, the highest biomass contribution anticipated is 9,630 PJ (230 Mtoe). This includes a maximum of 2,638 PJ (63 Mtoe) that would have to come from agricultural crops (if the entire biofuel contribution had to come from first-generation liquid biofuels). On the conservative assumption

that 15% of the biomass used is imported, the contribution that would have to come from the EU would be a maximum of 8,160 PJ (195 Mtoe).

Figure 8 shows the current use of biomass in 2007 and the target in 2020 based on the Renewable energy directive (2009/28/EC).

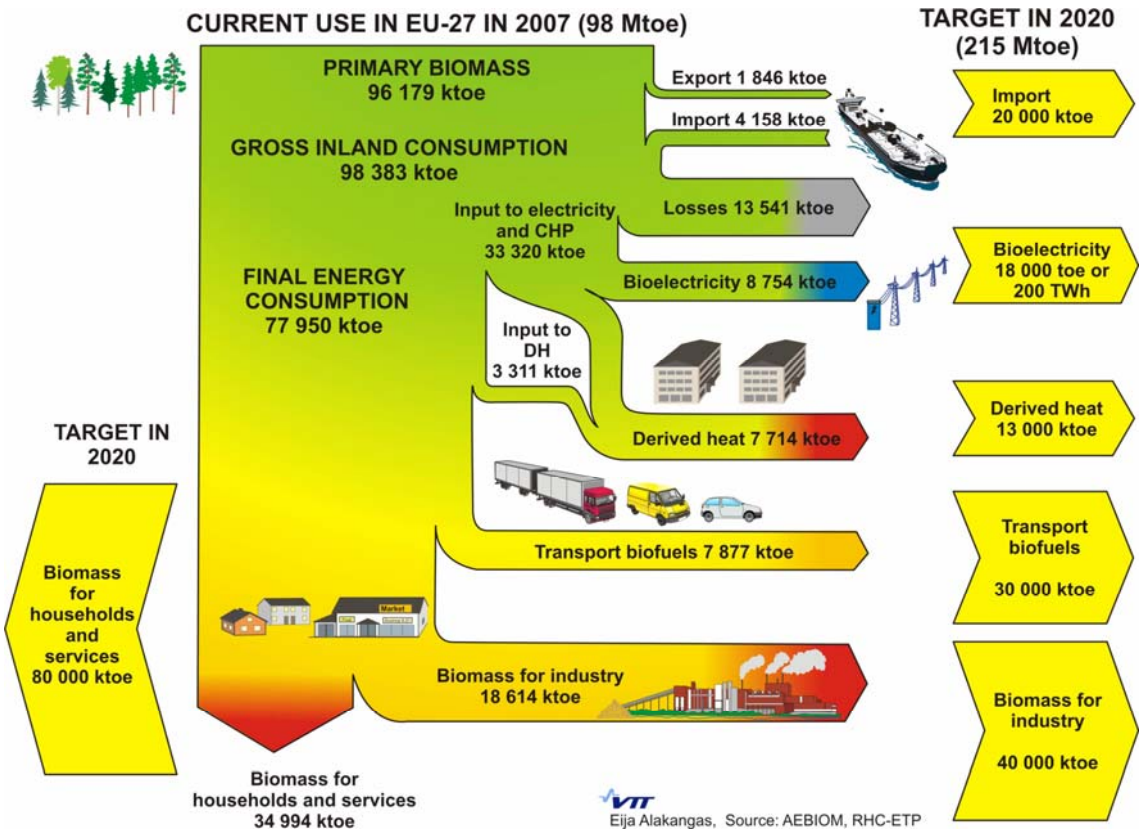


*Figure 8. Bioenergy use in EU27 in 2007 and estimation for biomass use in 2020. Eurostat, AEBIOM and Renewable Heating and Cooling Energy Technology Platform (RHC-ETP) (www.rhc-platform.org).*

# 3 Solid refined biomass trade in Europe – an overview

## 3.1 Method and limitations

As a first and paramount remark, solid biomass trade volumes and trade flows are notoriously hard to track. There are often unreliable and insufficient statistics on solid biomass use, let alone that traded volumes and direction of trade flows are properly recorded. One inherent problem related to the use of trade statistics is that in many cases, solid biomass can have several end uses next to energy: for example animal fodder (e.g. straw and many other agricultural residue streams), stable bedding (wood pellets), or pulp and paper production (wood chips). It therefore often impossible how much of the biomass was traded with an intended energy end-use. While for wood pellet and briquettes, it can be assumed that the intended end use is mainly energy, is far les clear cut for other solid biomass streams.

One solution can be to interview large-scale producers, traders and consumers which quantities they trade, and to/from which directions. This was done by the EUBIONET III to obtain the requested data. However, this approach will mostly yield incomplete information regarded traded quantities, and also may include the risk of double counting. Adding to this, there was also limited time available for the individual EUBIONET III project partners, so they were only able to obtain a rough overview, and not able to interview all market players to get a full analysis.

## 3.2 Overview of results

Figure 9 displays the total import and export of all European countries for which data was submitted. Figure 9 shows the total traded biomass volumes of refined solid biomass in selected European countries in 2006. Figure 10 shows an overview of solid refined biomass imports and exports in a number of European countries in 2006. All data should be considered rough estimates, and almost certainly incomplete.

From Figure 9, it would seem as if only a very minor part (about 1%) of the total solid biomass utilized in 2006 in the EUBIONET III countries was traded internationally. However, one should take into account the following factors:

- These statistics are only for refined solid biomass trade, i.e. mainly pellets and to very minor extent briquettes. There may be also significant trade in unrefined solid biomass, for example firewood (which is also traded in Greece), wood chips, which are traded for example in Latvia, Finland and Denmark, and straw, which is exported by Denmark to Germany.

- Since 2006, especially the production, trade and consumption of refined solid biomass fuels has strongly grown, probably much faster then the other solid biomass types.

- While the overall current use statistics are already incomplete, this is even more so the case for biomass trade statistics. A major reason is that only from January 2009 onwards, wood pellet trade statistics are recorded by EUROSTAT (CN code: 4401 30 20)

- Data for 2006 is largely incomplete and uncertain. For comparison, based on preliminary EUROSTAT data, between 1.7 and 2.6 million tons of wood pellets are traded in Europe in 2009. In comparison, we estimate that in 2006, between 1.5 and 1.9 million tons of wood pellets were traded (this includes both intra-EU trade and imports from e.g. Canada and Russia to EU countries).

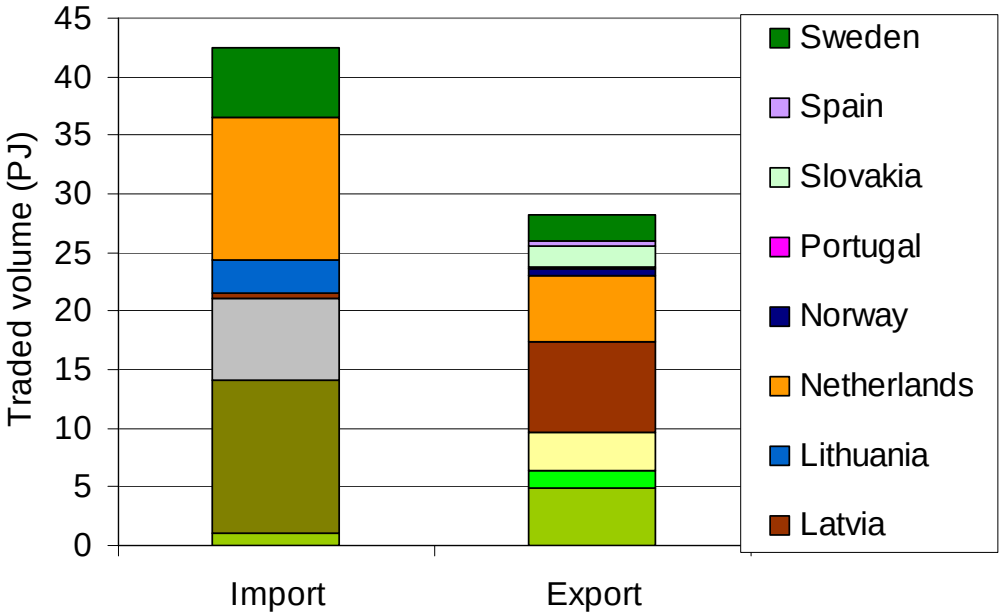


*Figure 9. Total traded biomass volumes (gross imports and exports) of refined solid biomass in selected European countries in 2006. All data should be considered rough estimates, and almost certainly incomplete.*

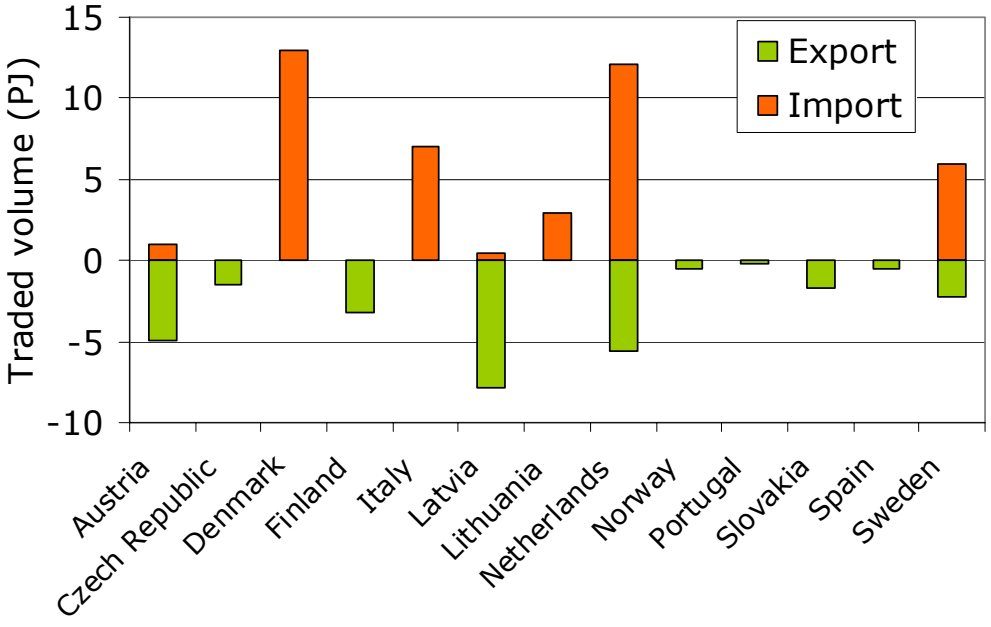


*Figure 10. Overview of solid refined biomass trade in a number of European countries in 2006. All data should be considered rough estimates.*

*Table 4. Overview of all trade data of refined solid biomass in 2006 as reported by EUBIONET III partners*

| Country | Year | Import (PJ) | From | Export (PJ) | To |
|---|---|---|---|---|---|
| Austria | 2006 | 1.03 | Czech Republic, Romania | 4.90 | Italy |
| | 2007 | 0.60 | Czech Republic, Romania | 5.44 | Italy |
| | 2008 | 2.32 | Czech Republic, Romania | 5.26 | Italy |
| Belgium | 2004 | 5.04 | Scandinavia, Easter Europe, Russia, Ukraine | 0.02 | France |
| | 2004 | 5.67 | Northern and Southern America, Asia, South-Africa | | |
| Czech Republic | 2006 | 0.02 | Slovakia | 0.96 | Austria |
| Denmark | 2006 | 13.00 | Eastern European countries, Canada | 0.00 | |
| Finland | 2007 | 0.13 | Russia, Baltic states | 3.14 | Denmark, the Netherlands, the UK and Belgium |
| Germany | 2006 | n.a. | Austria, Czech Republic, Sweden | n.a. | Scandinavia, Belgium, Netherlands, France, Austria |
| Italy | 2006 | 7.00 | Austria | 0.00 | |
| Latvia | 2006 | 0.43 | 14 countries | 7.83 | 18 EU countries |
| Lithuania | 2008 | 2.94 | | | Sweden, Denmark, Finland, Italy |
| Netherlands | 2006 | 12.08 | Mainly Canada, also Baltic states, Finland and Germany | 5.53 | Unknown (re-export) |
| Norway | 2006 | 0.00 | | 0.57 | Sweden |
| Portugal | 2006 | 0.00 | | 0.23 | Germany, Italy |
| Slovakia | 2006 | 0.00 | | 1.72 | Austria, Czech Republic, Hungary |
| Slovenia | 2006 | 0.00 | | 0.74 | Italy, Austria, Croatia |
| Spain | 2006 | 0.00 | | 0.48 | UK, Netherlands, Belgium, Ireland etc. |
| Sweden | 2006 | 6.0 | Canada, Latvia, Norway, Finland, Estonia | 2.20 | Denmark, Belgium, Norway |
| United Kingdom | 2006 | n.a | | n.a. | |

## 3.3 Major biomass commodities traded

From the individual country reports, we can differentiate major and minor trade flows:

A number of solid biomass commodities are all traded in amounts often more than 100,000 tons per year and in some cases also over large distances. These include wood pellets (by far the most important refined commodity, and reported in almost all EUBIONET III countries), wood chips (Denmark, Slovenia, Finland), used wood and firewood. Minor quantities of solid biomass traded are typically relatively small amounts (less than 10,000 tons per year) over short distances are traded, e.g.

wood briquettes[1], stumps, sawmill waste (sawdust, bark, chips), and mixed solid waste streams (RDF, PPDF). Typically, these are just traded between two neighbouring countries, e.g. Sweden and Norway, or Germany and the Netherlands.

### *3.3.1 Wood pellet trade*

By far the most important solid biomass traded across Europe is wood pellets. The main trade routes are discussed below.

A number of main wood pellet trade routes can be discerned (as displayed in Figure 11):

- Trade of industrial wood pellets from the Baltic countries, Finland and Russia to Sweden, Denmark, Belgium, the Netherlands and UK by vessel. These pellets are mainly intended for large scale use, i.e. co-firing in coal fired power plants or use in medium-to-large CHP plants in e.g. Sweden and Denmark.

- Global import of wood pellets to Belgium and the Netherlands by ship, mainly form Canada and the USA, in 2009 also from Australia. Again, these wood pellets are mainly destined fro cofiring in the coal power plants (some of them converted to stand-alone wood pellet plants) in Belgium and the Netherlands.

- Exports of high-quality wood pellets from Austria, Germany and Slovenia (by truck) and Portugal and Spain (by ship) to Italy. Italy has a huge number of domestic wood pellet boilers, and so demand for high quality pellets is large. This has attracted wood pellet imports, mainly by truck, from basically all surrounding countries (with the possible exception of France).

Next to these main trade routes, there is also small-scale short-distance border trade between neighbouring countries of high-quality wood pellets by truck. Typical examples are between Germany and Austria, Sweden and Norway or Sweden and Norway. While this formally also constitutes international trade, it has probably a more regional character.

### *3.3.2 Trade of other solid biomass*

Other (major) biomass stream, which are incidentally discussed in the various EUBIONET III country reports are:

***Wood chips***. In general, due to their high(er) moisture content and issues with (long-term) storage, it was deemed that the trade in wood chips is of less relevance, and was therefore not investigated thoroughly in the EUBIONET III project. However, there are incidental reports of large scale- trade. For example, Latvia exported 1.34 million cubic meters of wood chips, typically to Denmark, Sweden (and possibly to Belgium, Germany, U.K., and Lithuania).

***Firewood*** is a second fuel which is traded internationally, e.g. exported by Latvia, (450,000 $m^3$), Estonia and Finland; and traded by Norway and Greece.

***Waste wood (used wood)*** is a third woody biomass stream, which is traded all across Europe, is wood waste/used wood (226,000 $m^3$).

***Wood briquettes*** are, as mentioned earlier, also exported by some countries (Latvia, Lithuania and Slovakia) but very minor amounts compared to wood pellets.

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[1] With the exception of Lithuania, were in 2008 about 80% of domestic production (roughly 50,000 tons) were exported to Denmark. Also Slovakia exports briquettes to Austria.

***Straw***: Denmark reports significant exports of straw to the Netherlands, Germany, France and Belgium. It is however not clear, whether the end use is in all cases for energy.

***Other agricultural residues****:* In the UK: palm oil residues, olive residues, sunflower pellets and shea meal, from Indonesia, southern Europe and Africa.

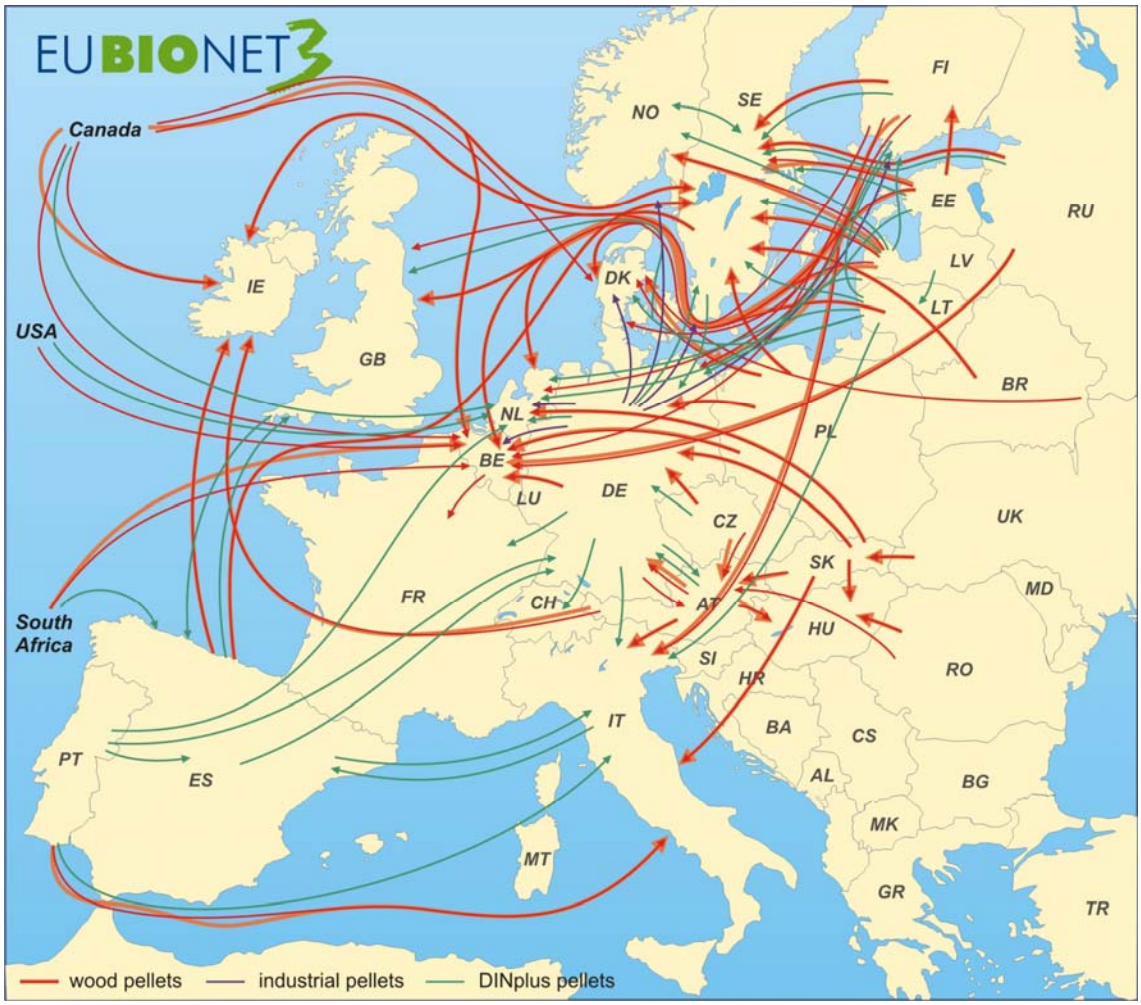


*Figure 11. Trading routes of wood pellets.*

# 4 Barriers and opportunities for solid biomass trade in Europe

## 4.1 Aim and data collection method

In this chapter, the barriers for solid biomass trade are discussed, as perceived by European traders (and in few cases also other market parties such as producers and large consumers) during the period April-September 2009. At the same time, solutions to overcome these barriers and opportunities to further increase trade are described.

These views have been obtained for 18 differing EU countries. All EUBIONET III partners were asked to conduct at least three interviews with traders in their country, and ask them what they considered to be the most important barriers for solid biomass trade. Traders also had the opportunity to indicate how these barriers could possibly be overcome, and which other circumstances currently could be considered opportunities for increased biomass trade. Appendix 1 contains the general template of the questionnaire in English (in some cases, the questionnaire was translated into the respective national language to facilitate the gathering of information). Partners had the opportunity to collect data by interviewing the traders face to face or over the phone, or send them the questionnaire by email. In the case of Italy, unfortunately no interviews could be carried out, and no barriers were reported.

Most of the interviews are available as appendices to the individual country reports. However, in some cases, the interviews contained confidential information. In these cases, the individual interviews were not published, but the general views and opinions were incorporated in the main text of the report.

## 4.2 Overview of biomass trade barriers

In Figure 12, the major and minor barriers are presented for all EUBIONET III member countries. They are discussed one by one in more detail in the sections below, including possible solutions.

As a general remark, the interviewees had the opportunity to mention as many barriers as they liked. Also, while they were specifically asked regarding barriers for biomass trade, the frequently also mentioned topics which were more related to production or consumption of wood pellets. This is of course logical, as a diminished supply or demand automatically means that less biomass can be traded.

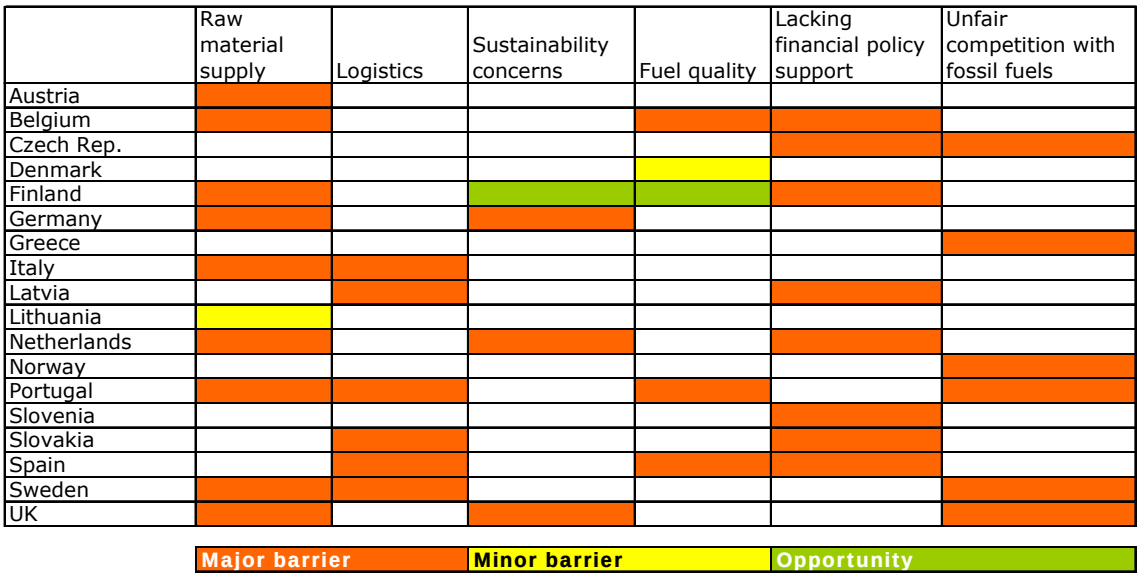


*Figure 12. Overview of main barriers for increased utilization and trade of solid biomass fuels as perceived by traders in different EU countries*

## 4.3 Raw material availability

Raw material availability is by far the most frequent barrier mentioned for increased utilization and trade of solid biomass, and probably also the most important one. It was especially mentioned by large-scale producers, such as Austria, Germany, Finland, Lithuania and Sweden. In many of these countries, due to the lack of feedstock (sawdust), the majority of companies have reduced their production volumes during last few years. It is interest that also Belgium, the Netherlands and the UK reported scarcity of feedstocks to produce wood pellets as a major market barrier. These are large pellet consuming countries with little or no domestic wood pellet production capacity (compared to their domestic demand). This is an indication, that this limitation is recognized widely by international market actors.

Remarkably, only Latvia seems to still have sufficient raw material supply for pellet production, as they specifically stated that resource availability was not an issue at the moment. However, Latvia currently imports large amounts of roundwood and sawn wood, so this resource availability may to a certain extent also depend on these imports. For comparison, wood imports in Finland have been severely limited by Russian export taxes, which has effectively also limited the availability of roundwood and other wood residues.

Generally, correspondents pointed out two possible solutions to the increasing feedstock scarcity:

1) Increased utilization of new feedstocks, such as waste wood/used wood, rejected wood, wood residues from pre-commercial thinnings, but possibly more high-quality feedstocks such as (pulp) wood chips and roundwood. In some countries, such as Germany and Sweden, these options are currently explored. However, in Belgium, wood production for an energetic use is not the main objective of the forest management policy, and governments are reluctant to address the topic. Also, the legal requirements for the Walloon forest exploitation mentioned that branches with a diameter less than 4 cm have to be left on site. Another constraint may be the high cost to recover these additional forest residues.
2) Increased import from regions which still have a large feedstock supply. Such regions may be both within the EU, but also outside the EU, e.g. Russia, Belarus, Canada and the US. In 2009, also imports were reported from South Africa and Australia, indicating that European wood pellet has

triggered a truly global production and supply of wood pellets for the European market.

## 4.4 Lack of financial policy support

A second major barrier mentioned by many respondents is the lack of financial policy support. This may concern both the amount of subsidy given and the stability of the subsidy regime. Also, this may concern both policy support for producing large-scale electricity (and/or heat) from biomass, but also support measures for small-scale biomass applications, e.g. investment subsidies for household pellet stoves.

Admittedly, this is a complaint voiced frequently and in many contexts by renewable energy producers, and may same very generic. However, it is important to point out that policy measures have triggered major trade flows of especially wood pellets in past years. For example, the generous subsidy on wood pellet stoves in Italy has triggered a large import of wood pellets from the surrounding countries to Italy. Similarly, the subsidy systems in the Netherlands and Belgium have made it possible that both countries currently import huge quantities of wood pellets (both just under one million tones per year, and rising). However, is these subsidies are (suddenly) abolished, or if continuation is insecure, this can cause major market disruptions (e.g. wood pellet over-supply) in the short term, and problems to secure long-term wood pellet trade contracts, which are the back bone for a stable trade.

Possible solutions are rather obvious: stable, long-term (e.g. 10 years) policies for biomass heat or electricity production increase market confidence and will trigger investments in renewable biomass production and trade.

## 4.5 Unfair competition with fossil fuels

Despite the subsidies given in many countries to support the use of solid biomass for energy, the (unfair) competition with fossil fuel is still mentioned as a major barrier. For example, in some EU countries, fossil fuels are exempted from VAT (or receive a lower VAT tariff), while biomass fuels are fully taxed under VAT.

While this answer was given in five EU member countries, we emphasize that this is not so much a specific trade barrier for biomass, but more a general barrier for all renewables as such.

## 4.6 Logistic barriers

More related to biomass trade, fossil fuels may also enjoy the benefits of a century (or more in the case of coal) of a well-established logistic infrastructure, which allows for a low-cost and efficient transport of these energy carriers.

Specifically traders from Latvia, Portugal, Spain and Sweden remarked that the logistics to collect the feedstock are both often severely limiting the amount of biomass that can be supplied and is driving up prices. Next to the collection of feedstock, also the transportation of the refined product (pellets) can be problematic, especially if the production facilities are not close to waterways or railroads, and transport has to take place over large distances by truck. For example, in Latvia, logistic limitations especially include limited weight capacities of local roads (which are often in bad shape, thus trucks are limited to 10 tons, driving up transport costs) and the availability and cost of storage facilities.

Interestingly, Austria pointed out that in their case, logistics are not an issue at all, probably as the feedstock for wood pellet production is sourced from nearby sawmills, and export distances to Italy are relatively short. Also in Finland logistics is well-organised in domestic trade, which is mainly based on trucks.

The traders did not go into much detail how the logistic barriers can be overcome. Especially the collection of forestry residues as raw material has been a challenge, which has been addressed in Finland, Sweden and Austria for decades, and has led to significant reduction of the delivered costs of forest residues. However, compared to residues produced at a central spot, these feedstocks are still more expensive, and would require more policy support o make more large-scale utilization possible.

Regarding the transport of refined solid biomass, optimization of logistic chains and increased utilization of rail and waterways would seem a logical step. Where transport over rail or water is not possible, more efficient use of trucks, improvement of roads, and optimization of intermediate storage facilities or terminals may me viable options to overcome these logistic barriers. In Finland and Sweden several projects are already going-on to build up large biomass terminals.

## 4.7 Sustainability criteria

This survey was conducted in the summer of 2009, during which – on a European level – no sustainability criteria for solid biomass were planned, and in many EU countries, this topic is probably not very well-known. On the other hand, Belgium already has legal requirements to prove the origin and sustainable production for biomass for renewable electricity production. Also, forestry certification is a well – established practice in basically all EU member countries.

Interestingly, sustainability criteria were seen as a (potential) obstacle by market actors in Germany, the Netherlands and the UK, but also as an opportunity in Finland. This is especially in wood biomass, because Finland has a long experience in forest certification (Finnish Forest Certification System based on PEFC) and 95% of forests are certified.

In the UK, concerns have been raised about the potential for increased biomass production to impact negatively on the availability of land and on existing markets through rising commodity prices, as food and non-food markets compete for the same crops. Sustainability of biomass production has been raised also as a concern and a barrier to expanding biomass trade especially from 'environmentally sensitive ecosystems', like south America, parts of Asia, etc as well as specific feedstocks like palm kernels.

In the Netherlands, similar concerns exist regarding the sustainable production of biomass as a barrier for the use of certain biomass streams, such as palm kernel expeller. It is a real problem that currently no label/certification system is in place. However, recently the first palm oil plantations have been RSPO –certified, and it is now investigated, whether the palm kernel expeller form these plantations are then automatically also RSPO-certified / sustainable. On the other hand, for many biomass streams used as animal feed (e.g. sunflower husk) the issue of sustainability plays a much lesser role.

The German respondents remarked that it is especially the uncertainty as such which sustainability criteria for solid biomass may be introduced in the future, and when. A solution to overcome this barrier would be to introduce "stricter but realistic norm for quality standards on EU level including realistic and "non-distorted" standards for sustainability".

The Finnish correspondents saw quality standards and sustainability criteria not as a barrier, but rather as an opportunity. In Finland, there are biomass fuel producers, which are looking business opportunities for wood fuel harvesting in other countries. These companies have experience and modern, efficient equipment available for wood fuel production, and are apparently confident that they will be able to meet possible quality standards and sustainability criteria.

## 4.8 Varying biomass fuel quality

The issue of biomass fuel quality (i.e. the physical properties of refined biomass fuels, e.g. wood pellets) has been raised by market actors in several countries. This issue seems to be especially important in Belgium, where at present, no difference is made between pellets set aside for an industrial or private use in Belgium. No certification system or quality controls are implemented for pellets used by public or private bodies, only foreign norms are used: two producers are DINplus certified, some traders import only DINplus pellets. Due to a lack of monitoring whether the standards are met, apparently also bad quality pellets are available on the market. To resolve this problem, a federal law is in course to fix wood pellets quality criteria for private use. The law entry in force should be end of 2009. Also in Portugal, the non-existence of a recognized entity responsible for the certification of solid biofuels is a problem. In order to sell their pellets in some European markets producers have to certify their products in other countries such as Germany, which is very expensive. Similarly, in Spain, market actors recommend that the current international biomass trade needs to accomplish a clear and firm legislation and to develop specific and operative norms/standards regarding the quality of biomass.

In Denmark, the chosen approach is different: All traders remark, that the building up of longer term relationships (not necessarily long term contracts) with producers and consumers based on mutual trust is essential for securing biomass of sufficient quality, and that is the way of facilitate international trade of biomass products. The feed-back from the traders is, that the introduction of standards, classification etc. on the biomass will not solve the mentioned challenges. On the contrary, rigid standards for product quality may in some cases be more in the way, because many biomass types have a natural variation in quality parameters depending on external factors beyond the control of the producer. This is indeed the case with straw, where the weather conditions in growth season and especially during harvest determines many of the most important combustion characteristics of the straw.

Finally, in Finland, quality standards were not found barrier but rather opportunity, as Finland produces generally high-quality wood pellets. If pellets are sold into many different countries with different standards, fuel analysis costs will be higher, because different requirements and different analysis methods applied. Therefore (the development of) international fuel specification standards were found important, because when trading to several countries which apply different standards, more different kind of fuel analysis is needed and this increase costs.

European CEN standards for solid biofuels are almost finalized and will be published in 2009 and 2010. Also work on developing quality standards internationally has started in ISO, and ISO standards for solid biofuels will be based on the European CEN standards. There will be 6 different Fuel specification and classes standards in multipart standard EN 14961 (Part 1 – General requirements, Part 2 – Wood pellets for non-industrial use, Part 3 – Wood briquettes for non-industrial use, Part 4 – Wood chips for non-industrial use, Part 5 – Firewood and Part 6 – Non-woody pellets for non-industrial use). Part 1, which includes classification of raw materials and master quality tables for 14 different traded forms, was published in January 2010. German and Austrian pellet associations has started to plan new international certification system, ENPlus, for wood pellets for non-industrial use.

## 4.9 Other barriers

Other barriers mentioned by market actors in at least two countries include:

- unstable markets (i.e. fluctuating prices for biomass resources)
- the lack of market transparency (e.g. prices, traded volumes)
- lack of reliable production, trade and consumption statistics of biomass fuels

Furthermore, in many countries, other barriers were reported, which often are related to local or national specific circumstances, for example:

- Strict regulations and additional requirements for the pellets production in Austria
- Trade of round wood from Russia has almost stopped because of trade duty fees (mentioned by Finland and Germany)
- The general lack of low-cost qualified labour in Latvia
- The Emission Allowance Unit (EAU) for peat in Sweden.

However, these seem to be only minor and typically local barriers. Concluding in general the barriers mentioned in sections 3.3-3.8 seem to be the most important one from a European perspective.

# 5 Individual input from the EUBIONET III country reports

In the following sections, the specific situation of refined solid biomass trade is described for all countries of the project partners of the EUBIONET III project. This information is taken in most cases directly from the respective sections of the individual country reports, and has only slightly been edited.

For each country, first, a general overview is provided of the current trade in solid refined biofuels. In a second section, the specific barriers and opportunities for solid (refined) biomass trade are summarized, based on the interviews that the project partners have conducted with local traders.

Note that is some cases, the individual country reports also provide additional information, e.g. on trade in unrefined solid biomass fuels (e.g. straw, fuel wood, peat etc., see e.g. the Finnish or UK country reports), or liquid biofuels (see e.g. the German country report). These parts have been exempted from this report, to provide a clear discussion of the refined solid biomass trade.

The quantitative information on trade flows of refined solid fuels has largely been summarized in section 1 (specifically Table 2). However, in some cases, there may be more detailed information available, e.g. on the specific trade of briquettes (which is generally negligible, except for Lithuania and Slovakia, and even then, absolute amounts are typically small).

All individual country reports are available from the EUBIONET III website, www.eubionet.net

## 5.1 Austria

*Ratbauer, J. & Sulzbacher, L. FJ-BLT*

*General overview*

Austria is a major exporter of wood products with an export surplus of more than 2.37 billion euros. In 2007, the Austrian wood pellet producers exported 316,000 tons, while only 35,000 tons were imported. The major export land for Austrian wood pellets is Italy, with nearly 100% of all exports. The wood pellets are exported in large parts by trucks and preferably in bagged cargo. Bagged pellets are preferred, because later they can be delivered with trucks to the consumer.

The amount of wood pellets, which are exported into other countries is marginal. In 2008, the export of wood pellets decreased over 10,000 tons to an export volume of 306,000 tons, while the import in 2008 has exploded up to 135,000 tons.

In 2008 Austria imported 100,000 tons wood pellets more than in 2007. Most of them were imported from Germany, where the production capacity was expanded. The major wood pellets import countries for Austria are the Czech Republic, Romania and since 2008 also Germany.

Unfortunately there were no data for the export or import of wood briquettes available.

*Barriers and opportunities for bioenergy trade*

The following statements were based on interviews, which were held with Austrian bioenergy traders. The interviews were conducted via telephone with wood chips and wood pellets traders, the two most important combustibles for solid bioenergy trade.

Firewood is also a very important combustible for the domestic heat supply, but it is mostly produced and sold by small and local producers like farmers and other forest owners. There are mostly no data available but rather estimates. The trading with firewood doesn't bear a meaning for the international bioenergy trade.

Based on the interviews, the following barriers were identified.

- The logistic do not pose a problem.
- A major barrier, which is preventing an increase of production, is the lacking supply of the raw material. The raw material for wood pellets and briquettes production is a by-product of the sawmill industry. Sawdust is a limited material and is getting more and more in demand. For this reason the price is continuously increasing.
- The pellet boilers are strongly promoted and the exchange of old oil heating is state-aided. But nobody considers the availability of the combustibles and that's the reason why prices will continue to rise.
- The largest barrier preventing increasing production is the instability of the market. The sales market as well as the raw material market. The raw material market is directly depending on the sawmill industry. The saw dust is a by-product of the sawmill industry. During the last years the sawmill industry is constantly decreasing the production capacity and so the amount of raw material for wood pellets and wood briquettes are also decreasing.
- Another barrier, which affects the export, is the influence of the foreign distributors. They try to lower the prices to the level of the production costs. The pressure on the part of the foreign traders and distributors causes the wood pellet producers and exporters to look for new distribution channels.
- Strict regulations and additional requirements for the pellets production in Austria are barriers preventing an increasing production and in further consequence the export of wood pellets and briquettes. More and stricter requirements in Austria make it harder for especially smaller wood pellets producer. It could be possible that wood pellet producers have to publish data of emissions or install a bio filter for their production.
- The price is one of the most influencing factors for production, export/import and the consumption of biomass.
- The availability of raw material depends on the actual wood price. If the price is high, it is profitable even for small forest owners to lumber or deforest and the supply of raw material for the wood chips production is increasing. Another barrier which is preventing increasing production is that the forest in Austria is very small structured and owned by countless private persons.
- The supply of raw material for the wood chips production is also depending on the demand of the saw mill industry, but not as strong as at other combustibles like pellets and briquettes.
- The production of wood chips is decentralised and the chippers are run by diesel, so the diesel price influences the price of the wood chips and the big industrial consumers are not willing to pay the high price.
- The export of wood chips is currently no issue.

*Proposals to overcome these barriers:*

- The objectivity must be enhanced. That means the cost saving should not be the main argument for the decision between a pellet boiler and a new and modern oil heating. The ecological and environmental issue should be more important.
- Another way, how this barriers could be overcome is to create specific biomass aid packages.
- One solution for these barriers is direct selling. The producer is also the distributor and could so avoid the market power of traders. We are expanding this form of direct selling since 2004 and we will do more like this in future. As producer we are delivering the wood pellets directly to the end user and so we are skipping the traders in the supply chain.
- One point is a higher wood price. If the wood price is increasing, the supply of raw material is also rising.
- Because of a storm last year, the supply of raw material was quite good. Also natural phenomena are influencing the market.
- There is no great potential for changes regarding regulations and political frameworks.

*Advantages:*

- A big advantage of the biomass is the independence from foreign energy sources. In Austria there is basically enough biomass, but to face the challenges of the future we will need an energy mix.
- Energy mix means a combined energy supply by all renewable sources like solar energy, community heating, wind energy, biomass and also fossil fuels and including all energy-saving measures.
- The opportunities are very limited because of the strong connection to the sawmill industry. The Seppele GmbH has to buy the raw material for the wood pellet and briquettes production. They do not have their own raw material. Because of the current economic situation the supply of sawdust is decreasing and the price has doubled since last year.
- In view of the pellets production and trade, the opportunities depend on the development of the sawmill industry.
- A future opportunity is the extension of combined heat and power plants. We are still delivering to some cogeneration plants. There are plans of the government to advance the combined heat and power stations.
- Opportunities regarding to the raw material market is strongly connected with the pulp and paper industry. There is a competition for raw material and the pulp and paper industry is dictating the price.

## 5.2 Belgium

*Pieret, N. CRA-W*

*General overview*

Belgium has a limited-resource potential. Biomass importations will thus play a major role to reach national targets. In this situation, setting up sustainable and quality criteria will be necessary. This certification system could be a trade barrier if they are too restrictive as an opportunity by ensuring a good image. Despite the inland limited biomass resource potential, raw materials are exported due to a lack of demand to use these resources or a restrictive waste or/and environmental policy (i.e. domestic wastes or used oils utilization).

One of the most important biofuel markets is wood pellets trade. In Belgium, wood pellets are used to produce electricity in big Electrabel power plants (Wallonia: Les Awirs, Flanders: Rodenhuize) or to produce heat (public bodies, householders, etc.). Belgian pellets production started in 2005. Today, Belgium counts seven

producers. They represent a capacity production of 450,000 tons. For the moment, current annual production reaches 213,279 tons, 30% are used in private sector. Due to electricity production, wood pellets importations are huge in Belgium from Canada, North America and Germany principally. Wood pellets are mainly imported by boat. However, it can be noted that Belgian pellets are exported (estimated to 500 - 1,000 tons/year) for private use to neighbouring countries, mainly France. Supply network starts to be well developed: 50 providers are registered in Wallonia and 5 bulk trucks are working in Wallonia (ValBiom data).

*Barriers and opportunities for bioenergy trade*

Presently, there is no difference between pellets set aside for an industrial or private use in Belgium. No certification system or quality controls are implemented for pellets used by public or private bodies, only foreign norms are used: two producers are DINplus certified, some traders import only DINplus pellets. Consequently, bad quality pellets are available on the market for householders causing trouble to the whole chain. The quality of Pellets produced in Wallonia is good, whereas quality problems are observed with imported pellets. Consequently, quality starts to become a barrier due to numerous household boilers out of use. Wood pellets image get spoiled and consumers are gradually loosing trust in pellets. To resolve this problem, a federal law is in course to fix wood pellets quality criteria for private use. The law entry in force should be end of 2009. Regarding certification systems and quality controls, a certification system is working for pellets imported to produce electricity (Laborelec and SGS collaboration, see EUBIONET III- Belgium report on different criteria for sustainability and certification of biomass and solid, liquid and gaseous biofuels).

Based on questionnaires to pellets traders for private use, more barriers are identified for this branch of the Belgian pellets trade. They are detailed below.

Some traders are only importing DINplus pellets. They report big difference of price between inland produced wood pellets and imported pellets without any explanation, slowing down importations of DINplus pellets for example. Consequently, good quality imported pellets are penalized. A price reference should be implemented as the CARMEN index in Germany.

The current economic crises and the low fossil fuels prices slow down investments in wood energy projects, for householders but also in public or industrial sectors. Furthermore, regional governments decide to reduce subsidies to wood energy to encourage other RES. Pellets traders consider that Belgian situation is very bad for the moment and announce some redundancies could happen in a near future if the situation doesn’t get better!

The competition with other sawdust or wood chips users could be problematic in the future. Forest residues utilization should be increased to reduce competition for raw material. However, wood production for an energetic utilization is not the main objective of the forest management policy at all. Indeed, governments are very careful about this topic. The legal requirements for the Walloon forest exploitation mentioned that branches with a diameter less than 4 cm have to be left in site.

Despite the quite well developed supply network, traders consider it should be more developed and implemented. The distance between production unit and the consumer should be reduced. In addition, boat and/or railway transportations should be privileged. Transport pellets and storage costs are also important and storage capacities are not big enough for the moment to guarantee furnishing householders during hard winter conditions. Aware of this problem, some pellets producers have just make investments to increase their storage capacity. Logistic and supply networks should be developed and adapted to users’ demand characteristics (storage capacities) to have a well adapted supply.

Energy audits should be achieved to promote only the best technologies. Financial support should be increased because best technologies are more expensive. A minimum fossil fuel price should be fixed to use the gain for financial support increments in RES projects. Service quality is not guaranteed and many boilers are out of use due to a wrong installation. One solution could be to create a real professional corporation qualified in biomass heat production systems (in particular wood) installation and management. Financial support should be allocated only to projects implemented by a trained installator.

People have to change their way of life by becoming responsible consumers: energy can become rare and thus has to be cautiously used. It is of major importance to follow up people awareness to favour RES use despite their currently higher cost.

## 5.3 Czech Republic

*Šarlej, M. UPEI VUT*

Czech biomass traders handle mainly pellets, briquettes and firewood. Biomass is supplied both to domestic and foreign markets. Major part of exported biomass is traded to Austria and Germany. Import of biomass to the Czech Republic is negligible; there are only small quantities of wood imported from Slovakia. Traded quantities of interviewed companies vary from 2,000 to 80,000 t/a.

The interviewed companies perceived some barriers. The first problem is potential consumer resistance in domestic market. A lot of people haven't enough information. There is also small interest in investing to new combustion equipment in Czech Republic. Another mentioned barrier is high costs of biomass fuels in comparison with coal.

The companies also mentioned few proposals how these barriers could be overcome:

- Information dissemination of using biomass,
- legislatively protection of renewable energy sources and
- biomass price cutting.

The traders agree on the fact, that the situation on the market has been getting better since their company foundation.

## 5.4 Denmark

*Hinge, J, DTI*

*General overview*

In Denmark biomass is imported and exported in (relatively) considerable amounts that are - compared to the Danish production and consumption.

Wood pellets are imported, especially from eastern European countries and Canada, to cover the increasing demand for private small-scale, medium scale (district heating plants) and large scale (CHP and power plant) consumption.

Straw is exported, mainly to Germany and the Netherlands, but in some years also to Austria, Belgium and France. It should be noted, that the major part of the exported straw may be used for feeding and bedding for animals and not for bioenergy production; however, it is not possible to distinguish between exported straw for bioenergy and non-bioenergy use, and anyways the mechanisms

regarding the international trade are the same, and considerations regarding barriers and opportunities are therefore relevant in this context.

The Danish power plants arrange tenders for straw producers/suppliers to bid on straw supplies. In recent years, a few straw producers/suppliers from abroad, especially Germany, have participated with bids in these tenders. However, there's no information as to whether any of these bides actually have received any contracts. In any way, the import of straw for energy purposes is considered to be negligible at the moment.

In general, the potential for international straw trade is considered to be considerable, with more countries turning towards exploiting straw as an energy source.

*Barriers and opportunities for bioenergy trade*

Interviews have been carried out with major Danish traders of biomass. But due to the competitive nature of market mechanisms in biomass, the companies are reluctant to give precise company-related information. Based on information gathered though the interviews with Danish traders of biomass it is concluded, that no major general or fundamental barriers are recognized by the major traders.

The major challenges lie in the relationship between producer/seller and the trader. All traders remark, that the building up of longer term relationships (not necessarily long term contracts) based on mutual trust is essential for securing biomass of sufficient quality, and that is the way of facilitate international trade of biomass products. The feed-back from the traders is, that the introduction of standards, classification etc. on the biomass will not solve the mentioned challenges. On the contrary, rigid standards for product quality may in some cases be more in the way, because many biomass types have a natural variation in quality parameters depending on external factors beyond the control of the producer. This is indeed the case with straw, where the weather conditions in growth season and especially during harvest determines many of the most important combustion characteristics of the straw.

## 5.5 Finland

*Alakangas, E., Veijonen, K. & Flyktman, M. VTT & Heinimö, J. LUT*

*Trade volumes*

This following text is based on a joint report by IEA Bioenergy Task 40 and EUBIONET III report (Heinimö & Alakangas 2009, available at the EUBIONET III website), EUBIONET III country report (Alakangas, E. et al. 2009). VTT has interviewed three biomass fuel producers, which are operating both in Finland and internationally.

The forest industry procures wood primarily for use as raw material. In many cases, the wood is imported from other countries. In the manufacturing of primary products, a significant amount of the raw wood ends up in energy production or is converted into by-products that are utilised in energy production. Biomass purchase and use of this kind is defined as indirect import of biomass fuels, and corresponding export is referred to as indirect export of biomass fuels. The above-mentioned wood streams jointly constitute the indirect trade of biomass fuels.

Similar to raw wood, a part of imported and exported forest products, food, and fodder streams end up as energy. Determining to what extent a country's bioenergy production is based on these products is troublesome, and they were thus excluded from the study.

The study covers all remaining biomass streams, which can be categorized as follows:

- Biomass fuels (products traded for energy production, such as fuel ethanol, wood pellets, and firewood)
- Raw materials that are traded for the manufacture of biomass fuels (e.g. sawdust and pulpwood used in pellet production or pre-processed biomass that is used in the production of transport biofuels)
- Raw wood (wood matter used in the manufacture of forest products)

First, cross-border biomass streams were considered in view of foreign-trade statistics. The information was obtained from the EUROSTAT database, which can be accessed freely over the Internet. The product groups selected in the investigation and their Combined Nomenclature (CN) codes are presented in the report of Heinimö & Alakangas.

Information on the volumes of import and export streams from the Foreign Trade Statistics and the wood streams determined for the forest industry provided a starting point for evaluating the energy balance of international biomass fuels trade. The product-specific data used and the assumptions made in the calculations of import and export balances of biomass fuels are presented in report of Heinimö & Alakangas 2009. In Finland, the direct import and export of biomass fuels, being mainly composed of wood pellets and tall oil, have a minor importance compared to the total consumption of biomass fuels. The largest biomass fuels streams are composed of raw wood. The indirect import of wood fuels was on the increase during the period under investigation. Foreign-origin wood energy as a proportion of Finnish primary energy consumption in 2004–2006 was calculated by means of the methodology described in Heinimö & Alakangas 2009.

Wood pellet production in Finland started in 1998. The Finnish pellet industry was founded on export supplying pellets to Sweden, where pellet markets were developing rapidly at the time. Since then, pellet production has increased steadily, climbing to 376 000 t (6.3 PJ) in 2008. The majority of Finnish pellet production has been consumed abroad. The number of export countries of pellets has increased resulting from booming pellet markets in Europe. In addition to Sweden, Finnish pellets have been exported to Denmark, the Netherlands, the UK and Belgium. In the main destination countries, the considerably higher taxation of fossil fuels in energy production and the subsidies for electricity from biomass have made the exportation of pellets economical. In Sweden and Denmark, the taxation of fossil fuels in heat production is remarkably higher than it is in Finland, and there wood pellets are mainly used for substituting coal in district heating and oil in space heating. The Netherlands have heavily subsidised renewable energy sources in electricity production, and wood pellets are primarily cofired there with coal in large power plants.

At the beginning of 2009, there were 24 wood pellet mills in operation. The total production capacity of the pellet mills is approximately 715,000 tons. Wood pellet production in 2008 was 373,000 tons, so about half of the capacity is in use. In the beginning of 2009 several pellet plants has stopped production for some time because of shortage of raw material. In 2009 imports of wood pellets from Russia and Baltic States has triple from previous years being about 35,000 tons in year 2009.

*Barriers*

Respondents stated out that the largest barrier is raw material price in wood pellet but also in other wood fuel production. This also effects to international markets. There are different price levels in different countries, which enhance trading to those countries which have higher price level. Prices are lower in Baltic States and Russia. Finnish wood pellet exporters can sell pellets only to countries, which prefer

high quality and can pay higher prices than on average in the market. Also the increase of wood pellet production has effected into the markets.

In Finland national incentives do not support use of pellets for heat and electricity production. About 70% of Finnish wood pellets are exported to countries like the Netherlands, Belgium, Poland and UK, which have support for RES electricity production or to heating sector in Sweden and Denmark, which have much higher $CO_2$ taxes for fossil fuels than in Finland.

In Finland trade of round wood from Russia has almost stopped because of trade duty fees. Because wood chips (including pulp chips) have lower export duty (5% of price) the import of chips for energy use has increased from Russia. Logistical costs are especially higher for wood chips, so export trade from Finland is negligible. The shipping route fees, port charges and train tariffs for transportation of wood fuels are higher in Finland than in other parts of Europe especially when exporting. The fees for shipping and ports services are lower, if you export regularly and several time of year. Also the train tariffs in Finland for transition trade are double compared to Russia.

Quality standards and sustainability criteria were not found barrier but rather opportunity. Of course, if pellets are sold into many different countries with different standards, fuel analysis costs will be higher, because different requirements and different analysis methods applied. In Finland are also biomass fuel producers, which are looking business opportunities for wood fuel harvesting in other countries. These companies have experience and modern, efficient equipment available for wood fuel production. Operating in other country is usually hindered by support schemes, which are only applied for entrepreneurs origin from this country and foreign operators can not compete without support with local actors.

In domestic market one barrier for market actors is to get information of local wood fuel potential and availability for sales. This information is not publicly available for all market actors. Especially traders would appreciate information about thinnings which need to be carried out in private forests and are they willing to sell wood from their forests. Most of wood fuel production is connected to round wood procurement, where logging residues, stumps and other unmerchantable wood are harvested for energy. However, wood fuel procurement from thinnings is made separately and need for matchmaking of forest owners and fuel producers is important.

*Barriers to overcome – proposals and opportunities from interviewees*

One proposal was that a reliable price index for industrial wood pellets and wood chips/hog fuel can use against price risks in order to support investments for biomass energy and raw material purchase. Future contracting based on price index is then possible. This kind of index service is under development for industrial wood pellets and wood chips for international market by Foex Indexes in Finland.

If support mechanism will be harmonised in Europe, the use of biomass fuels will be more local. Then local biomass is more profitable and costs for logistics will be lower. Also use of biomass could increase in Finland, because of high potential. It is also important to develop incentives in Finland, which support the bioenergy use in the sector outside the emission trading system (ETS) that use of biomass fuels is also increasing in this sector. This sector requires higher quality fuel e.g. from thinnings which make production costs higher.

Web-based information system on local forest fuel potential could be a tool, where private forest owners can inform, if they have need for thinnings or are selling wood.

If own biomass potential is lower then different kind of high-energy quality biomass fuels with lower production costs will be needed for international trade. These fuels

can be torrefied biomass, pellets or "biomass coal" which can replace coal in power production. Only small investment for fuel handling in coal plants is then needed, if this kind of fuels are available in the market.

*Summary*

Traders of biomass fuels find the raw material price, especially for pellet production, too high, which is increasing production costs and use in domestic markets. It is also difficult to find information on local biomass potential and private forest owner willing to sell wood from their forest. Investments on biomass installations are high and price index for risk protection is needed in biomass fuel contracting.

Sustainability criteria is an opportunity within traders. International fuel specification standards are found important, because when trading to several countries which apply different standards, more different kind of fuel analysis is needed and this increase costs. Different support mechanism in different EU member are enhancing international trade of biomass fuels instead of using them in local markets.

## 5.6 Germany

*Martikainen, A. FNR*

*General overview*

The pellet market country report of pellets@las states that exact figures on pellet import to and export from Germany are hard to get, because the size of the market does not allow tracing all volumes traded across borders.

Main trends are seen in DEPV figures for 2008 (Production: 1.46 million tones; consumption: 900,000 tons). They show that Germany is a large exporter of wood pellets. Disregarding pellet imports, this means that at least 560,000 tons were exported.

It is known that industrial pellets are mainly exported to Scandinavia, Belgium and the Netherlands. DINplus pellets are exported to France, Austria, Italy and Switzerland and small amounts are imported from Austria, Czech Republic and Sweden. In summary the most important trade flow in Germany is the export of industrial pellets.

*Barriers and opportunities for bioenergy trade*

Two biomass traders were interviewed, VERBIO Vereinigte Bioenergie AG, a producer and trader of biofuels, and GEE Energy & GmbH Co.KG, a producer and trader of wood pellets and briquettes, about the barriers and opportunities on the biomass market.

GEE Energy underlines that a lack of raw material, especially lack of saw dust, partially also of round wood, is the most important reason preventing increasing production. Other aspects concerning production are " unsound (inexperienced) market actors, who do not have know-how and experience (e.g. consumer needs, quality expectations; uncertainty about future sustainability standards for raw material; and different (technical) standards within countries". The company proposes a harmonisation of standards, which would make the trade between countries easier.

According to the interviews with German traders, a significant problem on the market is the unfair global competition. Import and export tariffs (e.g. Russia for round wood) influence the markets and competition negatively. A further problem is that there is no uniform legislation on the European market and as a result there is no free market.

GEE Energy says that on the pellet market there is a lack of a global classification and clear bioenergy trade statistics. The huge growth of the US market, which means that even pellets and solid biomass (wood) from Canada will be used more in North America instead of Europe, influences the trade.

For the demand side a significant barrier is the lack of information. GEE Energy lists different aspects:

- Uncertainty of price developments of fossil fuels and also biomass fuels
- Uncertainty of maturity of technologies (e.g. heating systems), technical progress and changes in legislation (e.g. tougher law for emissions etc.)
- Uncertainty of which technologies are today and will be in the future the best choice
- Installers etc. are often not well educated regarding new renewable technologies (will not recommend a pellet boiler instead of old technology that he knows) training of direct contacts / decision influencers for heating system
- Wrong public information about assumed environmental impacts (e.g. on particulate matter etc.)"

To overcome the barriers on the market, GEE Energy proposes a "stricter but realistic norm for quality standards on EU level including realistic and "non-distorted" standards for sustainability". A proposal for Germany is a "change in law about timing after which an agricultural area becomes forest" This would make investments in future perspectives such as energy plantations easier.

GEE Energy sees current opportunities for biomass trade due to the fact that the market for fossil fuels is volatile and prices tend to increase (lack of supply security). Additionally, legislation and government aid, political targets and environmental reasons are supporting the bioenergy market and biomass trade.

## 5.7 Greece

*Eleftheriadis, I, GRES*

*General overview*

Pellets are the only refined biofuel produced in Greece today. Actually, it a new fuel, concerning domestic production, trade and consumption. The only data available for pellets production is for the year 2007. The production increased up to 79,000 tons over against the capacity of production which was recorded at 77,200 tons per year. The use of other materials for testing, having faster production rate in pellets production operations, explains the above mentioned difference. Only three companies, with significant production capacity, are acting in this sector. It is important to point the low demand and use of pellets, in national level. In personal communication with pellets producers, it was mentioned that the production and use of pellets will be increased next years. Briquettes are an imported biofuel, but there are not specific records about the use in heat generation. So, data or statistics about briquettes is missing.

Currently, there is no survey or inventory in National Statistics about refined wood fuel trade. The only data available is about imports and exports of wood fuels in general. The only way to have a view of imports and exports of pellets is to receive such information from pellets producers and market traders and retailers, because of the lack of information in statistics.

*Barriers and opportunities for bioenergy trade*

The opportunity cost of the residues (e.g. cereals straw has already a market price as it is sold for animal feeding purposes) does not help the market to create a

stable price range. Additionally, it is not possible to predict market prices for biofuels and to make plans.

Biomass fuels compete with oil and natural gas in energy production. The market of diesel for house heating is subsidized by the state and finally it is sold in lower price than the diesel for transportation. According the contract between the state and natural gas suppliers, the price of gas, delivered in Greece, Additionally the VAT for natural gas was determined at 9%, instead the 19% of VAT for solid biofuels (e.g. splitted wood logs).

The promotion for solid biofuels, as well as, for systems using biomass is limited. So, consumers have no complete knowledge about possibilities, advantages or disadvantages from the use of biofuels, and the implementation of bioenergy schemes is very low.

## 5.8 Italy

*General overview*

Since the internal production is not sufficient to cover the entire pellet needs, no export of refined biomass is monitored from Italy to abroad. No data is available regarding the trade source of import.

*Barriers and opportunities for bioenergy trade*

From the interviews with biomass traders, it appears that there are two main barriers for bioenergy trade in Italy:

1) Raw Material availability: the pellet production is linked to the sawmill residues; if the building activity decreases then residues production decreases and then also the pellet production;

2) Lack of transport availability: import is slowed down if there's no transport order from the country where the exported goods are addressed.

## 5.9 Latvia

*Blumberga, D. & Ozolina, L. Ekodoma*

*General overview*

In Latvia the main biomass import flows are round timber and sawn timber. The imported amounts have decreased in the last years (in last nine months of 2008 the imported amounts decreased for about 65%), because of the economical situation in the country. The round timber and sawn timber mainly are imported from Russian Federation and Belarus. Biomass for energy production in Latvia is imported in small amounts, mainly for further trade. The types and amounts of imported biomass for energy production in 2007 were: wood waste/used wood (35,000 $m^3$), woodchips (19,000 $m^3$) and firewood (5,000 $m^3$). The typical trade routes are to Denmark, Finland, and Poland.

The types and amounts of exported biomass in 2007 were: wood chips (1,340,000 $m^3$); firewood (450,000 $m^3$); wood pellets (425,000 tons); wood waste/used wood (226,000 $m^3$); wood briquettes (15,000 tons). Typical trading routes: Scandinavian countries, Belgium, Germany, U.K., and Lithuania.

*Barriers and opportunities for bioenergy trade*

No special barriers for biomass import for energy production have been determined so far. The main reason is that there are enough biomass resources for energy production in Latvia.

As in Latvia the main biomass trade flow is export, barriers and opportunities were identified for the export of wood biomass. To get the overview of the barriers and opportunities of wood biomass export in Latvia, two questionnaires were disseminated. From the respondents point of views there are some logistic, economical, support policy, and social barriers that prevent biomass export system in Latvia. The following barriers were listed:

- Logistics – limited weight capacities of local roads (as in Latvia the quality of roads is bad, there are many roads with weight restrictions for trucks that weight more than 10t. This factor may affect the transportation costs), availability of territory for storage (the cost for land purchase is very high and also there is not many appropriate and favourable territory for storage building);
- Economic – the banks do not provide financing for current asset;
- Support policy – there is governmental tax support for fossil fuels, therefore RES are not used, and the government value-added tax pays back in long time period.
- Trade policy – both respondents did not see any barriers in trade policy. There is no import/export tax system for biomass in Latvia.
- Social - labour force. Due to economical situation there is a lot of labour force, but the labour quality is low. The reasons are small salary, no social guaranties, and unpaid taxes.

The respondents gave the following arguments for different barriers (that may appear) overcoming:

- Logistics – availability of territory for storage or limited storage capacity. If there is no possibility to build a new storage for productions storing, there are possibilities to rent the storage from others. There are a lot of unused storages in Latvia because of the economical situation in country.
- Economical – related to transportation. Latvian companies have the same opportunities to find the most appropriate transportation companies as other Europe-located market actors. There is only a question about will to look for these opportunities.
- Support policy – support schemes. Governments of other European countries have developed internal market support schemes for the companies. This means that these companies not interested in biomass export and they are not competitors for our local companies.
- Social – labour force. If the company offers a fair salary and pays all taxes, there will be no problems with available and qualitative labour force.

*Opportunities:*

There are good opportunities for biomass trade (export) in current and future economical situation in Latvia. This is only question of time, policy, and overall attitude. Concerning biomass trade within the country there are low opportunities due to bad management system among local biomass consumers (e.g. they do not make timely payments for delivered biomass). New workplaces in local biomass production and transportation will be found if the management system is arranged.

From the respondents point of views the main biomass trade opportunities are financial benefit from local biomass resources usage and paid off the taxes, and extra workplaces.

## 5.10 Lithuania

*Erlickytė-Marčiukaitienė, R. & Marčiukaitis, M., LEI*

*General overview*

Lithuania is mainly a producer and exporter of the refined wood fuels. Wood briquettes and pellets have been produced since 1994 and 1999 respectively in Lithuania. These refined wood fuels are produced mainly from sawdust. The amount of production of refined wood fuels is constantly increasing in Lithuania.

There are about 10 wood pellet producers and about 15 wood briquettes producers in Lithuania producing more than 1,000 tons per year. Besides, there are about 20 smaller companies.

About 95% of wood pellets produced in Lithuania are exported to Scandinavian countries (Denmark, Sweden, Finland), Germany, Italy, etc., because the pellet demand in Lithuania is not high due to the price of this fuel. Also there are no industrial pellet consumers in Lithuania and only a small part of householders has installed pellet boilers.

Wood briquettes are more widely used by Lithuanian householders (about 20% of Lithuanian production), because it is not necessary to reconstruct or replace firewood stoves for the combustion of wood briquettes. About 80% of wood briquettes (50,000 tons) are exported to Denmark, Germany and Belgium. Due to the lack of feedstock (sawdust), the majority of companies have reduced their production volumes during last few years.

*Barriers for bioenergy trade*

The largest international bioenergy trade stream for Lithuania is pellet export. Two largest pellet producers have been chosen for the interviews. Interviews are attached in the Annexes of the Lithuanian country report. According to interviews, companies report that currently there are no major barriers preventing export of the production.

Currently only a small part of feedstock for pellet production is imported from other countries (Poland, Belarus), because local resources cover major part of feedstock demand. In the future, smaller companies may face problems with the feedstock supply as the number of sawmills is decreasing as well as wood processing volumes. There may be other specific trade barriers related to prices, taxes and other constraints, but companies do not provide such information.

*Opportunities for bioenergy trade*

The demand of pellets in other countries is high, and one of the companies is going to double its production capacities this year by installing another pellet production line.

Also the production volumes may increase if there is higher demand in Lithuania. Constantly increasing fossil fuel prices and increasing number of local producers of pellet boilers give basis for the hope that wood pellets as well as briquettes will become more popular in Lithuania. Today, the increasing number of individual householders installing pellet boilers is observed, because more and more people discover the advantages of using this kind of fuel.

## 5.11 The Netherlands

*Junginger, M. UU*

*General overview*

The Netherlands have been a major importer of solid refined biomass fuels. Unfortunately, it was not possible to specify the exact quantities of biomass imported for each specific country. Suppliers are in general reluctant to reveal the exact origin, as this is commercial-sensitive information. In general, major quantities of wood pellets are sourced from Canada (and more recently since 2008 also the USA). Minor quantities were imported from the Baltic States, Finland and Germany. In total, the Netherlands imported about 12.1 PJ of wood pellets in 2006.

Regarding the export of refined wood fuels the Netherlands are consuming much more than their domestic production, little or no export of wood pellets produced in the Netherlands is taking place. The harbours of Amsterdam, Flushing and especially Rotterdam act as a hub and redistribution centre for e.g. wood pellets from North America to Germany, the UK or Denmark. Approximately, 5.5 PJ of the 12.1 PJ were re-exported in 2006.

*Barriers and opportunities for bioenergy trade*

Based on the interviews with Dutch traders, the following main barriers are identified:

- All traders interviewed emphasized that the uncertainty regarding subsidies, i.e. commitments under the former MEP system (which still is responsible for the majority of imports) and the uncertainty whether the current SDE feed-in premium system for renewable electricity will include co-firing of wood pellets in the future.
- A concern regarding the sustainable production is a barrier for the use of certain biomass streams, such as palm kernel expeller. It is a real problem that currently no label/certification system is in place. However, recently the first palm oil plantations have been RSPO –certified, and it is now investigated, whether the palm kernel expeller form these plantations are then automatically also RSPO-certified / sustainable. On the other hand, for many biomass streams used as animal feed (e.g. sunflower husk) the issue of sustainability plays a much lesser role.

The current economic crisis has had several effects influencing the competitive position of wood pellet use. Various traders reported different effects:

- On the supply side, especially in the USA, the housing market has collapsed, which means less timber is sawn and thus less sawdust is produced, leading to less availability of cheap feedstock. On the other hand, it has enabled the use of plantation wood in amongst others Alabama, so the crisis has also opened up new feedstock sources.
- Ocean dry bulk freight rates have collapsed, leading to lower transport costs. However, as many traders have often fixed transport rates significant time ahead, the effects are not as strong as could be expected.
- On the end-use side, the prices for coal have more than halved, the prices for $CO_2$ have about halved, and the price for electricity has been decreasing.
- Overall, the economic crisis has probably led to a worse competitive position for wood pellets cofiring then e.g. in the beginning of 2008.

## 5.12 Norway

*Rørstad, P. K. & Solberg, B., UMB*

*Trade of refined wood fuels*

Due to lack of statistics we have only quantitative data for total import and export. According to Nobio (Martinsen, pers. comm.) most of the pellets trade is with Sweden, while the majority of briquettes are traded with the Baltic countries.

*Trade of other types of biomass*

Total import and export varies between years, and this variation is even larger when looking at pellets and briquettes separately. The pellets export in 2006 is the largest in the available sample, and has thereafter declined. This should be seen in light of the reduction in production. Given the relatively small size of the pellets producers in Norway and the general high cost level, Norwegian producers are probably not competitive given international pellets prices.

As can be seen from the table above, the quantities traded are quite small. From the trade of other biomass resources we know that the trade is substantial. For example, imported pulpwood constituted between 43 and 47% of the total pulpwood use in Norway in the period 1999 – 2007. If we look at trade with biomass closer to refined wood fuels we also see large quantities.

The firewood market illustrates how dynamic these trades seem to be. Firewood import peaked in 2003. The winter of 2003 was coldest winter during the time span of the data and electricity prices were very high. Comparing import of firewood and electricity prices during the main heating season (first quarter), we find a very high correlation coefficient (0.91). This dynamic in the firewood market indicates that are no trade barriers per se, and there are no reasons why this should not hold for the market for refined wood fuels. Any barriers are therefore related to the industry or to the domestic market.

*Barriers to increased trade of pellets and briquettes*

The interviews confirm that the trade in itself is in general of no problem. One respondent mention some problems with a Russian trading partner, though. The major barrier for increased use (and import) of refined wood fuels is the price of alternative energy sources, e.g. electricity and heating oil. This is especially the case in northern Norway, where households are exempt from some of the taxes on electricity. The cost of transportation is a major cost factor mentioned by the respondents. Most of the pellets are imported from Sweden by road transport, implying a transport distance of more than a couple of hundred kilometres. In addition to increasing the price, this lowers the environmental benefits from biomass energy (but the benefit is still positive). Finally, is should be mentioned that the world's second largest pellets plant is under construction in Norway. BioWood Norway is expected to start production in primo 2011. The planned capacity is 450,000 ton/year, hence about 10 times the current total production in Norway. The annual wood use will be about 1.2 million $m^3$ – imported from Canada, Western Africa and the Baltic countries. The main reason for using imported wood chips is the higher costs (esp. road transport) of domestic wood and the lack of a domestic market for this large amount of chips. Their major market will be European electricity generators and industrial companies.

## 5.13 Portugal

*Almeida, T. CBE*

*General overview*

The production of refined biomass (mostly wood pellets) increased significantly in Portugal since 2006. Currently there are about 16 companies producing pellets, some of them have a yearly production capacity higher to 100,000 tones. It is estimated that in 2008 the annual production capacity of wood pellets was approximately 400,000 tons. In 2009 other big plants started their production.

The growth rate of pellets production in Portugal in last years is impressive. However, this is not related with the demand of the internal national market. In fact, the domestic pellet consumption in Portugal is very limited. The major pellets plants are exporting all their production mainly to Central and North of Europe, by vessel from Aveiro and Sines harbours. Presently these plants are mostly producing wood pellets "Class 2", for use in power plants. It is estimated that over 90% of the produced pellets in Portugal are exported. The Portuguese data on exporting and importing of refined biomass are the result of information provided by the three major manufacturers of briquettes and pellets that operated in Portugal in 2006.

Concerning the export of refined biomass, it is important to highlight that the production and trade of wood pellets changed significantly in Portugal since 2006. Therefore the amounts presented in table 1 are considerably lower than the real values and do not reflect the current reality.

The import of refined wood fuels, as verified in 2006, remains insignificant. This is due to the relatively small domestic market compared to the large number of manufacturers.

*Barriers and opportunities for bioenergy trade*

Interviews were made to three pellets and/or briquettes producers, including the oldest producer of Portugal. The main barriers and opportunities identified for refined wood fuels production and trade are:

Main barriers towards production increase:

- Increase in the price of raw material. The price of raw material (sawdust) is very high which affects the companies profitability. This aspect hampers the sale of these products to the external market;
- Lack of raw material due to the emergence of many new pellet producers;
- Emergence of many new producers who are fixing prices for pellets that are not sustainable. This increases the risk for the older companies.

Main barriers to export:

- Very high transportation costs (per truck), bringing unacceptable costs to the buyer;
- The non-existence of a recognized entity responsible for the certification of solid biofuels in Portugal. In order to sell their pellets in some European markets producers have to certify their products in other countries such as Germany, which is very expensive.

Main barriers to import:

At the moment the import of briquettes and pellets are marginal because there are many producers in Portugal. It is considered a non profitable activity.

Main barriers to consumption in national market:

- Lack of market information and lack of purchasing power;
- Small penetration of pellet stoves and boilers due to the high cost of these equipments, which are imported;
- Keeping the rate of VAT in pellets and briquettes at 20%, in contrast to the VAT rates of gas and electricity, which is 5%, penalizes the domestic consumer, and affect the economic activity.

Proposals to overcome the barriers:

- Increasing awareness of the product (pellets) in Portugal, especially for potential industrial consumers;
- Certification of solid biofuels in Portugal;
- Reduce the VAT rate to 5%, the value applied to the natural gas and electricity, as well as in the biomass burning systems (national market);
- More fiscal incentives for renewable energies.

Current opportunities for biomass trade:

- Strong demand for pellets in some European countries which facilitates their commercialization in the European market.
- Gradual increase of consumption in the domestic sector as well as in all industrial market.

## 5.14 Slovakia

*Fáber, A, ECB*

*General overview*

The Slovakia has been a major exporter of solid refined biomass fuels. Each year, high-grade fuels production is increasing. Briquettes and pellets produced in Slovakia are sold on domestic market in only a minimum. More than 90% of manufactured output is exported to neighbouring countries, especially Austria. Fact is, that buying interest is huge. Evidence of this is the fact that price of high-grade bio-fuels rose by 80 percent. The company Lesy SR, š. p. has produced 110,000 tons of chips in 2006, approximately 20% of this production was exported mainly to Austria and Hungary.

*Barriers and opportunities for bioenergy trade*

There is an effort in Slovakia to promote development of biomass for energy purposes. Wider development of biomass heating prevents large gasification. The prevalent form of wood usage is burning of fuel wood, against use of raw wood material in the form of chips and pellets. Use of forest chips for the heat production expects to ensure sufficient quantity of heat through a central distribution. Large heating stations are starting, or already started reconstruction of biomass boiler units.

Pellets and briquettes are as fuel more expensive than timber or wood chips, but can offer many advantages. With appropriate technology, total costs of heating pellets are comparable to natural gas.

Possible barriers to conversion to heat biomass use are:

- ignorance and distrust of new technologies (e.g. heating pellets, pellet, straw)
- lack of information on biomass energy heating costs
- lack of state support in the transition to biomass heating
- lack of national support for biomass projects.

Based on the interviews with Slovakian traders, the following main barriers are identified:

- All traders interviewed emphasized that the uncertainty regarding subsidies and financial resources.
- High transport costs
- The current economic crisis has had several effects influencing to use the wood chips and firewood for heating systems.

*Opportunities*

Increase of fossil fuel prices. Slovak Republic as a country with high energy needs, is presently highly dependent on imported energy resources. Influencing by the growth of energy prices has a direct impact on reduction of national economy competitiveness. In the case of household fossil fuel prices growth mean higher costs for their housing. The share of household on energy costs is about 15% of average income, with lower income groups to 30%. In developed countries is this share less than 10%.

In Slovakia, the law No. 309/2009 on the promotion of renewable energy was passed from 1.9.2009.

## 5.15 Spain

*Robles Fernández, S., Manso Ramírez, a. & Ramírez Fernández A.,AAE*

*General overview*

Spain is major exporter of solid refined biomass fuels than importer. Unfortunately, in no way was possible to specify the exact quantities of biomass imported and exported for each country. Most of the suppliers are reluctant to reveal this information.

In general, besides national consumption of refined biomass fuel, since 2006 until present time major quantities of wood pellets have been exported to France, Italy, Portugal, United Kingdom and Central Europe and minor quantities have been imported from Italy, United Kingdom and South Africa.

*Current trade barriers*

- Actually, one of the main problems with biomass in Spain is that production is bigger than consumption. There is a lack of a stable growing demand (national deadlock both in electrical and thermal uses), possibly due to the legislative uncertainty in the electricity area (cocombustion) or lack of confidence in its stability and current low price of fuels derived from petroleum.
- Present incentives and specific subsidies for the sector are not higher enough to promote the development of the biomass sector.
- Lack of "specialized" dissemination: sectors including domestic, industrial, electricity generation, hybridation with other renewables, etc.
- There is not stability in the supply, in part due to variations of agriculture campaigns and lack of alternatives (energy crops).
- Collecting costs for forest and agriculture residues are sometimes too high because the biomass is dispersed and there are other cheaper elimination processes.
- Wood pellets consumption is affected because of the competition of the olive pit, which is cheaper and only needs conditioning, but not a manufacturing process.

*Possible opportunities and solutions*

- It is necessary to obtain a biomass fuel of better quality (in terms of energy and with regard to the logistics of supply) with lower costs that allows living "appropriately" with all the necessary links (agricultural/forestry, distributor/manager, etc.).
- Dissemination at all levels, as occurs in other renewable energies, remarking the positive influence of this autochthonous fuel in local employment, decreasing of fire risks and emissions, external energy dependence, etc.
- There has to be a higher demand in order to achieve an increase of the production. Therefore, an active promotion on using biomass as an alternative in thermal generation in domestic sector is required.
- The current international biomass trade needs to accomplish a clear and firm legislation and to develop specific and operative norms/standards regarding the quality of biomass.
- It is possible that specific aid, not only to the consumers, but also for the areas of distribution and generation as well as fulfilment of the prohibitions or related parallel measures (prohibition of coal, $CO_2$ emissions, etc) could help to boost biomass fuel trade.

## 5.16 Sweden

*Olsson, O., Hillring, B. & Cardoso, M. SLU*

*General overview*

Since the 1990's, Sweden has imported rather large amounts of biomass fuels. The imports have primarily consisted of refined and unrefined wood fuels for the district heating (DH) and combined heat and power (CHP) sector. Many Swedish DH and CHP plants are located close to port facilities, which enable them to import biomass fuels by sea, thereby lowering transport costs and making trade of biomass fuels profitable not only from the Baltic States and Russia, but also from Canada. The Swedish import of bioenergy products has traditionally consisted of wood chips and pellets from the Baltic States, wood pellets from Canada and recovered wood from Mainland Europe. (Olsson 2006; Hillring & Vinterbäck 2000; Ericsson & L. J. Nilsson 2004)

With the implementation of official trade statistics for wood pellets starting in January 2009, it has recently become possible to track trade flows in wood pellets to and from Sweden. According to these statistics, Russia was the biggest source of imported wood pellets, followed by Germany, Finland, Estonia and Latvia. Furthermore, bio-ethanol, mainly from Brazil, has also emerged as a large import commodity as a result of Swedish governmental policy promoting ethanol as transport fuel. In 2008, Sweden imported about 400,000 cubic meters of ethanol.

In order to get a broad picture of how Swedish bioenergy market actors view the barriers and opportunities for bioenergy trade, both producers and (large-scale) consumers were contacted.

*Barriers and opportunities for bioenergy trade: producer's perspective*

Eight large biomass producing companies were contacted. Two of them were interviewed (phone) and 2 responded by e-mail.

The typical traded biomass for these companies were peat, wood pellets, wood waste, fuel wood (chips, stumps) and sawmill waste (sawdust, bark, chips). None of the two companies traded large amounts of biomass internationally, with only small amounts being imported and exported to and from Norway.

The barriers that these traders perceive were:

- Logistic constrains (transport) leading to biomass fuel price increase.
- The acquisition of sufficient amounts of raw materials in the immediate surroundings for the production of biomass fuels.
- Lack of demand (few consumers) in the immediate surroundings.
- The technology for acquiring wood fuels must be developed even more.
- Too many traders/players at the moment in the sector make the price setting more volatile
- The taxes/fees for fossil fuels are not high enough to create incentive for the use of biomass fuels.
- The Emission Allowance Unit (EAU) for peat.
- Fast change and increase of biofuel price due to scarcity of raw materials

Some proposals of how to overcome the mentioned barriers were:

- Development of infrastructure (especially the road and railroad transport sector).
- Develop more efficient techniques for acquiring wood fuels.
- Increased import.
- Lower the emission factor for peat to 0.
- The correct biofuel to the right user (it is important to see the whole picture).
- Sound use of biomass fuels (especially in scarcity situations that drive the fuel prices up)

The traders' comments about the present possibilities for biofuel trade were:

- The situation is all in all is very good because the demand has increased lately.
- Our company could increase the production amounts but we can't because the demand sector is too low (few customers)
- The demand is big but the supply of base or raw material is limited as a result of the global economic crisis.
- We don't have any problems to allocate our present production but it is quite difficult to find enough raw materials.
- The sector (soli biofuels) is a growing market where new investments are being done.
- Politicians are acting with responsibility by decreasing the use of fossil fuels by means of taxes/fees

*Barriers and opportunities for bioenergy trade: user's perspective*

Six different relatively large biofuel users were contacted. Three of them were interviewed by telephone and three responded to the questions by e-mail.

The types of biomass fuels used in the responding companies were:

- Light and thick vegetable oil - Wood briquettes
- Wood chips from broad-leaved species - Wood waste
- By-products from sawmill industries (sawdust, bark)
- Logging residues (tops and branches) - Salix
- Wood pellets
- Peat
- Wood fuels (chips, bark)

Typical trade routes were:

- Import: For example from Canada (wood pellets), Poland (wood pellets), Norway (wood waste, by-products from sawmills), Belarus, Baltic countries and Russia (peat and wood)
- Export: No export

Barriers:

The interviewees saw the following aspects as barriers to further trade in bioenergy:

- Logistic constrains (transport) due to the fact that biomass fuels are a bulky product. This creates transport problems (especially regarding railway) leading to high transport costs and consequently to elevated biofuel prices.
- Optimization of the transport sector is necessary.
- The public authority's permission process concerning installations of new biofuel facilities (e.g. district heating plants) is too slow and too complicated.
- Biofuel prices are still too high in Sweden, especially as a result of transport expenses.
- "Know how" among producers is not yet optimal compared to some producers abroad (high production capacities can not be reached).
- Lack of knowledge among the biofuel producers is still a problem
- The price for the Emission Allowance Unit (EAU) for peat is still to high
- Forest contractors are a key group for long term biofuel production and their marginalization (unemployment) due to the ongoing economic crisis is very negative, consequently it is very important not to lose this group.
- The sector is still young and a very risky one, biofuel prices change too quickly and are too volatile and mobile due to unbalanced biofuel market (supply and demand are still unbalanced due to many new players and always not so serious). A well functioning trade market is still not present.
- Too few big suppliers drive up biofuel prices, it would be much better if the market were freer (more suppliers)
- High investment costs
- Political resolutions concerning fees and taxes for fossil- and biomass fuels.
- Doubtful if supply levels of biomass fuels are enough to cover a general conversion to bioenergy
- Prices, customer demands, political situation
- Peat is included in the Emission Allowance Unit (EAU)

Possibilities for future trade were deemed excellent, as a result of the ongoing global economic crisis the prices are decreasing.

Some proposals on how to overcome the mentioned barriers:

- Permission processes (concerning new constructions) must be simplified.
- Higher taxes for fossil fuels must be implemented.
- Development of transport infrastructure, especially roads and railway sectors.
- The branch is still young and needs some time to redevelop in order to function well.
- The knowledge within the sector is still poor but will be better as time goes by.
- More suppliers of peat are needed.
- More active buyers and traders, and less forest "proprietors"
- The market must be aware not losing the forest contractors, they are a very important sector for the biofuel market

## 5.17 United Kingdom

*Panoutsou, C. & Perry, M. ICSTM*

*General overview*

The UK currently imports significant amounts of biomass material for bioenergy applications. In the UK country report, an overview of the scale of this trade is which shows imports, exports and total supply of primary biomass used for energy. This shows that the disposal of wastes provides the largest single source of biomass

in the form of methane from landfill and sewage. The largest non-waste source of biomass is the highly aggregated "other plant-based biomass" category, of which over 40% is imported.

*Cofiring & the Electricity Market*

Most of the unspecified biomass imports are used for biomass cofiring in coal-fired power stations. Precise data are difficult to obtain, but it is estimated that in 2005 Great Britain imported a minimum of around 765,700 tons of biomass for cofiring for electricity production (at least 54% of the total 1.4 million tons of biomass cofired). The materials in question consisted largely of palm oil residues, olive residues, sunflower pellets and shea meal, from Indonesia, southern Europe and Africa.

Cofiring of biomass in coal-fired power stations began on a commercial scale with the establishment of the RO in 2002. Generation from cofiring grew rapidly to reach 2.5 TWh in 2005. An important driver for this was that cofiring required little capital investment compared to other eligible technologies and could make use existing infrastructure (i.e. large coal-fired power stations). This made cofiring the third largest generator of renewable electricity behind large-scale hydro and landfill gas and ahead of wind. Generation from cofiring fell to 2 TWh in 2007 while generation from wind reached 5.3 TWh. The fall in generation was partly due to limitations on the proportion of Renewables Obligation credits (ROCs) that could be claimed from cofiring as well as uncertainties surrounding the technology's long-term status within the RO.

In 2009, the structure of the RO changed to allow a permanent, unlimited role for cofiring within the RO. At the same time, the RO was 'banded', meaning that some technologies receive more ROCs per MWh than others. Under this regime, dedicated biomass power plants receive more support than cofiring (1.5 and 0.5 ROCs per MWh respectively). Generation in dedicated biomass power plants has risen from 0.9 TWh in 2005 to 1.26 TWh in 2007/08. The UK's largest biomass power plant, Steven's Croft, was commissioned in 2007 and has a generation capacity of 42 $MW_e$. Other plants with a combined capacity of 500 $MW_e$ are in the planning or development stage. If these projects are realised, the market for solid biomass feedstocks would expand significantly, potentially leading to growth in the importation of biomass feedstocks.

*Barriers and opportunities for bioenergy trade*

Barriers

- Availability of sufficient sustainable biomass at economic prices. Biomass feedstocks which are both sustainable and economic are and will be the biggest challenge for trade companies. As biomass competes with low cost commodities like fossil fuels, it is becoming increasingly difficult to secure the required biomass volumes at sensible cost. Biomass procurement is most of the times the key factor which increases its purchase cost.
- Concerns have also been raised about the potential for increased biomass production to impact negatively on the availability of land and on existing markets through rising commodity prices, as food and non-food markets compete for the same crops.
- Sustainability of biomass production has been raised as a concern and a barrier to expanding biomass trade especially from 'environmentally sensitive ecosystems', like south America, parts of Asia, etc as well as specific feedstocks like palm kernels.
- Immature market – established product specifications and market information still developing. Need to establish supply infrastructure.
- As biomass, especially condensed forms like pellets, are related to the price of fossil fuels, recent markets are not very favourable as oil and coal prices present decreasing trends.

Opportunities

- Current opportunities are actually very limited. The required effort to secure sufficient, sustainable and economic biomass feedstocks is huge and disproportionate to the profits, at the moment.
- The largest biomass consumers at the moment are Belgium and the Netherlands. UK has reduced the available subsidies so looking out of the UK for new and emerging markets/ customers is considered a good opportunity.
- A broader variety of feedstocks may become available in the longer term with advances in logistics and biomass conversion technologies.

New markets for environmentally damaging residue dumping or more efficient use of currently low zero or negatively

# 6 Summary and conclusions

*European biomass potentials and utilization*

The total annual figure for reported biomass resources in 24 EU countries and Norway is around 6,577 PJ (157 Mtoe).

The greatest potential (46%) to increase the use of biomass in energy production seems to lie in forest residues and herbaceous & fruit biomass. The utilisation of forest residues is often connected with round wood harvesting especially in Nordic countries, so the use of round wood by the forest industry impacts also the exploitation of the forest residue potential. Industrial by-products and residues (bark, sawdust, cutter chips, grinding dust, etc.) are quite well exploited in energy production and pellet or briquette production.

The solid biomass use in 2006 was 3 166 PJ (76 Mtoe) reported by EUBIONET III partners and subcontractors. This means that currently 48% of the estimated biomass potential is exploited.

Firewood is the most used biomass (30%), but figure of firewood is not very accurate, because most of the traded firewood is not registered in official statistics. Industrial by-products and residues represent the next biggest biomass types contributing to the total figure: use of solid by-products covers 20% of the total consumption, whilst the share of spent liquors (mainly black liquor) is 15%. Forest residues comes next with 15% share of the total figure, and is followed by herbaceous and fruit biomass resources 7%, used wood 6% and refined wood fuels 5%. Use of pellets has increased in many countries and it exceeds the production. Pellets are mainly produced from wood industrial by-products and residues and there might some overlapping with solid industrial wood residue figures, so pellets are included in resources under industrial by-products and residue.

EUBIONET III figures for the potential of herbaceous and fruit biomass are much smaller than other assessment studies of resources. The European Environmental Agency reported that the environmentally-compatible biomass potential comprises 3 350 PJ (80 Mtoe) from agriculture, while the EUBIONET III partners reported a total of 1 582 PJ (38 Mtoe).

Furthermore, next to residue streams (such as straw, olive residues and other herbaceous and fruit biomass resources), EUBIONET III partners were asked to report the potential of energy grasses (reed canary grass, miscanthus and other crops). We do have to point out those assumptions for the potential of these energy crops may vary widely, depending amongst others on the assumptions on the availability of (abandoned) cropland. Thus, assumptions for the potentials of these energy crops may vary widely, as they were often derived from national studies, and not established using a common methodology.

The EUBIONET III solid biomass potential does not include solid municipal or industrial waste e.g. paper and board. In 2006, about 260 million tons of municipal waste (MSW) was produced in the EU27, of which 20% was incinerated producing 243 PJ (5.8 Mtoe) energy. If about 50% of the waste production was to be used for energy (instead of the current 243 PJ), it could yield 1,540 PJ (37 Mtoe) of energy. Typically, the biodegradable fraction is about 50% and average net calorific value in highly industrialized old EU member states is of the order of 10 MJ/kg [Vehlow J. et al, 2007). If this biomass waste potential is added to the EUBIONET III biomass potential, the total biomass and estimated biodradable fraction of waste potential would increase to a total of around 7,347 PJ (175 Mtoe). This potential is entirely needed to achieve targets of biomass use in 2020. The implementation of this potential is very much depending on regional potential and regional biomass demand. The analysis of regional potential is needed for better estimated on implementation potential.

*Barriers and opportunities for solid biomass trade in Europe*

As was shown in this report, biomass trade in Europe has been growing strongly, especially for refined biomass fuels such as wood pellets. It is clear that while in many countries, local biomass potentials still remain to be exploited, on the longer term, it is likely that some European countries with a high demand for biomass but little supply may face a shortage of biomass, while others may still have an abundant supplies. While so far only a (very) small part of the total biomass utilized in the EU is traded internationally, this share is rapidly growing. Especially the trade of refined biofuels (i.e. wood pellets) has been growing strongly, and is likely to continue to grow in the years to come. Nevertheless, also other forms of solid biomass, e.g. wood chips, waste wood, firewood and agricultural residues are traded, sometimes also in significant quantities. However, these trade flows are much harder to monitor.

Based on the viewpoints of biomass traders in many EU countries, the following barriers are currently limiting solid biomass trade:

- Raw material scarcity (especially for the production of wood pellets) is seen as a major bottleneck for the further increase in the production and trade of European biomass. At the same time, this shortage may actually increase the import of refined (and unrefined) biomass from outside the EU, e.g. Canada, the USA and North-West Russia.

- Logistical issues, such as bad roads and lack of suitable infrastructures in harbors are also a major barrier, hampering especially the low-density biomass types

- Sustainability criteria were seen as a (potential) obstacle by market actors in Germany, the Netherlands and the UK, mainly because it is largely unclear if (and which) solid biomass streams will have to meet sustainability criteria. However, Finnish traders also saw this as an opportunity, especially for wood biomass, because Finland has a long experience in forest certification.

- Clarity on biomass fuel quality is generally required to increase consumers confidence, especially for wood pellets delivered to households.(stricter enforcement of) technical standards may be a solution. However, as commodity-specific solutions to guarantee fuel quality may also be an option

Refined biomass (especially pellets) has been able to overcome these barriers due to their high energy density, sufficient policy support in various countries and (initially) abundant feedstock supply.

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# Appendix 1 – Questionnaire of EUBIONET III – Interview of biomass traders

**Contact details**

| | |
|---|---|
| *Respondent:* | |
| *Company:* | |
| *Traded biomass fuels*<br>*Traded annual volumes (e.g. tons or PJ)* | |
| *Date:* | |
| *Interviewed by* | |

a) What are currently the largest barriers preventing increasing production and export / import and consumption of biomass?

b). How could these barriers be overcome - proposals

c) What are current opportunities for biomass trade?

NOTE:

On purpose, we have not structured these questions further, as we anticipate that (perceived) barriers and opportunities can vary strongly from country to country. As a result, we expect a qualitative discussion of ongoing trade barriers & opportunities, of approximately 2 pages long (one for each trade flow). This discussion should in general contain:

- the type of biomass traded,

- typical trade routes (e.g. export from your country to countries A, B, C, import from countries X, Y & Z)

- if possible, rough estimates of the quantities traded (this is optional),

- all kinds of barriers and opportunities that traders may perceive. The definition of 'barrier' is very wide. For example, it could be logistic constraints (e.g. limited harbour capacity), economic constraints (the shipping costs are too high), support policy constraints (a subsidy for electricity from biomass was suddenly cancelled), trade policy (an export tariff for round wood), etc.

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**More information on EUBIONET III project**

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