Lot 5: Bioenergy's role in the EU Energy Market

Biomass availability in Europe

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Introduction

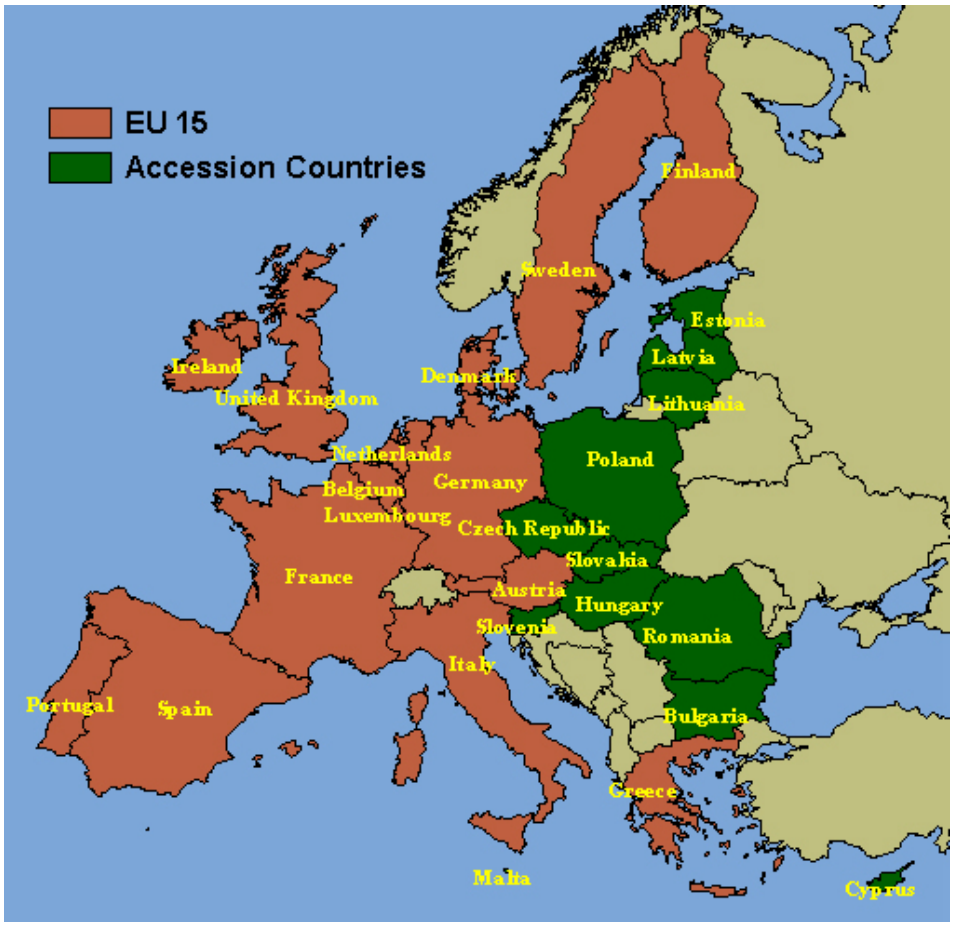
Biomass refers to all forms of plant derived material that can be used for energy: wood, charcoal, herbaceous, plant matter, agricultural wastes and forestry operations, etc. It is the 4th largest energy source worldwide accounting for approximately 15% of total energy supply and the predominant renewable energy source. However data and reliable and long term statistics concerning biomass are lacking and are difficult to collect since unlike many fuels, biomass fuels are often gathered by individuals for individual use. Furthermore a significant number of non-energy uses of biomass brings extra pressure on supply and make the assessment of biomass resources difficult.

The purpose of this study has been to prepare supply curves for biomass fuels in terms of qualities, quantities and costs in Europe for the further assessment of the role of biomass in the European market. The European countries considered are Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, UK, Slovak Republic, Slovenia, Spain.

The work has been organized in four different tasks:

a. Classification of biomass sources according to fuel quality and supply sector
b. Analysis of potential supply quantities
c. Analysis of delivery costs
d. Analysis of the sectors that serve as biomass suppliers (i.e. agriculture, forestry, industry, wastes)

CRES collected information for EU 14; BTG CEE for Czech Republic, Slovakia, Poland, Hungary and Slovenia and ESD Bulgaria for Bulgaria, Romania, Latvia, Lithuania and Estonia.



Classification of biomass fuel resources

The biomass resources considered as well as their classification based on fuel quality and conversion technology are presented in Table 1.
Agricultural residues include a wide range of plant material produced along with the main product of the crop. Examples of these types of residues that could be used for energy production are straw, orchard prunings, corn stems and cobs etc.
Livestock wastes include wet animal manure for biogas production and dry manure such as poultry litter that can be used in thermochemical conversion technologies.
Several energy crops have been studied throughout Europe: perennial grasses (e.g. miscanthus, switchgrass, giant reed, cardoon, etc.) and short rotation coppice for the production of lignocellulosic material; oil crops (e.g. rapeseed and sunflower) for the production of biodiesel; sugar and starch crops for bioethanol production.
Two types of forest biomass were considered: wood fuel and forest residues produced during logging activities, forest thinnings and cleanings etc.
Industrial residues that can be used as biomass resources for energy production are produced mainly in forest and food industries. These residues may consist either from dry lignocellulosic material (e.g. saw dust, husks, kernels, etc.) or from wet cellulosic material (e.g. sugar baggasse). Black liquor, the lignin naturally occurring in wood, dissolved out with the hemi-cellulose during sulphate pulping normally burnt in recovery boilers to provide process heat and to recover the chemicals, was also included in this category.
A large proportion of the resource base for biomass consists of wastes. In the framework of this study it has been decided to consider separately: demolition wood, municipal solid waste that can be used in incineration plants for energy production, landfill gas, and sewage sludge gas.
Park and garden wastes such as cut grass and tree prunings were also considered in the study, but unfortunately very little information was found on these biomass resources.
Finally in the framework of the study the option of biomass importation has been incorporated. Therefore intra European biomass trade as well as the imports from developing countries were considered, and the collected data for each country are presented in the Annex.

Table 1. Classification of the biomass fuel resources under study.

Sector	Resource	Fuel category	Fuel quality (indicative)		Conversion technology
			Moisture content (% wet basis)	Ash content (% dry basis)	
Agriculture	Agricultural residues	Dry ligno-cellulosic (e.g. straw, prunings)	30-50	2,2-17	Combustion, gasification, liquefaction
	Livestock waste	Wet cellulosic	74-92,1	27,1-35,4	Digestion
		Dry lignocellulosic (e.g. poultry litter)	75	17,5-28	Combustion, gasification, liquefaction
	Energy crops	Dry lignocellulosic	12,5-50	0,3-8,4	Combustion, gasification, liquefaction
		Oil seeds for methylesters	na	<0,02	Extraction
		Sugar/starch crops for ethanol	na	<0,02	Fermentation
Forestry	Wood fuel	Dry lignocellulosic	46,7	0,4-5	Combustion, gasification, liquefaction
	Forest residues	Dry lignocellulosic	46,7	3,2	Combustion, gasification, liquefaction
Industry	Industrial residues	Dry lignocellulosic	10-30	0,71-18,34	Combustion, gasification, liquefaction
		Wet cellulosic	80-99	3,8-5,9	Digestion
		Black liquor	90	36,4	Combustion
Waste	Regulated waste	Municipal waste	30	36	Combustion
		Demolition wood	30-40	0,58	Combustion
	Non regulated waste	Landfill waste	30	36	Digestion
		Sweage sludge	72,8	26,4	Digestion
Parks and gardens	Urban wood	Dry lignocellulosic	35	39,4	Combustion, gasification, liquefaction
	Cut grass	Wet cellulosic	75-80	8,4	Digestion

Analysis of potential supply quantities

The assessment of biomass resources – and particularly studies that consider all types of biomass for relatively large geographical areas, generally faces two related problems, namely the availability of reliable data, for both existing residues and wastes and future potential crops and the definition of available resource, when limits – including technical & economics – are uncertain.

Biomass sources are varied and disparate. Many biomass residues have no market and remain in forest and agricultural fields after harvesting operations. These are not traded and there are hence no trade records. Many residues that are used are traded informally – such as domestic firewood, straw for animal feed – and trade records are unreliable.

The assessment of energy crops faces similar problems. The area of land suitable for cropping is clearly a primary consideration and, given reasonable agricultural land

use, is reasonably straightforward to estimate. However, the area of land available for energy cropping will depend largely on the extent to which it is competitive with alternative land uses.
The resource assessment in this study was made in three steps:
[1] The first step was to find country information on the technical resource potential, defined as the total annual production of all resources given no limits. This potential represents the total quantity of biomass resources in a region and can be considered as the upper bound of bioenergy. To allow comparison and conversion, all resource estimates were expressed as oven dry tonnes (zero moisture content).
[2] The second step was to find country information on the available resource potential, defined as all resources available with estimated, realistic limits, considering: technical, physical, environment, agronomic, silvicultural and economic factors.
[3] Finally the energy potential of the different biomass resources expressed in PJ/year was estimated based on the Gross Calorific Value of each resource category (Table 2).

Table 2. Average Gross Calorific Values for the different biomass resources used in this study.

Resource category	Gross Calorific Value dry basis (GJ/dry tonne)
Dry lignocellulosic	18.0
Wet cellulosic	9.0
Poultry manure (combustion)	14.5
MSW (combustion)	12.0
Oils and fats *	36.0
Ethanol *	26.0

* GJ/tonne of liquid biofuel

The reference year for all data was chosen to be the year 2000 and when this was not possible the year for which the most recent data were reported. No data before 1995 were used.
According to the general approach of the study data from literature should be used. However in the cases were no data were found in literature own estimates based on commonly used methodologies were used. This approach was followed for the estimation of agricultural residues and livestock waste.
In the case of crop residues, the crops that cover over 1% of the total Utilized Agricultural Area (UAA) in EU 15 and produce dry lignocellulosic residues (moisture content <50%) were considered. These crops are: common wheat (10,8% of UAA), durum wheat (2,9% of UAA), barley (8,7% of UAA), maize (3,3% of UAA), sunflower (1,6% of UAA), rapeseed (2,8% of UAA), olive trees (2,8% of UAA) and vines (2,7% of UAA).
The estimation of the technical potential of the above crop residues was based on the cultivated area or the agricultural production for each crop in each country, for the year 2000 (Source: Eurostat) and average product to residue ratios or residue yields (in dry tons/ha) derived from literature (Table 3).
Straw estimates were based on an average 0.5 grain/straw ratio for central – northern EU countries and on an 0.9 straw/grain ratio for southern European countries. Corn residues include stalks and ear cobs and were estimated according to a 0.7 corn grain/corn residue ratio. The respective ratio for rapeseed according to the same source is 1,6 seed/residue ratio, and for sunflower 3,3.

The estimates for olive tree prunings were based on an average of 120 trees/ha and 25 kg dry prunings per tree, resulting in a yield of 0,3 t/ha. The estimates for grapevine prunings were based on an average production of 1,5 t/ha.

Table 3: Product/residue ratio (wet basis) and moisture content of the main agricultural crop residues for Europe (Dalianis and Panoutsou, 1995).

Crop	Residue	Moisture Content (%)	Product/ Residue ratio
Cereals	Straw	15	0,5 (Central – northern Europe)
		15	0,9 (Southern Europe)
Maize	Stalks	50	0,7
Rapeseed	Stalks	45	1,6
Sunflower	Stems & Leaves	40	3,3
Vineyard	Prunings	45	1,5 t/ha
Olive trees	Prunings	35	0,3 t/ha

The availability of these types of residues for energy purposes is restricted by several technical, environmental or economic factors that are difficult to be quantified. According to Dalianis and Panoutsou (1995) from the total agricultural residues produced in EU15, 48% are being exploited in non-energy (e.g. animal feeding) or traditional energy applications and a further 40-45% of the unexploited quantity cannot be exploited for various technical and/or economical reasons. Based on the findings of this study it was chosen to use this conservative availability factor of 30% for all agricultural field residues under consideration in Europe.

The average volume of faeces and urine largely differ from one type of animal to another and mainly depend on their age and lifeweight (Steffen et al., 2000). However in order to assist in the planning, design and operation of manure collection, storage, pre-treatment and utilization systems for livestock enterprises mean values have been developed by various researchers. In this analysis we adopted ASAE Standards co-efficients, presented in table 4. The values represent fresh faeces and urine.

Table 4. Coefficients of waste generated per animal category (ASAE D384.1 DEC99)

Animal category	Typical live animal mass (kg)	Total fresh manure per 1000 kg animal liveweight per day	Total solids (%)
Dairy	640	86	0,14
Veel	91	62	0,08
Swine	61	84	0,13

Having in mind the possibilities for collection and energy use of the manure, it is assumed that only 50% can be considered available for energy production.

In the case of poultry manure, a co-efficient of 0.03 dry kg/animal/day was applied.

In general, it is assumed that energy crops will be cultivated on the land with the lowest financial returns, which in the EU at present is the, set-aside land. This assumption has been followed in this study as well and information on the land set aside under both set aside schemes of the Common Agricultural Policy namely voluntary and compulsory set aside, were collected for 2000. For the accession countries information were collected for the agricultural land that is left idle. Especially for Poland, for which no information was found on idle agricultural land,

10% of the land cultivated with cereals, were considered that could be cultivated with energy crops.
The resource potential for landfill gas was assumed to be the biodegradable fraction of the waste that is landfilled. The resource potential for inceneration was assumed to be the waste that is not landfilled excluding the quantities composted or recycled. All sewage sludge has been assumed to be available for anaerobic digestion with energy recovery.

Agricultural biomass

In EU – 15, agriculture is the most important land use in geographic terms occupying 40% (130 million ha) of the total land area (323 million ha). Also Europe is one of the world's largest and most productive suppliers of food and fibre with the European Union (15) accounting alone for 10% of the global cereal production and 16% of global meat production in 1998.
The total resource potential of agricultural crop residues has been estimated to 1064 PJ/yr (~25 Mtoe) for EU and 306 PJ/yr (~7 Mtoe) for the Accession countries. The respective values for livestock waste is 514 PJ/yr (~14 Mtoe) for EU and 132 PJ/yr (~3 Mtoe).

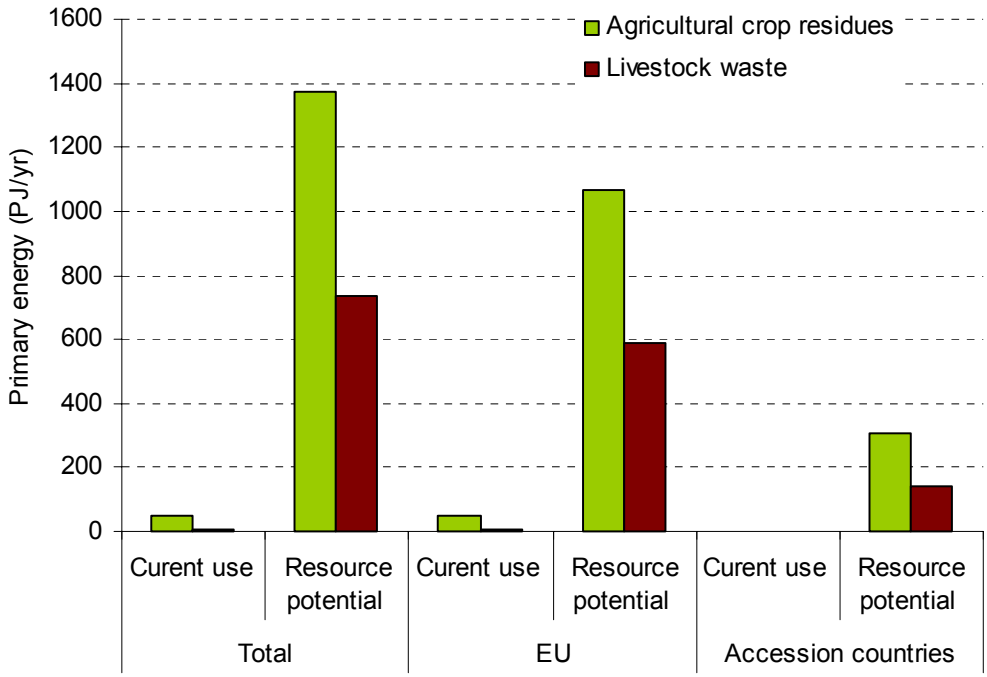


Figure 1. Current use and resource potential of agricultural crop residues and livestock waste in Europe.

According to EU's White Paper for renewable energy the contribution of biomass in the European energy market that could be made by agricultural and forest residues is estimated at 30 Mtoe. In this study the estimated energy potential of solid agricultural residues and forest residues is ~ 40 Mtoe. In the summary report on biomass survey in Europe (April 2003) of the project EUBIONET – European Bioenergy Networks (Contract No: 4.1030/S/01-1000/21) the potential of all the European Union countries in terms of biogas production from animal waste, sewage sludge and landfills is estimated at nearly 18 Mtoe. In this project the respective stimate was 16 Mtoe.

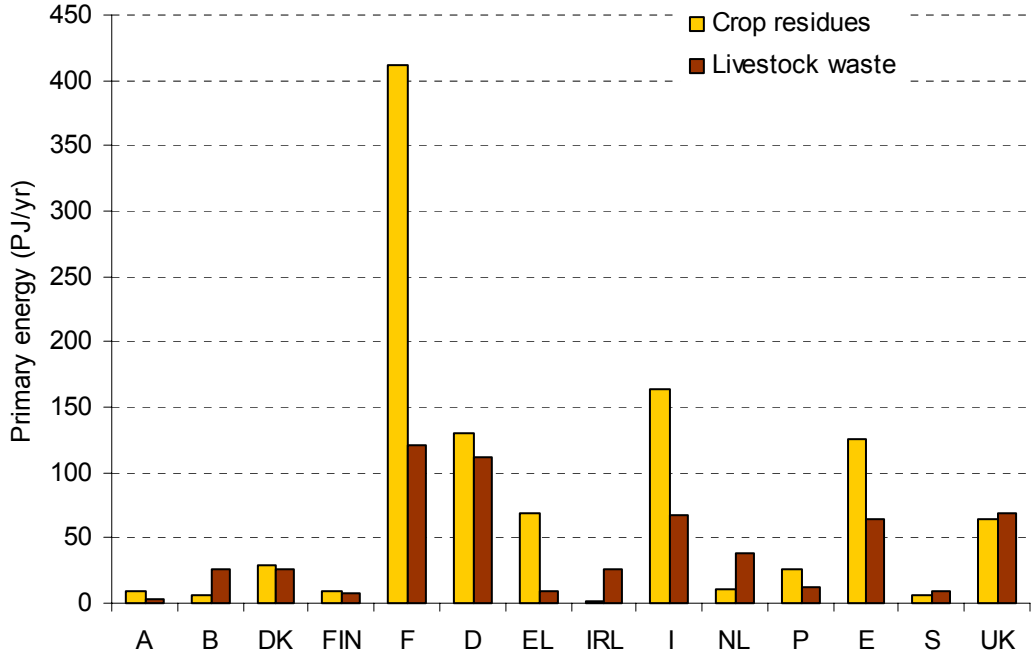


Figure 2. Primary energy potential of the theoretically available crop residues and livestock waste in EU-14.

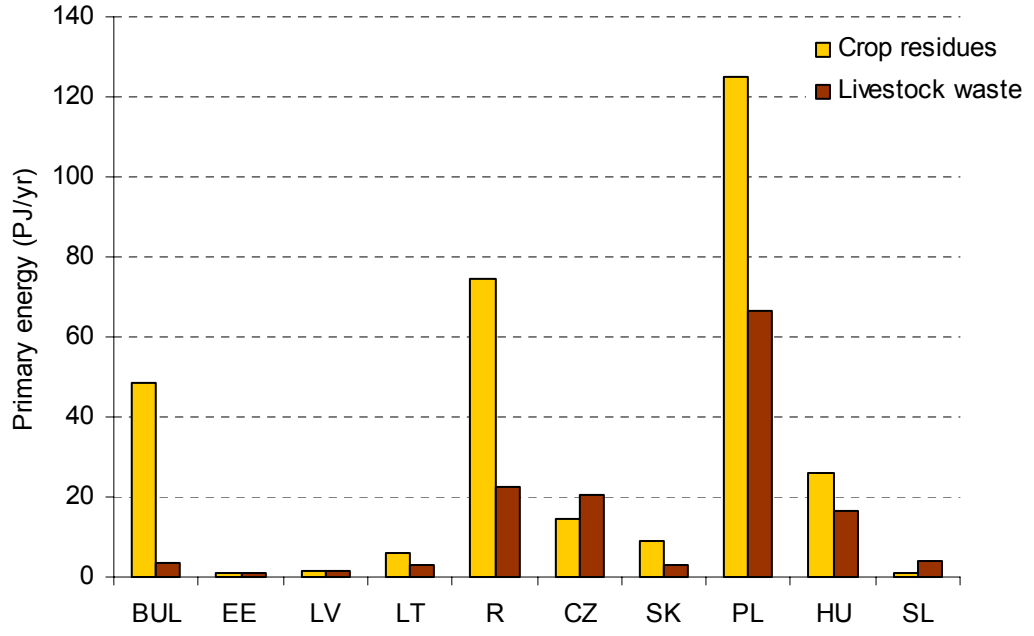


Figure 3. Primary energy potential of the theoretically available crop residues and livestock waste in the Accession Countries.

According to the collected data, the total arable land in EU in 2000 was 73,5 million ha from which 5,6 million ha were included in the set – aside scheme. The total arable land for the Accession Countries in the same year was 44,1 million ha from which 2,2 million ha can be considered available for the cultivation of energy crops.

In order to achieve the target in the White Paper for 45 Mtoe from energy crops, 10 million ha of land should be cultivated with these types of crops while only 5,6 million ha of arable land had been set aside in EU in the year 2000.

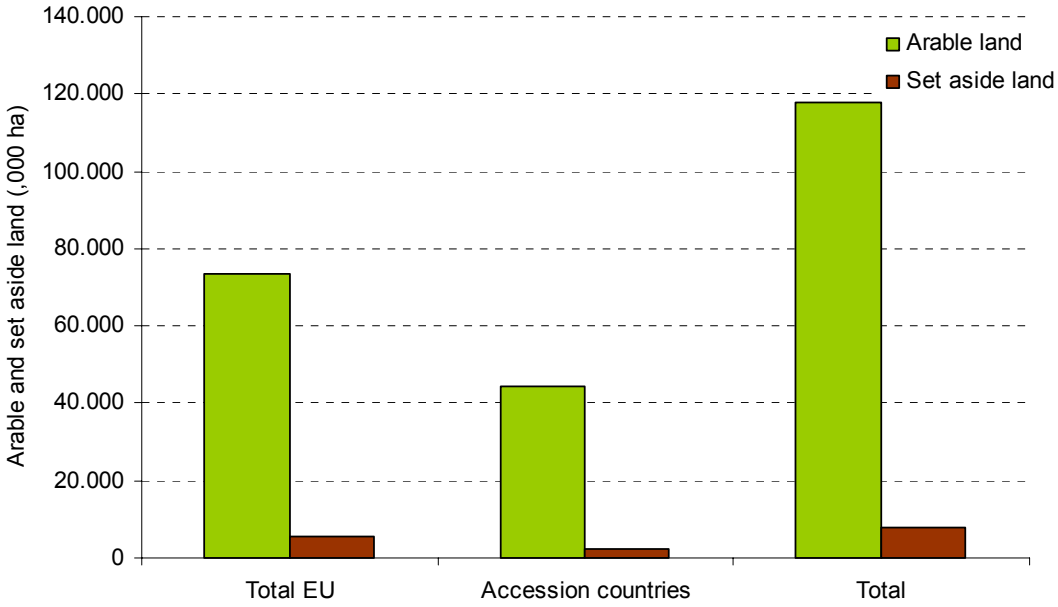


Figure 4. Arable land and set aside land (idle agricultural land for Accession countries) in Europe for the year 2000.

Forest biomass

The European continent has nearly 215 million ha of forests and other wooded land, accounting in total for nearly 30% of the continent's land area and about 5% of the world's forests. There is about 0,28 ha of forest and other wooded land for every European, while the world average is 0,63 ha per capita. Unlike those of many other regions, were deforestation is proceeding at a rapid pace, European forests have been expanding steadily since the beginning of the 20th century (apart from times of war) in both area and growing stock. Almost all of Europe's forests are managed, and have been managed for a very long time and primary or virgin forests are limited.

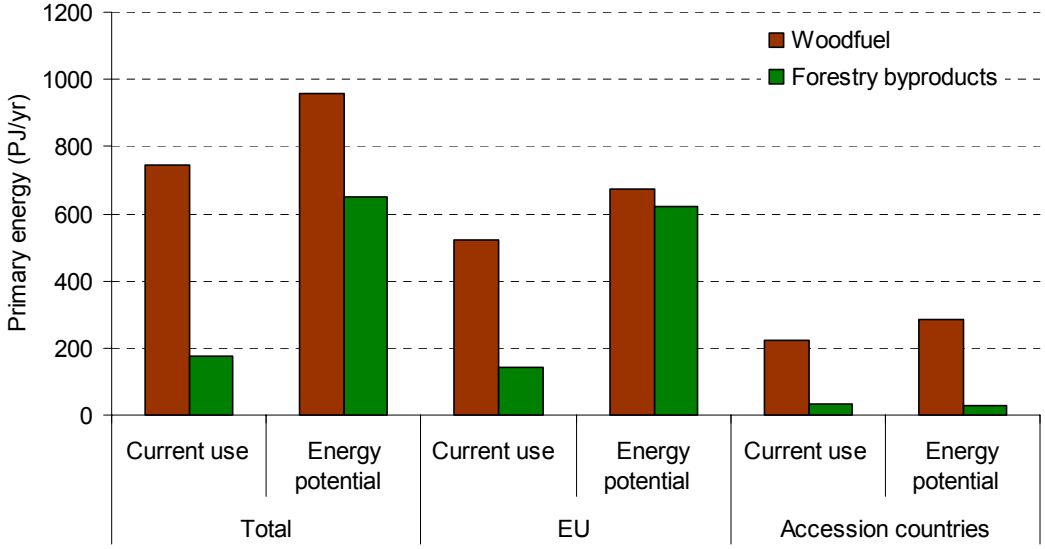


Figure 5. Current use and resource potential of forest biomass in Europe

The total energy potential of the sector for EU was estimated to 1292 PJ/year (~31 Mtoe) and for the Accession countries under study 315 PJ/year (6 Mtoe). More specifically, the energy potential of woodfuel in EU was estimated to 673 PJ/yr (~11,6 Mtoe) and of forest residues 619 PJ/yr (~15 Mtoe).The respective values for the 10 Accession countries under study were for woodfuel 284 PJ/yr (~7 Mtoe) and forestry residues 30 PJ/year (1 Mtoe). The low value of forest residues compared to woodfuel in Accession countries can be attributed to the fact that no separate figures were found for these biomass resources in all countries. The energy potential of forest residues combined with the energy potential of agricultural residues is in line with the White paper target.

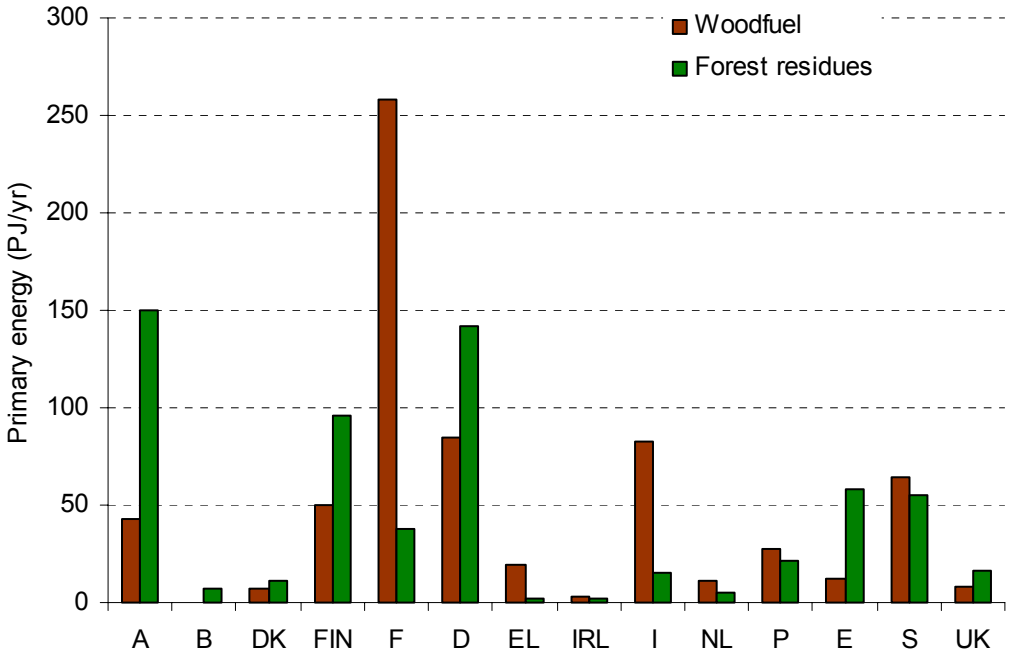


Figure 6. Primary energy potential of the theoretically available woodfuel and forest residues in EU-14.

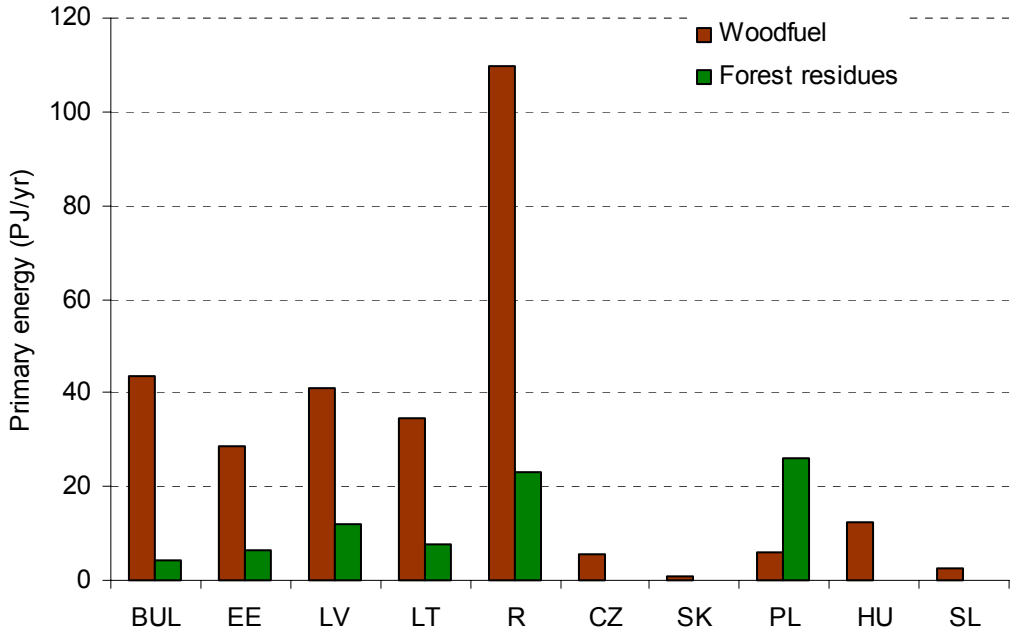


Figure 7. Primary energy potential of the theoretically available woodfuel and forest residues in the Accession countries.

Industrial biomass

Industrial waste that can be used as biomass resources for energy production include waste wood from wood processing industries, sludges, remains of food crops processing, etc.

The total energy potential of the sector for EU was estimated to 878 PJ/year (21 Mtoe) and for the Accession countries under study 229 PJ/year (5 Mtoe). More specifically, the energy potential of dry residues in EU was estimated to 426 PJ/yr (~10,17 Mtoe), industrial sludges 39 PJ/ry (~0,93 Mtoe), and black liquor 413 PJ/yr (~9,87 Mtoe). The respective values for the 10 Accession countries under study is for dry residues 168 PJ/yr (~3 Mtoe), industrial sludges 80 PJ/yr (~1,9 Mtoe), and black liquor 41 PJ/yr (~1,01 Mtoe).

According to EU's white paper for renewable energy the contribution of biomass in the European energy market that could be made by biogas exploitation from agro-industry effluents, animal waste, sewage treatment and landfill is estimated at 15 Mtoe. In the summary report on biomass survey in Europe (April 2003) of the project EUBIONET – European Bioenergy Networks (Contract No: 4.1030/S/01-1000/21) the potential of all the European Union countries in terms of biogas production from the same biomass resources is estimated at nearly 18 Mtoe. In this project the respective estimate was 16 Mtoe.

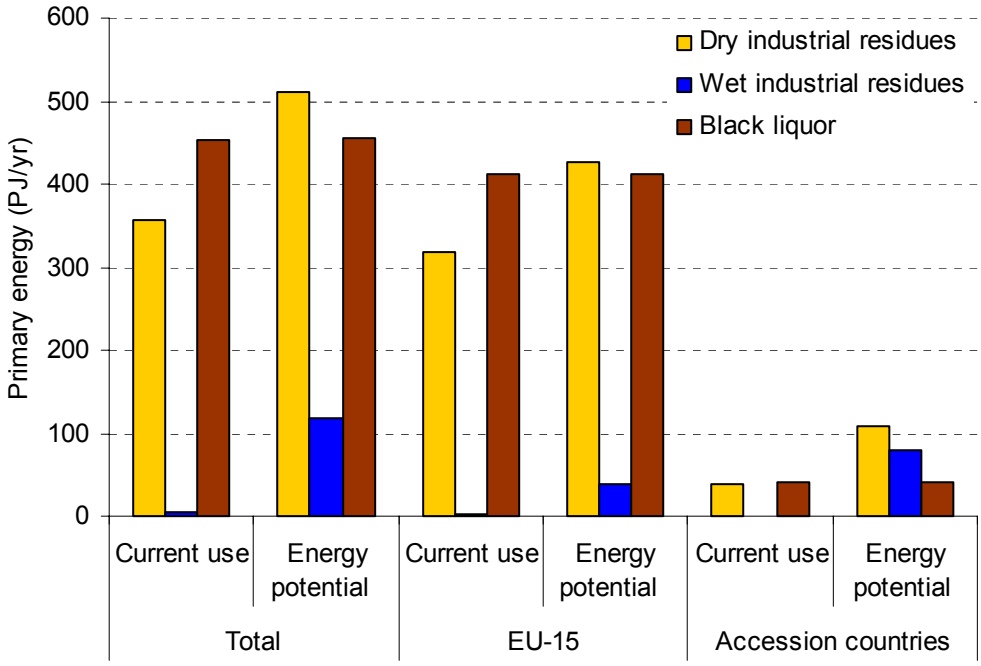


Figure 8. Current use and resource potential of industrial residues and waste in Europe.

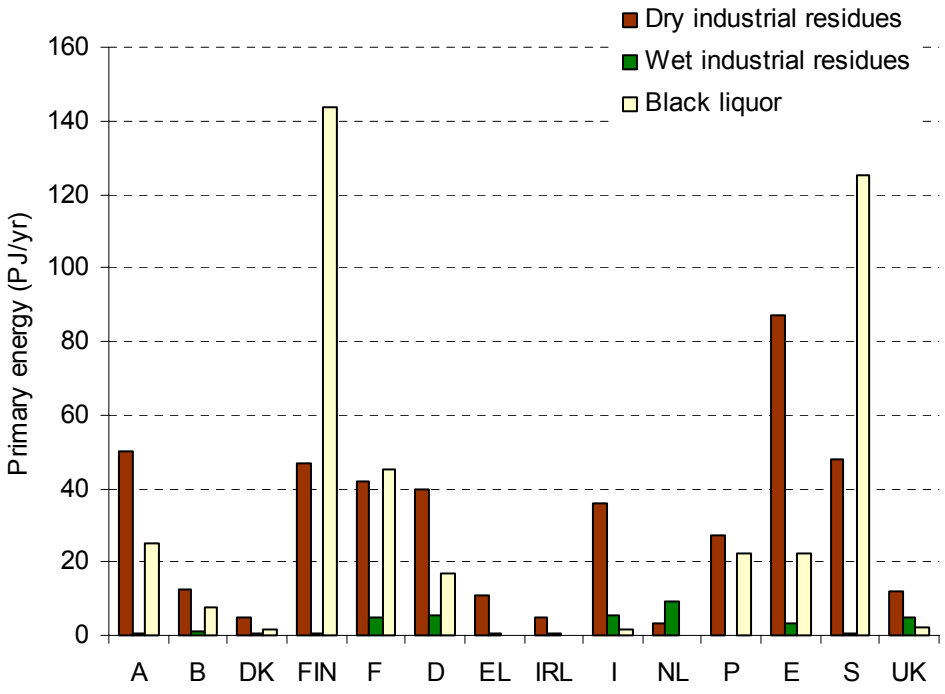


Figure 9. Primary energy potential of the theoretically available dry and wet industrial residues and black liquors in EU-14.

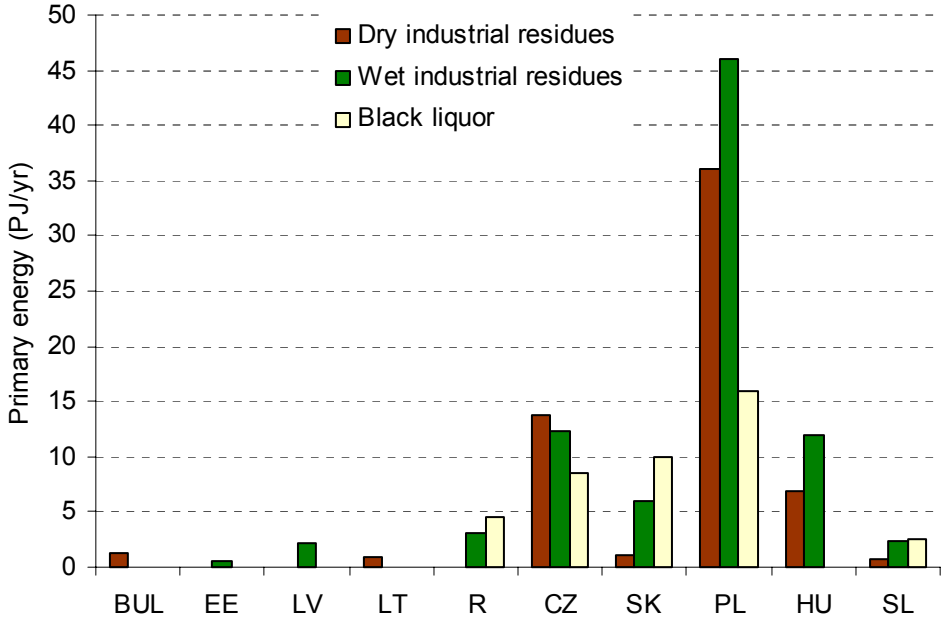


Figure 10. Primary energy potential of the theoretically available dry and wet industrial residues and black liquors in the Accession countries.

Waste biomass

Waste is defined as: “any substance or object which the holder disposes of or is required to dispose of pursuant the provisions of national law in force” (EU, 1975, Article 1).

In this study the “waste sector” in terms of biomass resources includes municipal solid waste, sewage sludge and demolition wood (industrial solid and liquid waste were considered separately in the industrial sector analysis).

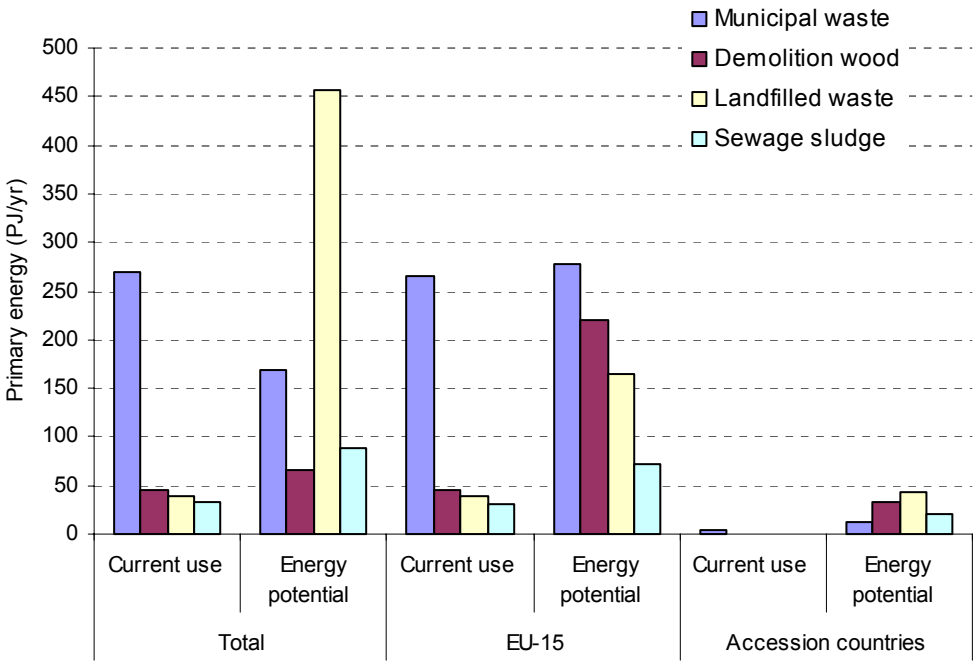


Figure 11. Current use and resource potential of biomass waste in Europe.

The total energy potential of waste for EU was found to be 736 PJ/year (18 Mtoe) and for the Accession countries under study ~110 PJ/year (3 Mtoe). More specifically, the energy potential of sewage sludge gas in EU was estimated to 73 PJ/yr (~2 Mtoe), landfill gas 164 PJ/ry (~4 Mtoe), municipal waste for incineration to 279 PJ/yr (~7 Mtoe) and demolition wood 221 PJ/yr (~5 Mtoe).The respective values for the 10 Accession countries under study were for sewage sludge 21,06 PJ/yr (~0.5 Mtoe), landfill gas 43,3 PJ/yr (~1,03 Mtoe); municipal waste for incineration 12,7 PJ/yr (~0,3 Mtoe) and demolition wood 33,04 PJ/yr (~0,79 Mtoe).
According to EU's White Paper for renewable energy, the contribution of biomass in the European energy market that could be made by biogas exploitation from animal waste, agro-industry effluents, sewage treatment and landfill is estimated at 15 Mtoe. In the summary report on biomass survey in Europe (April 2003) of the project EUBIONET – European Bioenergy Networks (Contract No: 4.1030/S/01-1000/21) the potential of all the European Union countries in terms of biogas production from the same biomass resources is estimated at nearly 18 Mtoe. In this project the respective estimate was 16 Mtoe.

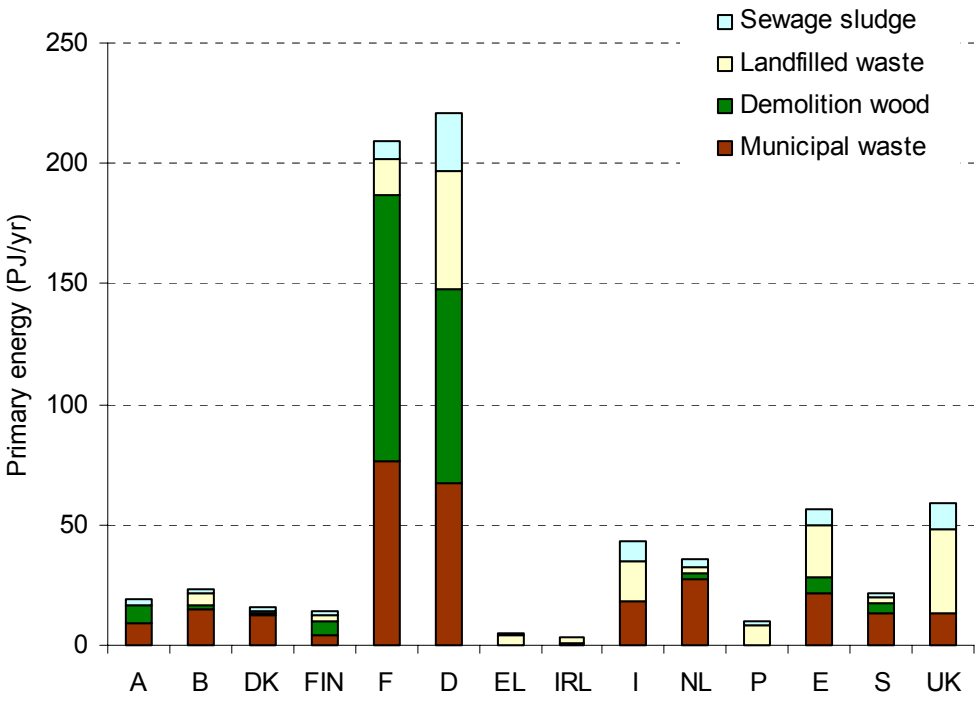


Figure 12. Primary energy potential of the theoretically available waste in EU-14.

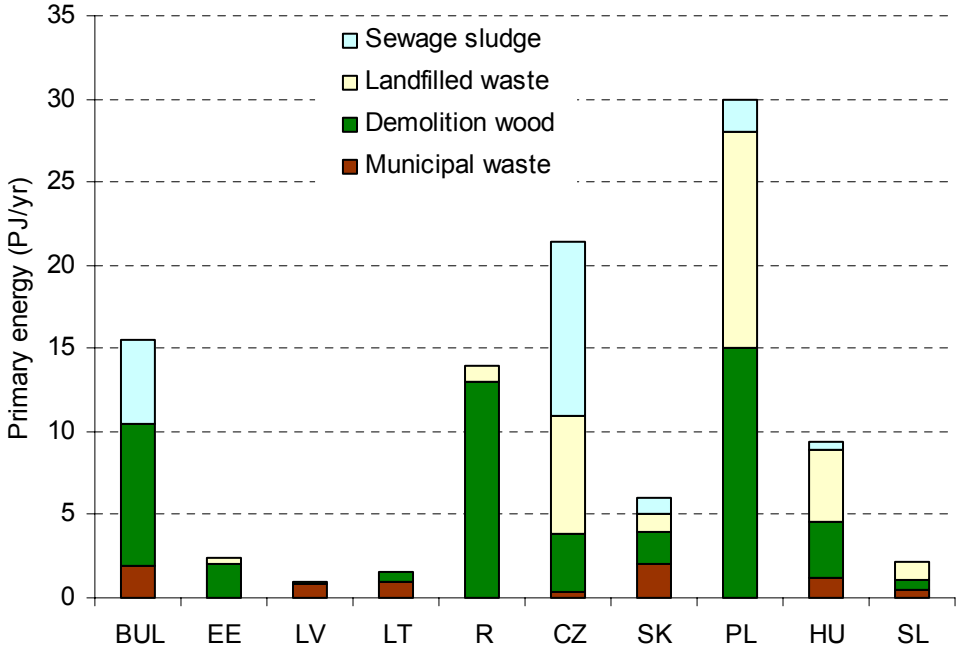


Figure 13. Primary energy potential of the theoretically available waste in the Accession countries.

Analysis of the delivery cost

The cost of biomass is an important element in the cost of produced energy, e.g. contributing 40% to 50% to the cost of electricity.

The final delivery cost of biomass can be analyzed in the following cost factors:

- ✓ Production costs of biomass fuels.
- ✓ Transportation costs from production site to energy conversion plant (in relevant studies a round trip for 150 km is considered).
- ✓ Other costs, such as storage, handling, etc.

Also some types of biomass (e.g. straw) may have an opportunity cost in non-energy markets such as food, cattle feed, etc.

The delivery cost of the different types of biomass for the different European countries, were recorded in €/GJ, analyzed (if possible) in "production", "transportation" and "other costs" in order to establish better understanding of biomass fuel prices. In the cases where biomass had an alternative market and therefore an opportunity cost, this cost was also recorded separately. Since the collection of reliable data for biomass is difficult, cost ranges were used. All costs refer to the year 2000.

In the following paragraphs the results concerning the total costs of the different biofuels are presented.

The cost of crop residues in EU 14 ranged between 1.4 €/GJ in Spain to 6.45 €/GJ in Ireland. No information was found for Belgium and Portugal. The largest differences within the country were observed in Greece ±1.9 €/GJ and Netherlands ±1.1 €/GJ

The average cost of crop residues in the accession countries ranged between 1.5 €/GJ in the Czech republic and 2.65 €/GJ in the Slovak republic. The differences within the country observed were considerable and reached ±1.35 €/GJ in the Slovak republic.

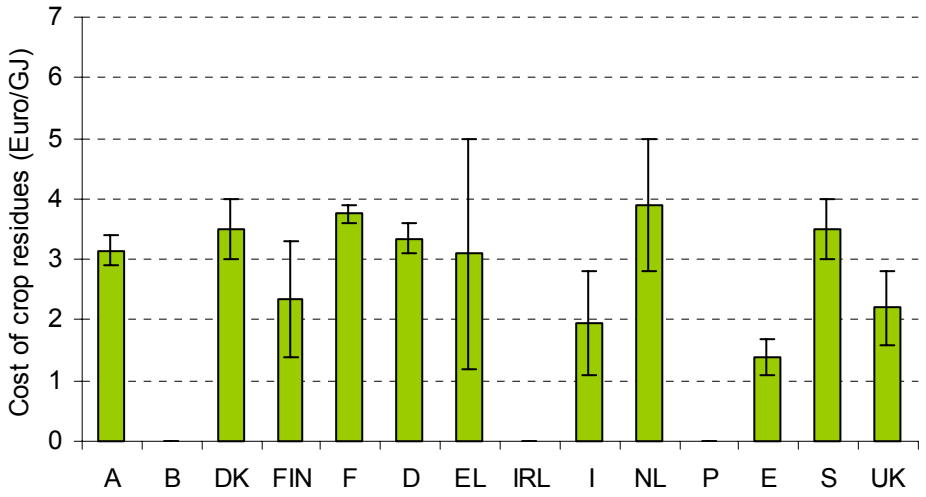


Figure 14. Costs of crop residues in EU-14.

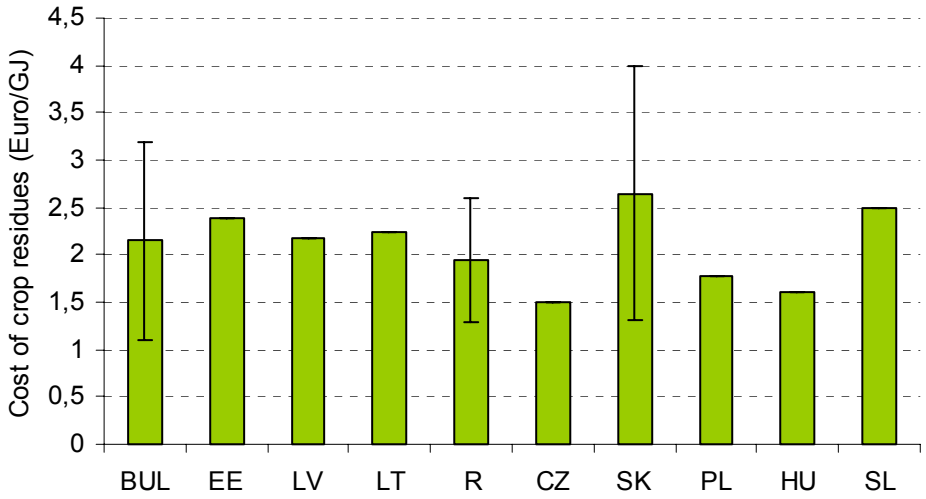


Figure 15. Costs of crop residues in Accession countries.

The cost of energy crops for solid biofuels in EU 14 ranged between 1.72 €/GJ in Spain to ~4 €/GJ in the Netherlands. Differences within the country ranged between ±0.28 €/GJ in Austria and ±2 €/GJ in UK. No information on the cost of energy crops for solid biofuels were found for Denmark and Portugal.
In the accession countries the average cost of energy crops for solid biofuels ranged between 1.82 €/GJ in Lithuania and 18.6 €/GJ in Slovenia. No information was found for Bulgaria, Estonia, Latvia and Romania.

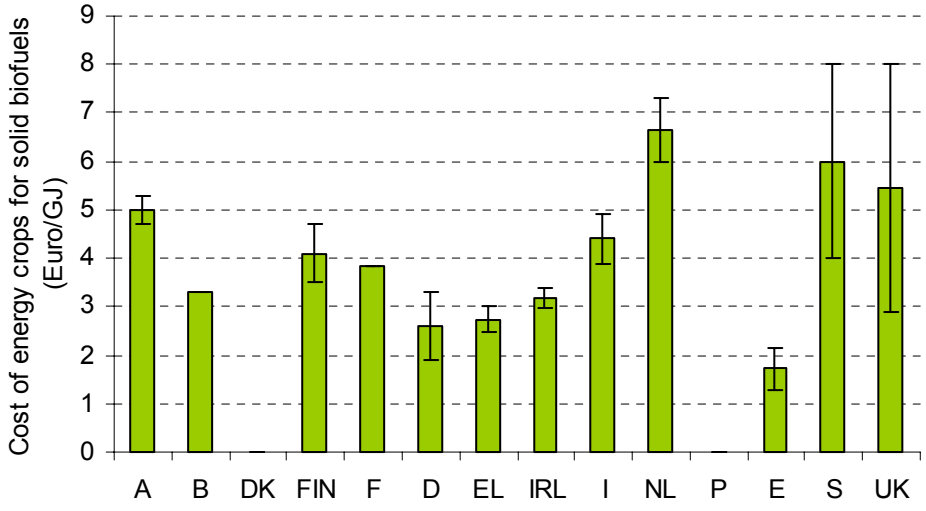


Figure 16. Costs of energy crops for solid biofuels in EU-14.

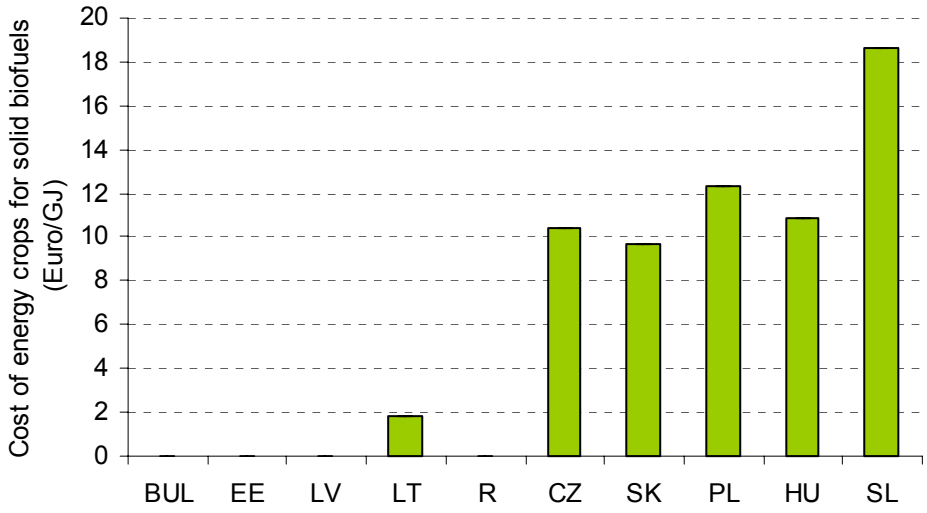


Figure 17. Costs of energy crops for solid biofuels in Accession countries.

Information on the cost of energy crops for biodiesel production was found only for Austria, Finland, France, Greece and Italy and the recorded costs ranged between 4.5 €/GJ in Greece and 24.28 €/GJ in Austria. A range of ±0.55 €/GJ was recorded for Italy.
In the accession countries the average cost of energy crops for biodiesel ranged between 5.6 €/GJ in the Slovak republic and 14.24 €/GJ in Lithuania. No information was found for Estonia and Romania.

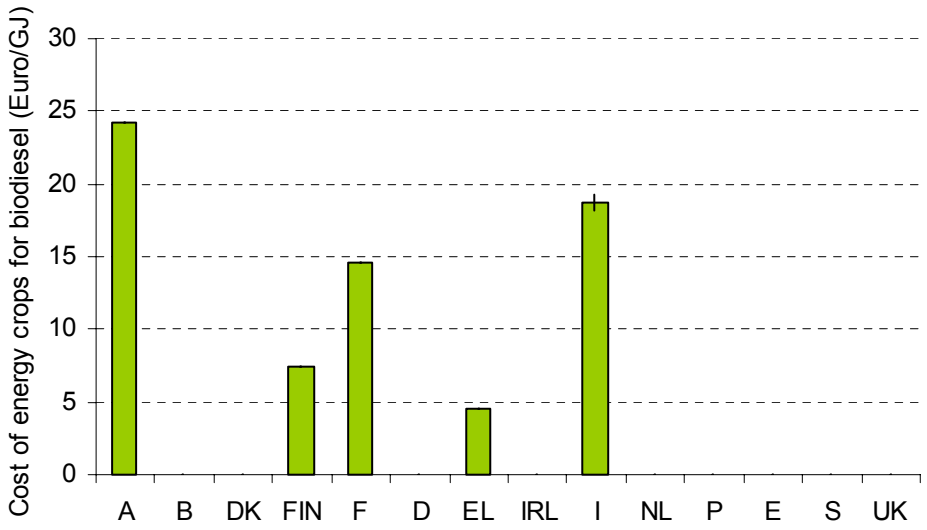


Figure 18. Costs of energy crops for biodiesel in EU-14.

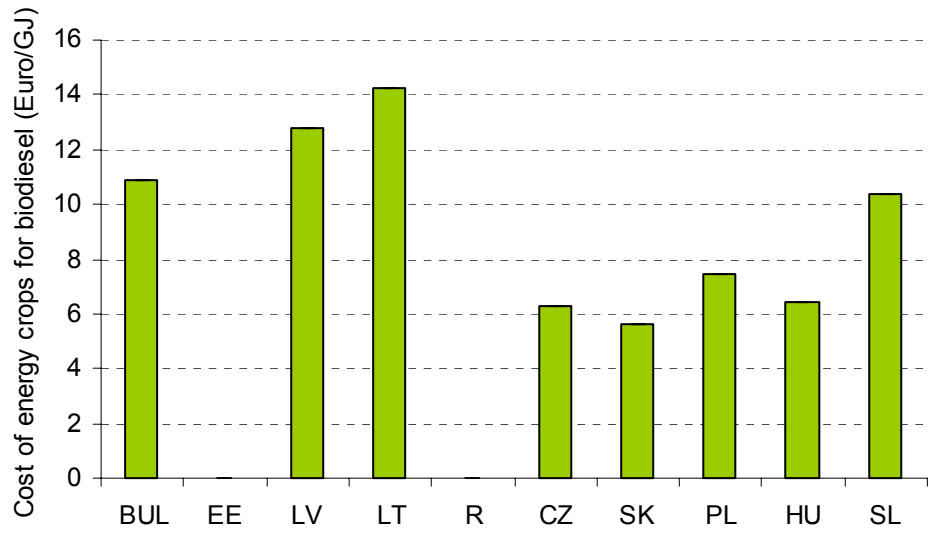


Figure 19. Costs of energy crops for biodiesel in Accession countries.

Information on the cost of energy crops for bioethanol production was found only for France (20.8 €/GJ) and Spain (9.2 €/GJ).
In the accession countries the average cost of energy crops for bioethanol ranged between 3.3 €/GJ in the Slovak republic and 22.75 €/GJ in Latvia. No information was found for Lithuania, Estonia and Romania.

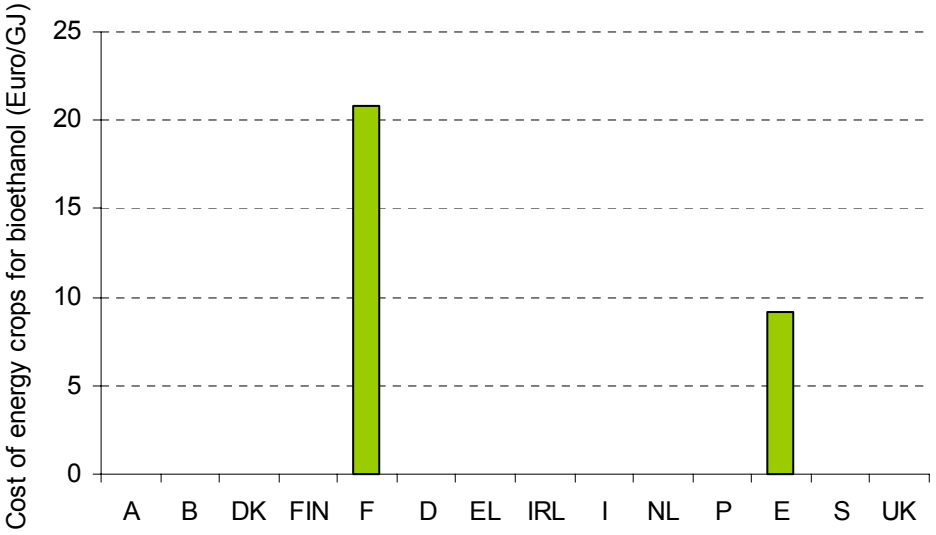


Figure 20. Costs of energy crops for bioethanol in EU-14.

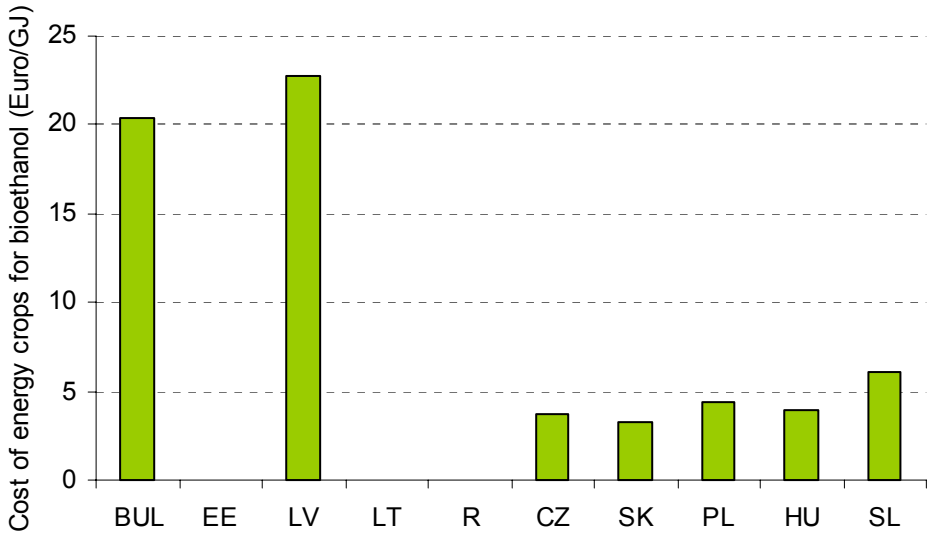


Figure 21. Costs of energy crops for bioethanol in Accession countries.

The cost of woodfuel in EU 14 ranged between 2.1 €/GJ in Finland and 8.7 €/GJ in UK. The largest differences within the country were observed in Denmark ±2 €/GJ and UK ±5.3 €/GJ
The average cost of woodfuel in the accession countries ranged between 1.05 €/GJ in Estonia and 7 €/GJ in Slovenia. Differences within the country were reported only in Poland and was ±0.3 €/GJ.

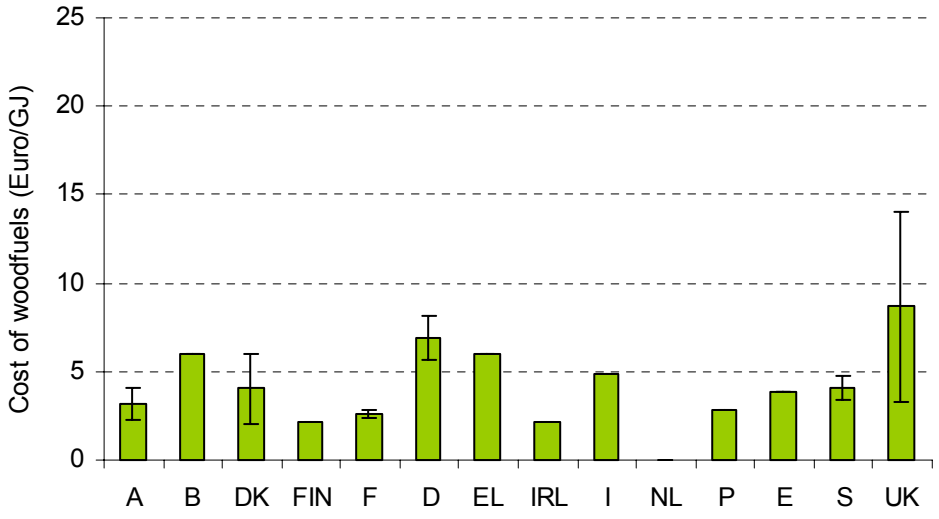


Figure 22. Cost of woodfuel in EU-14.

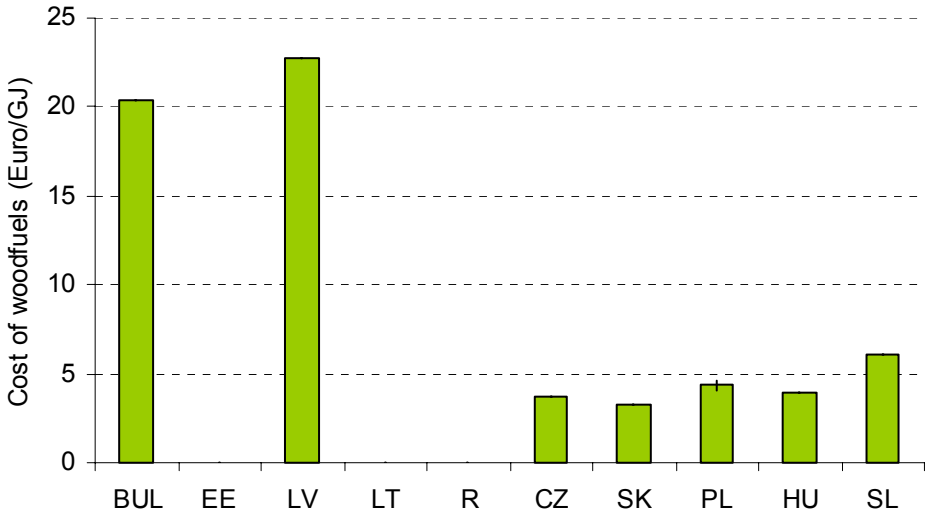


Figure 23. Costs of woodfuel in Accession countries.

The cost of forestry byproducts in EU 14 ranged between 1.4 €/GJ in Spain and 6.7 €/GJ in Finland. The largest differences within the country were observed in the Netherlands ±1.4 €/GJ and Belgium ±1.05 €/GJ
The average cost of forestry byproducts in the accession countries ranged between 0.8 €/GJ in Poland and 7.7 €/GJ in Slovenia. Differences within the country were reported only in Poland and was ±0.4 €/GJ.

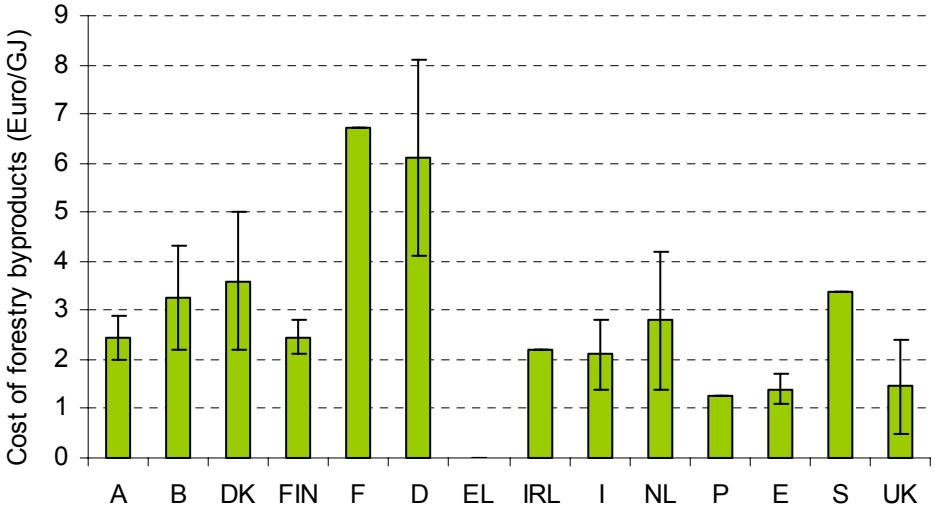


Figure 24. Costs of forestry byproducts in EU-14.

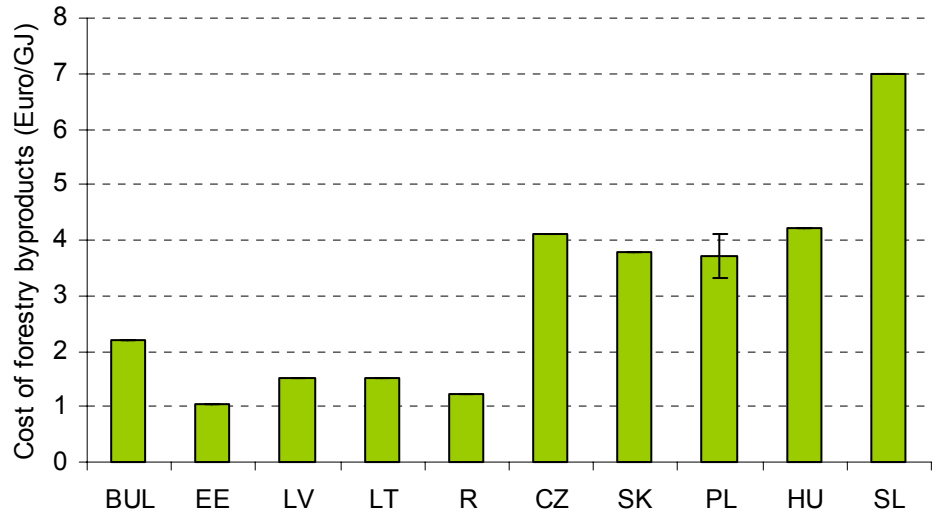


Figure 25. Costs of forestry byproducts in Accession countries.

The cost of solid industrial residues in EU 14 ranged between 0.92 €/GJ in Austria and 3.3 €/GJ in Germany. The largest differences within the country were observed in Germany ±2.3 €/GJ.
The average cost of solid industrial residues in the accession countries ranged between 0.8 €/GJ in Latvia and Litnhuania and 6.9 €/GJ in Slovenia. Differences within the country were reported only in Poland and was ±0.9 €/GJ.

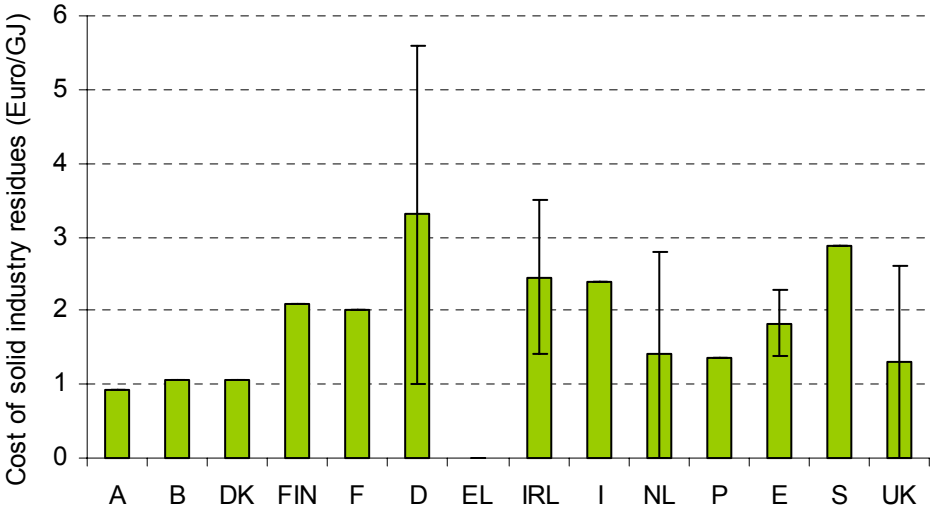


Figure 26. Costs of solid industrial residues in EU-14.

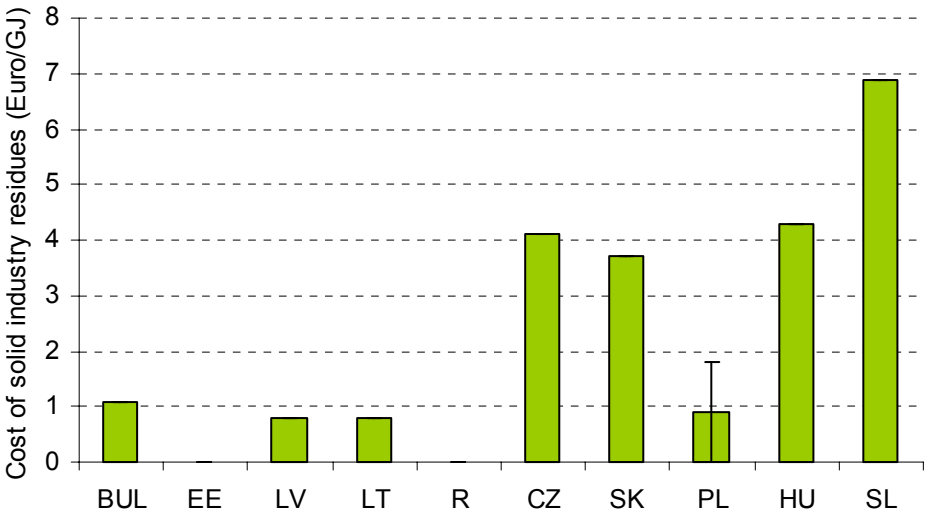


Figure 27. Costs of solid industrial residues in Accession countries.

Sector Analysis

The objective of sector analysis was to assess the future potential of biomass resources in Europe, based on per sector market trends and policy developments.
The sectors considered were:

- Forestry sector
- Agricultural sector
- Industrial sector
- Waste sector

Cereals are the world's most important source of food, both for direct human consumption and indirectly as inputs to livestock production. The growth rate in cereal production in industrial countries (including EU countries) has been 1,4% per year in the decade 1989-1999 and according to the study of FAO on "World Agriculture Towards 2015/2030" (Rome, 2002), is expected to fall to 1,1% per year for the period 1999 – 2015 and to 0,9% for the period 2015 – 2030. The growth rate in cereal production in transition economies was negative in the decade 1989-1999 (-4,2%) but it is expected to rise to 1% per year for the period 1999 – 2030.
The consumption of livestock products has grown considerably during the past three decades, especially in the newly industrializing countries. However, future growth in consumption of both meat and milk may not be as rapid as in the recent past, given the reduced scope for further increases in major consuming countries. In developed countries the scope for increased demand is limited. Population growth is slow and the consumption of livestock products is already very high. At the same time health and food safety concerns are holding back demand for meat. The growth rate in meat consumption in terms of kg/capita/year in industrial countries (including EU countries) is expected to be around 0,5% between 1999 and 2030 and in transition countries around 1% in the same period. The respective growth rates for milk and dairy product consumption for the same period are expected to be lower (0,15% for the industrial countries and 0,4% for transition countries).
Concerning set aside land, according to the EC report " Prospects for agricultural markets 2002 – 2009" an increase of ~1% in the total set aside land (compulsory and voluntary) is expected mainly due to a decline in the relative profitability of arable crops.
Some European countries (e.g. Bulgaria, France, Finland, Hungary, Ireland, Spain and the United Kingdom) have had long term policies to expand their forest resource

or to improve its quality. These programmes, along with natural extension onto marginal agricultural land have outweighed losses of forest land to other uses, notably urban and infrastructure, causing Europe's forest area and growing stock to expand steadily since the early 1950s. According to the Forest Resource Assessment 1990, the European forest area increased by 1,9 million hectares between 1980 and 1990. Losses of forest land to other uses, notably urbanisation and transport infrastructure, were outweighed by the afforestation of former agricultural land and natural extension. Several approaches are used to project future wood supply at the national or regional level, such as: detailed modelling of the biological processes; aggregation of management plans registered with the forest authority; econometric models etc. In the ETTSV study on European timber trends and prospects: into the 21st century, national correspondents made a synthesis of available national information and used their judgement when necessary. According to this study, no major changes are expected in the area of exploitable forest in Europe which is expected to expand by 3,3% in the years between 1990 and 2020. Removals are expected to rise by about 0,7% per year. In summary the European forest is expected to continue to accumulate wood as the harvest will remain well below the biological potential, even though a larger proportion of the increment will in fact be utilised. National experts expect wood energy supply and use to grow at around 1% a year from 1990 to 2020.

The largest producer of dry industrial residues that can be used as a biomass resource for energy production is wood industry (including pulp and paper industry).

According to the study mentioned above on European timber trends and prospects: into the 21st century wood energy supply (including wood processing residues and black liquors) is expected to grow at around 1% a year from 1990 to 2020, which is about the same speed as sawnwood consumption.

The progressive implementation of the Urban Waste Water Treatment Directive 91/271/EEC in all Member States is increasing the quantities of sewage sludge. In the EEA Techical Report 69, projections on sewage sludge generation for 2005 are presented and increases between 2000 and 2005 range between 0,4% a year in Spain to 4% a year in Belgium the average value being ~2% a year. This trend was adopted for both industrial sludges and sewage sludge.

EU is aiming for a significant cut in the amount of waste generated, through new waste prevention initiatives, better use of resources, and encouraging a shift to more sustainable consumption patterns. Furthermore, the European landfill directive set a target to reducing the quantities of biodegradable municipal solid waste sent to landfill to 35% of 1995 levels by 2020, corresponding to a reduction of ~3% a year.

On the other hand projections on household waste generation in EU (EEA Technical report No 28) showed that an increase of ~1% a year can be expected between 2000 and 2010 corresponding to respective increase in the quantities of waste available for incineration.

Table 5. Future trends in biomass availability in Europe.

Sector	Resource	Fuel category	2010 Increase or decrease of available biomass energy potential compared to 2000 (%)	2020 Increase or decrease of available biomass energy potential compared to 2000 (%)	Comment
Agriculture	Dry crop residues	Dry lignocellulosic	10%	20%	+1% a year
	Livestock waste	Wet and dry cellulosic	5%	10%	+0,5% a year
	Energy crops	Set aside or idle agricultural	10%	20%	+1% a year
Forestry	Woodfuel	Dry lignocellulosic	10%	20%	+1% a year
	Forestry	Dry lignocellulosic	10%	20%	+1% a year
Industry	Industrial residues	Dry lignocellulosic	10%	20%	+1% a year
		Wet cellulosic	20%	40%	+2% a year
		Black liquor	10%	20%	+1% a year
Waste	Regulated waste	Municipal waste	10%	20%	+1% a year
		Demolition wood	10%	20%	+1% a year
	Non-regulated waste	Landfilled waste	-30%	-60%	-3% a year
		Sewage sludge	20%	40%	+2% a year

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Annex

Country Data

Austria

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	1	1055556	555556	500000	9
	Livestock waste	Wet cellulosic	0,08	1800000	1690000	110000	1
		Dry cellulosic	:	151077	0	151077	2,1
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	1	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	30,9	2388889	0	2388889	43
	Forestry byproducts	Dry lignocellulosic	23,8	8333333	0	8333333	150
Industry	Industrial residues	Dry lignocellulosic	51	2777778	0	2777778	50
		Wet cellulosic	:	80000	0	80000	0,72
		Black liquor	24,91	2491000	0	2491000	24,91
Waste	Regulated waste	Municipal waste	7,8	775000	0	775000	9,3
		Demolition wood	1	388889	0	388889	7
	Non-regulated waste	Landfilled waste	0,36	196000	0	196000	0,7
		Sewage sludge	0,36	211900	0	211900	1,91
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			10,786 PJ/year from which 93% is firewood from Germany and Croatia				10,78
Biomass exports			7,624 PJ/year from which 98% is firewood				7,62

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	3800	biodiesel t/ha/year	1,15
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	1399000		
Set aside land	107000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	4,9	:	0	4,9	2,9-3,4
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	3,89-4,54	0,31-0,39	0,42	4,7-5,27	:
		Oil seeds for methylesters (rapeseed)	21,94	0,39	1,94	24,28	10,47-11,67
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	2,3-4,1
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	2-2,9
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	0,92
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			2,7 (firewood) - 7,11 (wood pellets)				
Biomass exports			2,34 (firewood) - 7,78 (wood pellets)				

Belgium

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	1262343	883640	378703	6,8
	Livestock waste	Wet cellulosic	:	3979000	1989500	1989500	18
		Dry cellulosic	:	602250	0	602250	8,4
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0,72	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	0,32	17.778	0	17.778	0,32
	Forestry byproducts	Dry lignocellulosic	0	411.111	0	411.111	7,4
Industry	Industrial residues	Dry lignocellulosic	5,7	700000	0	700000	12,6
		Wet cellulosic	:	100000	0	100000	0,9
		Black liquor	7,6	760000	0	760000	7,6
Waste	Regulated waste	Municipal waste	13,1	1245000	0	1245000	14,9
		Demolition wood	:	71500	0	71500	1,3
	Non-regulated waste	Landfilled waste	:	1558000	0	1558000	5,8
		Sewage sludge	:	113000	0	113000	1,0
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports							0,25 PJ fuelwood
Biomass exports							0,09 PJ fuelwood

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	815000		
Set aside land	24000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	:
	Livestock waste	Wet cellulosic	0	0	0	0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	3,038	0,23	0	3,31	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	6,05
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	2,2-4,3
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	1,05
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Denmark

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	13,05	5350000	3745000	1605000	28,9
	Livestock waste	Wet cellulosic	1,29	4972000	2486000	2486000	22,4
		Dry cellulosic	:	2297753	0	229753	3,2
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	7	388889	0	388889	7
	Forestry byproducts	Dry lignocellulosic	8,5	611111	0	611111	11
Industry	Industrial residues	Dry lignocellulosic	5,9	277778	0	277778	5
		Wet cellulosic	0,150	50000	0	50000	0,45
		Black liquor	1,61	161000	0	161000	1,61
Waste	Regulated waste	Municipal waste	30,34	1045000	0	1045000	12,5
		Demolition wood	:	130000	78000	52000	0,936
	Non-regulated waste	Landfilled waste	0,55	133000	0	133000	0,6
		Sewage sludge	0,680	200000	0	200000	1,8
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			0,7 PJ sawdust and wood pellets from the Baltic States and Canada				0,7
Biomass exports			very low biomass exports				0

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	606	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	2281000		
Set aside land	213000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	3-4
	Livestock waste	Wet cellulosic	0	0	0	0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	2,1-3,1	0,4-0,7	0,4-0,5	3-4	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	2-3,35
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	4-5
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	:
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Finland

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	1802810	1261967	540843	9,7
	Livestock waste	Wet cellulosic	0,03	1535000	767500	767500	6,9
		Dry cellulosic	:	86702	0	86702	1,213828
	Energy crops	Dry lignocellulosic	0,216	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	45,3	2777778	0	2777778	50
	Forestry byproducts	Dry lignocellulosic	5	5333333	0	5333333	96
Industry	Industrial residues	Dry lignocellulosic	47	2611111	0	2611111	47
		Wet cellulosic	0,06	50000	0	50000	0,45
		Black liquor	143,54	14354000	0	14354000	143,54
Waste	Regulated waste	Municipal waste	2	376000	0	376000	4,5
		Demolition wood	:	338000	30550	307450	5,5
	Non-regulated waste	Landfilled waste	0,15	705000	0	705000	2,6
		Sewage sludge	0,41	158000	0	158000	1,4
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			12,3 PJ wood mainly from Russia				12,3
Biomass exports			~0,8 PJ wood pellets to Denmark, Sweden & Netherlands				0,8

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	1000	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	2187000		
Set aside land	177000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	1,4-3,3
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	3-4,2	0,5	0	3,5-4,7	0
		Oil seeds for methylesters (rapeseed)	7,2	0,2	:	7,4	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	2,1
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	2,1-2,8
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	2,1
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			2,37				
Biomass exports			7,14				

France

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	63365050	40476161	22888889	412
	Livestock waste	Wet cellulosic	0,002	18881000	9440500	9440500	85,0
		Dry cellulosic	:	2551022	0	2551022	35,7
	Energy crops	Dry lignocellulosic	:	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	11,8	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	2,4	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	158,68	14333333	0	14333333	258
	Forestry byproducts	Dry lignocellulosic	:	2111111	0	2111111	38
Industry	Industrial residues	Dry lignocellulosic	8,28	2333333	0	2333333	42
		Wet cellulosic	1,85	570000	0	570000	5,13
		Black liquor	45,08	4508000	0	4508000	45,08
Waste	Regulated waste	Municipal waste	75,8	6343000	0	6343000	76,1
		Demolition wood	:	6166666,667	0	6166666,667	111
	Non-regulated waste	Landfilled waste	2,06	3892000	0	3892000	14,4
		Sewage sludge	2,6	878000	0	878000	7,9
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports							0,24
Biomass exports							0,02

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	258000	biodiesel t/ha/year	1,65
sugar rich crops	11579 sugarbeet+13885 cereals	ethanol t/ha/year	2 for wheat - 5,5 for sugarbeet
Total arable land	18440000		
Set aside land	1489000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	3,6-3,9
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	:	:	:	:	3,83
		Oil seeds for methylesters (rapeseed)	:	:	:	:	14,64
		Sugar/starch crops for ethanol	:	:	:	:	20,8
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	2,4-2,8
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	6,7
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	2
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

:

Germany

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	2,5	7222222	0	7222222	130
	Livestock waste	Wet cellulosic	1,26	21139000	10569500	10569500	95
		Dry cellulosic	:	1178866	0	1178866	16,5
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	8,64	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	85	4.722.222	0	4.722.222	85
	Forestry byproducts	Dry lignocellulosic	55	24900000	17000000	7900000	142
Industry	Industrial residues	Dry lignocellulosic	40	2222222	0	2222222	40
		Wet cellulosic	:	630000	0	630000	5,67
		Black liquor	16,76	1676000	0	1676000	16,76
Waste	Regulated waste	Municipal waste	59,3	5559000	0	5559000	67
		Demolition wood	:	4500000	0	4500000	81
	Non-regulated waste	Landfilled waste	~0	13096000	0	13096000	48,6
		Sewage sludge	15,7	2661000	0	2661000	23,949
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			3,5 PJ (195826,5 t of sawdust from Austria Czech NL, Poland belgium, France, Italy, Denmark, Switzerland, 60178,4 t of chips from conifers from Belgium, Czech, NL, Austria, France, 45000 t of firewood)				3,5
Biomass exports			15 PJ (184741,4 t of sawdust to Austria, NL, Poland, Belgium, France, Italy, Denmark, Switzerland, Norway, Hungary, UK, 1074929 chips from conifers to Belgium. Czech, NL, Austria, France, Switzerland, Italy, Sweden, Norway, Denmark, UK, Russia, Others and 28000 t firewood (logs and chopped))				15

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	332000	biodiesel t/ha/year	1,23
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	11804000		
Set aside land	1137000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	3,1-3,6
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	1,5-1,8	0,4	1,13	1,9-3,3	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	5,6-8,2
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	4,1-8,1
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	1-5,6
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Greece

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,007	8585000	4759691	3825309	69
	Livestock waste	Wet cellulosic	0	515545	0	515545	4,6
		Dry cellulosic	0	312075	0	312075	4,36905
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	19,8	1100000	0	1100000	19,8
	Forestry byproducts	Dry lignocellulosic	0	99000	0	99000	1,78
Industry	Industrial residues	Dry lignocellulosic	10,24	594000	0	594000	10,62
		Wet cellulosic	0,23	74500	0	74500	0,67
		Black liquor	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	:	:	:	:
	Non-regulated waste	Landfilled waste	0,004	1068000	0	1068000	4
		Sewage sludge	0,058	86000	0	86000	0,8
Parks and gardens	Urban wood	Dry lignocellulosic	0	:	:	:	:
	Grass	Wet cellulosic	0	:	:	:	:
Biomass imports							
Biomass exports							

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	2741000		
Set aside land	30000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,12-1,62	0,08	0	1,2-1,7	4-5
	Livestock waste	Wet cellulosic	0	0	0	0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	2,39-2,94	0,08	0	2,47-3,02	:
		Oil seeds for methylesters (rapeseed)	3,6	0,91	0	4,51	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	6
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	:
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Ireland

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	144500	85000	59500	2,1
	Livestock waste	Wet cellulosic	:	2644000	0	2644000	23,8
		Dry cellulosic	:	128695	0	128695	1,8
	Energy crops	Dry lignocellulosic	:	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	3,4	188889	0	188889	3,4
	Forestry byproducts	Dry lignocellulosic	0	195000	67000	128000	2,3
Industry	Industrial residues	Dry lignocellulosic	1,17	260000	0	260000	4,7
		Wet cellulosic	:	144750	70340	74410	0,67
		Black liquor	0	0	0	0	0
Waste	Regulated waste	Municipal waste	:	57000	0	57000	0,7
		Demolition wood	:	6500	0	6500	0,1
	Non-regulated waste	Landfilled waste	1	587000	0	587000	2,2
		Sewage sludge	:	43000	0	43000	0,4
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports							~0
Biomass exports							~0

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	1050000		
Set aside land	29000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	6,45
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	2,6-3,05	0,31	0	2,97-3,37	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	2,2
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	2,2
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	1,4-3,5
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Italy

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	14921000	5849000	9072000	163,29
	Livestock waste	Wet cellulosic	0,16	11655000	5827500	5827500	52
		Dry cellulosic	:	1095000	0	1095000	15,3
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	2,8	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	57,6	4611111	0	4611111	83
	Forestry byproducts	Dry lignocellulosic	:	860000	0	860000	15,48
Industry	Industrial residues	Dry lignocellulosic	:	2410000	410000	2000000	36
		Wet cellulosic	:	580000	0	580000	5,22
		Black liquor	1,77	104000	0	104000	1,77
Waste	Regulated waste	Municipal waste	23,4	1527000	0	1527000	18,3
		Demolition wood	:	:	:	:	:
	Non-regulated waste	Landfilled waste	:	4434000	0	4434000	16,4
		Sewage sludge	:	924000	0	924000	8,316
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			1,96 PJ biodiese fro France & Germany + 5,6 PJ firewood from Croatia, Slovenia, Northern Africa				7,56
Biomass exports			~0				0

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	11-13
Oil containing crops	60000	biodiesel t/ha/year	2,2-2,9
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	7984000		
Set aside land	231000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	1,1-2,8
	Livestock waste	Wet cellulosic	0	0	0	0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	3,6 - 4,6	0,2-0,3		3,9-4,9	:
		Oil seeds for methylesters (rapeseed)	16,8-18,1	1,1-1,3	0	18,1-19,2	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	4,81
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	1,4-2,8
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	2,39
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Netherlands

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	960000	340000	620000	11,3
	Livestock waste	Wet cellulosic	0,04	8021000	5614700	2406300	21,7
		Dry cellulosic	:	1177289	0	1177289	16,5
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	11,5	638889	0	638889	11,5
	Forestry byproducts	Dry lignocellulosic	3	260000	0	260000	4,6
Industry	Industrial residues	Dry lignocellulosic	2,2	188889	0	188889	3,4
		Wet cellulosic	0,749	2700000	2205000	495000	9,4
		Black liquor	:	:	:	:	:
Waste	Regulated waste	Municipal waste	7,3	2252000	0	2252000	27,024
		Demolition wood	44,8	361250	191250	170000	3,2
	Non-regulated waste	Landfilled waste	2,568	887000	0	887000	2,1
		Sewage sludge	2,108	349000	0	349000	3,141
Parks and gardens	Urban wood	Dry lignocellulosic	:	165000	50000	115000	2,2
	Grass	Wet cellulosic	:	200000	40000	160000	1,4
Biomass imports			0,04 PJ				0,04
Biomass exports			3 TJ wood briquettes and pellets to Denmark, Germany and Austria				0,003

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	10-12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	909000		
Set aside land	16000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	2,8-5
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	6-6,7	0,5-1	0,1-0,3	6-7,3	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	:
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	1,4-4,2
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	0-2,8
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Portugal

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	2002000	569000	1433000	25,8
	Livestock waste	Wet cellulosic	0,03	1663000	831500	831500	7,5
		Dry cellulosic	:	383250	0	383250	5,3655
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	27,4	1522222	0	1522222	27,4
	Forestry byproducts	Dry lignocellulosic	:	1173000	0	1173000	21
Industry	Industrial residues	Dry lignocellulosic	20,23	1500000	0	1500000	27
		Wet cellulosic	:	49219	21083	28136	0,25
		Black liquor	22,4	2240000	0	2240000	22,4
Waste	Regulated waste	Municipal waste	:	4000	0	4000	0,048
		Demolition wood	:	:	:	:	:
	Non-regulated waste	Landfilled waste	:	2142000	0	2142000	7,9
		Sewage sludge	:	246000	0	246000	2,14
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports							~0
Biomass exports							0,1 PJ

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	1990000		
Set aside land	80000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	0
	Livestock waste	Wet cellulosic	:	:	:	:	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	:	:	:	:	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	2,78
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	1,25
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	1,37
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Spain

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	29,7	23351738	16346217	7005521	126
	Livestock waste	Wet cellulosic	0,45	9714000	4857000	4857000	44
		Dry cellulosic	:	1401600	0	1401600	20
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	2,08	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	12,1	672222	0	672222	12,1
	Forestry byproducts	Dry lignocellulosic	20,5	3250000	0	3250000	58,5
Industry	Industrial residues	Dry lignocellulosic	68	4850000	0	4850000	87,3
		Wet cellulosic	:	390000	0	390000	3,51
		Black liquor	22,5	2250000	0	2250000	22,5
Waste	Regulated waste	Municipal waste	11,7	1827000	0	1827000	21,924
		Demolition wood	:	364650	11050	353600	6,4
	Non-regulated waste	Landfilled waste	:	5735000	0	5735000	21,3
		Sewage sludge	:	787000	0	787000	7,1
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports							0,14 PJ
Biomass exports							0,66 PJ

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	13317000		
Set aside land	1329000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	1,1-1,7
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	1,29-2,15			1,29-2,15	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	9,2	:	:	9,2	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	3,8
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	1,1-1,7
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	1,38-2,28
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Sweden

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,5	2516798	2212909,1	303889	5,47
	Livestock waste	Wet cellulosic	0,11	1948000	974000	974000	8,8
		Dry cellulosic	:	80187	0	80187	1,1
	Energy crops	Dry lignocellulosic	4,59	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	1,17	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	56,2	2205556	0	2205556	64,2
	Forestry byproducts	Dry lignocellulosic	27	3055556	0	3055556	55
Industry	Industrial residues	Dry lignocellulosic	48	2666667	0	2666667	48
		Wet cellulosic	0,32	90000	0	90000	0,81
		Black liquor	125	12500000	0	12500000	125
Waste	Regulated waste	Municipal waste	16,87	1105000	0	1105000	13,3
		Demolition wood	:	253500	1300	240500	4,3
	Non-regulated waste	Landfilled waste	1,55	621000	0	621000	2,3
		Sewage sludge	2,92	236000	0	236000	2,1
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports							25-32 PJ
Biomass exports							0,24

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	15000	dry matter tons/ha/year	17
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	2706000		
Set aside land	264000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	3-4
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	2,4-7,6	0,4-0,5	0-0,5	4-8	0
		Oil seeds for methylesters (rapeseed)	:	:	:	:	0
		Sugar/starch crops for ethanol	:	:	:	:	0
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	3,39-4,75
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	3,39
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	2,89
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

United Kingdom

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	3 (66)	3600000	0	3600000	64,8
	Livestock waste	Wet cellulosic	:	9900000	4950000	4950000	44,55
		Dry cellulosic	:	1720245	0	1720245	24,08343
	Energy crops	Dry lignocellulosic	:	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	8,5	472222	0	472222	8,5
	Forestry byproducts	Dry lignocellulosic	:	888889	0	888889	16
Industry	Industrial residues	Dry lignocellulosic	11,5	666667	0	666667	12
		Wet cellulosic	:	570000	0	570000	5,13
		Black liquor	1,95	195000	0	195000	1,95
Waste	Regulated waste	Municipal waste	18,6	1099000	0	1099000	13,188
		Demolition wood	:	:	:	:	:
	Non-regulated waste	Landfilled waste	30,6 (66)	9539000	0	9539000	35,4
		Sewage sludge	6,7 (66)	1193000		1193000	10,7
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			Fuelwood				0,16
Biomass exports			Fuelwood				1,84

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12 -20
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	5876000		
Set aside land	567000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	:	:	:	1,6 - 2,8
	Livestock waste	Wet cellulosic	:	:	:	:	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	2,4-7,6	0,4-0,5	0-0,5	2,9-8	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	:	3,33-14
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	0,5-2,4
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	0	0	0	0	0-2,6
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Bulgaria

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,2	3876000	1195000	2681000	48,258
	Livestock waste	Wet cellulosic	0	893700	749000	144700	1,3023
		Dry cellulosic	0	152413	0	152413	2,133782
	Energy crops	Dry lignocellulosic	0,00054	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	22,788000	2426000	0	2426000	43,668
	Forestry byproducts	Dry lignocellulosic	0	228000	0	228000	4,104
Industry	Industrial residues	Dry lignocellulosic	0,400000	76800	7200	69600	1,2528
		Wet cellulosic	:	:	:	:	:
		Black liquor	0,003150	1750	0	1750	0,063
Waste	Regulated waste	Municipal waste	2	86000	0	86000	1,892
		Demolition wood	0	720000	0	720000	8,6
	Non-regulated waste	Landfilled waste	:	:	:	:	:
		Sewage sludge	0	1600000	0	1600000	5
Parks and gardens	Urban wood	Dry lignocellulosic	0	90300	0	90300	0,668
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			20000 m3/year wood residues. Wood pellets (less than 1000 t/yr), imported from the Czech Republic			0,16	:
Biomass exports			25100 m3 wood fuel. Charcoal (less than 20 000 t/yr), exported to Greece.			0,2	

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	5	dry matter tons/ha/year	6
Oil containing crops	0	biodiesel t/ha/year	0,4
sugar rich crops	0	ethanol t/ha/year	1,9
Total arable land	3523800		
Set aside land	292510		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,58-1,48	0,77	0	1,35-2,25	1,10-3,2
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	:	:	:	:	:
		Oil seeds for methylesters (rapeseed)	10,71	0,19	0	10,9	:
		Sugar/starch crops for ethanol	20,13	0,27	0	20,4	:
Forestry	Woodfuel	Dry lignocellulosic	1,44	0,77	0	2,21	:
	Forestry byproducts	Dry lignocellulosic	1,53	0,77	0	2,3	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	0,3	0,77	0	1,07	:
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:	:	:	7,2	:
Biomass exports			10	0,22	0	10,22	:

Estonia

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	540000	486000	54000	0,972
	Livestock waste	Wet cellulosic		452700	363000	89700	0,8073
		Dry cellulosic	0	26959	0	26959	0,377426
	Energy crops	Dry lignocellulosic		n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel & Forestry byproducts	Dry lignocellulosic	15,863	1600000	0	1600000	28,8
Industry	Industrial residues	Dry lignocellulosic	5,288	350000	0	350000	6,345
		Wet cellulosic	:	:	:	:	:
		Black liquor	0,555	48000	0	48000	0,555
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	:	:	:	:	:
	Non-regulated waste	Landfilled waste	0,049	568000		568000	2,1
		Sewage sludge	0	43000	0	43000	0,318
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			Minor imports of wood residues.				
Biomass exports			Wood fuel: 200 680 m3; Wood residues: 393692 m3.				4,7

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	test fields	dry matter tons/ha/year	3,2
Oil containing crops	28800	biodiesel t/ha/year	0,46
sugar rich crops	329400	ethanol t/ha/year	0,56
Total arable land	1128000		
Set aside land	220000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,62	0,77	0	2,39	:
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	:	:	:	:	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	1,05	:
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	:
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic					0
Biomass imports			only minor quantities are imported				
Biomass exports			firewood (2,2 Euro/GJ), wood chips (2.6 Euro/GJ), wood pellets (3,7 Euro/GJ), wood briquettes (3,5 Euro/GJ)				

Latvia

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,01035	722000	650000	72000	1,296
	Livestock waste	Wet cellulosic	0,0049	641000	505800	135200	1,2168
		Dry cellulosic	0	35445	0	35445	0,49623
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel Forestry byproducts	Dry lignocellulosic	25,3	2267000	0	2267000	40,8
Industry	Industrial residues	Dry lignocellulosic	8,9	667000	0	667000	12
		Wet cellulosic	0	9789	0	9789	0,0881
Waste	Regulated waste	Municipal waste	0	184100	0	184100	2,2092
		Demolition wood	:	:	:	:	:
	Non-regulated waste	Landfilled waste	0	225400		225400	0,8
		Sewage sludge	:	13889	0	13889	0,125
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			Not existing				
Biomass exports			Industrial wood chips: 5 800 000 GJ/year (2.6 Euro/GJ); Pellets: 350 000 GJ/year (3.7 Euro/GJ); Briquettes: 50 000 GJ/year (3.5 Euro/GJ).				5,8

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	~400000	dry matter tons/ha/year	3,65
Oil containing crops	1700	biodiesel t/ha/year	0,68
sugar rich crops	12700	ethanol t/ha/year	0,58 - 2,57
Total arable land	420000		
Set aside land	2946000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,4	0,77	0	2,17	:
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	:	:	:	:	:
		Oil seeds for methylesters (rapeseed)	12,62	0,19	0	12,81	:
		Sugar/starch crops for ethanol	22,48	0,27	0	22,75	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	1,5	:
	Forestry byproducts	Dry lignocellulosic	:	:	:	1,6	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	0,8	:
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			not existing				
Biomass exports			wood chips (2.6 Euro/GJ), wood pellets (3,7 Euro/GJ), wood briquettes (3,5 Euro/GJ)				

Lithuania

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,105	3400000	3060000	340000	6,12
	Livestock waste	Wet cellulosic	0,011	1515700	1268900	246800	2,2212
		Dry cellulosic	0	69773	0	69773	0,976822
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel Forestry byproducts	Dry lignocellulosic	21,57	1917000	0	1917000	34,506
Industry	Industrial residues	Dry lignocellulosic	4,680000	416000	0	416000	7,488
		Wet cellulosic	0,042500	102778	0	102778	0,925
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	:	:	:	:	:
	Non-regulated waste	Landfilled waste	:	277778	0	277778	1
		Sewage sludge	0,1005	56667	0	56667	0,51
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports							
Biomass exports			Firewood, wood chips, pellets and briquettes, equivalent to 250 000 GJ/year. Also peat export, equivalent to 84 000 GJ/year. (101)				0,25

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	1015000	dry matter tons/ha/year	3,65
Oil containing crops	55000	biodiesel t/ha/year	0,68 - 2,52
sugar rich crops	28000	ethanol t/ha/year	0,71
Total arable land	980000		
Set aside land	2946000		
	300000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,48	0,77	0	2,25	:
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	1,05	0,77	0	1,82	:
		Oil seeds for methylesters (rapeseed)	14,05	0,19	0	14,24	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	1,5	:
	Forestry byproducts	Dry lignocellulosic	:	:	:	1,6	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	0,8	:
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			not existing				
Biomass exports			wood chips (2.6 Euro/GJ), wood pellets (3,7 Euro/GJ), wood briquettes (3,5 Euro/GJ)				

Romania

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic		7826000	3698000	4128000	74,304
	Livestock waste	Wet cellulosic		5735172	4427172	1308000	11,772
		Dry cellulosic	0	757116	0	757116	10,599624
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel Forestry byproducts	Dry lignocellulosic	109,857	6103200	0	6103200	109,8576
Industry	Industrial residues	Dry lignocellulosic	9	1277800	0	1277800	23,0004
		Wet cellulosic	:	:	:	:	:
		Black liquor	2,5	300000		300000	3
Waste	Regulated waste	Municipal waste	0	379000	0	379000	4,548
		Demolition wood	:	:	:	:	:
	Non-regulated waste	Landfilled waste	0	3416700	0	3416700	13
		Sewage sludge	0	134000	0	134000	0,9916
Parks and gardens	Urban wood	Dry lignocellulosic	:	:	:	:	:
	Grass	Wet cellulosic	:	:	:	:	:
Biomass imports			Not existing				
Biomass exports			Very small quantities (less than 4000 dry tons annually of wood fuel+wood residues) (110)				0,072

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	6
Oil containing crops	44825	biodiesel t/ha/year	0,45
sugar rich crops	57903	ethanol t/ha/year	1,19
Total arable land	9906000		
Set aside land	500000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,58-1,9	0,7	0	1,28-2,6	:
	Livestock waste	Wet cellulosic	0	0	0	0	0
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	:	:	:	:	:
		Oil seeds for methylesters (rapeseed)	:	:	:	:	:
		Sugar/starch crops for ethanol	:	:	:	:	:
Forestry	Woodfuel	Dry lignocellulosic	:	:	:	1,24	:
	Forestry byproducts	Dry lignocellulosic	:	:	:	0,58	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	:	:	:	:	:
		Wet cellulosic	0	0	0	0	0
Waste	Regulated waste	Municipal waste	0	0	0	0	0
		Demolition wood	0	0	0	0	0
	Non-regulated waste	Landfill gas	0	0	0	0	0
		Sludge gas	0	0	0	0	0
Parks and gardens	Urban wood	Dry lignocellulosic	0	0	0	0	0
	Grass	Wet cellulosic	0	0	0	0	0
Biomass imports			:				
Biomass exports			:				

Czech Republic

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,09	5.792.000	4.996.480	795.520	14,3
	Livestock waste	Wet cellulosic	0,10	3.060.645	1.072.271	1.988.374	17,9
		Dry cellulosic	:	302.278	0	302.278	2,7
	Energy crops	Dry lignocellulosic	0,00	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	2,42	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	7,62	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	4,77	300.000	0	300.000	5,4
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	:
Industry	Industrial residues	Dry lignocellulosic	1,46	760.000	0	760.000	13,7
		Wet cellulosic	0,65	1.436.825	0	1.436.825	12,3
		Black liquor	8,47	573.386	0	573.386	8,5
Waste	Regulated waste	Municipal waste	0,43	50.400	2.800	47.600	0,4
		Demolition wood	0,00	191.614	0	191.614	3,4
	Non-regulated waste	Landfilled waste	0,12	789.568	0	789.568	7,1
		Sewage sludge	0,02	1.165.196	0	1.165.196	10,5
Parks and gardens	Urban wood	Dry lignocellulosic	0,00	51.819	0	51.819	0,9
	Grass	Wet cellulosic	0,00	41.854	0	41.854	0,4
Biomass imports			wood 35000 t dry; methylester 3.200 t;				0,7
Biomass exports			wood 243000 t dry; methylester 72 t;				4,4

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	appr. 10	dry matter tons/ha/year	8
Oil containing crops	84.203	biodiesel t/ha/year	0,8
sugar rich crops	15.700	ethanol t/ha/year	3,0
Total arable land	3.082.000		
Set aside land	70.300		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,9	0,6	0,0	1,5	:
	Livestock waste	Wet cellulosic	0,0	0,0	0,0	0,0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	5,7	4,8	0,0	10,4	:
		Oil seeds for methylesters (rapeseed)	6,0	0,2	0,0	6,3	:
		Sugar/starch crops for ethanol	2,9	0,7	0,0	3,7	:
Forestry	Woodfuel	Dry lignocellulosic	2,2	0,6	1,3	4,1	:
	Forestry byproducts	Dry lignocellulosic	0,0	0,6	4,0	4,6	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	2,2	0,6	1,3	4,1	:
		Wet cellulosic	0,0	0,0	0,0	0,0	:
Waste	Regulated waste	Municipal waste	0,0	0,0	0,0	0,0	:
		Demolition wood	0,0	0,0	0,0	0,0	:
	Non-regulated waste	Landfill gas	0,0	0,0	0,0	0,0	:
		Sludge gas	0,0	0,0	0,0	0,0	:
Parks and gardens	Urban wood	Dry lignocellulosic	0,0	0,0	0,0	0,0	:
	Grass	Wet cellulosic	0,0	0,0	0,0	0,0	:
Biomass imports			:				
Biomass exports			:				

Slovakia

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	1.160.400	648.000	512.400	9
	Livestock waste	Wet cellulosic	:	123.500	116.665	120.000	1
		Dry cellulosic	:	153.694	0	153.694	2,2
	Energy crops	Dry lignocellulosic	0	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	1	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	1	44.255	0	44.255	1
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	:
Industry	Industrial residues	Dry lignocellulosic	0	40.400	12.120	28.280	1
		Wet cellulosic	0	754.738	0	754.738	6
		Black liquor	10	674.880	0	674.880	10
Waste	Regulated waste	Municipal waste	1	145.904	0	145.904	2
		Demolition wood	0	100.416	0	100.416	2
	Non-regulated waste	Landfilled waste	0	295.659	0	295.659	1
		Sewage sludge	:	122.641	0	122.641	1
Parks and gardens	Urban wood	Dry lignocellulosic	0	12.310	6.436	5.874	0
	Grass	Wet cellulosic	0	9.942	5.198	4.744	0
Biomass imports			12500 dry tons				0,23
Biomass exports			66480				1,2

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	:	dry matter tons/ha/year	12
Oil containing crops	20.548	biodiesel t/ha/year	0,5
sugar rich crops	:	ethanol t/ha/year	2,2
Total arable land	1.450.000		
Set aside land	28950		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	0.3-2.3	0,5	0,5-1,21	1.3-4	:
	Livestock waste	Wet cellulosic	0,0	0,0	0,0	0,0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	5,4	0,5	3,8	9,7	:
		Oil seeds for methylesters (rapeseed)	5,4	0,2	0,0	5,6	:
		Sugar/starch crops for ethanol	2,6	0,7	0,0	3,3	:
Forestry	Woodfuel	Dry lignocellulosic	2,1	0,5	1,2	3,8	:
	Forestry byproducts	Dry lignocellulosic	0,0	0,5	3,6	4,1	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	2,0	0,5	1,2	3,7	:
		Wet cellulosic	0,0	0,0	0,0	0,0	:
Waste	Regulated waste	Municipal waste	0,0	0,0	0,0	0,0	:
		Demolition wood	0,0	0,0	0,0	0,0	:
	Non-regulated waste	Landfill gas	0,0	0,0	0,0	0,0	:
		Sludge gas	0,0	0,0	0,0	0,0	:
Parks and gardens	Urban wood	Dry lignocellulosic	0,0	0,0	0,0	0,0	:
	Grass	Wet cellulosic	0,0	0,0	0,0	0,0	:
Biomass imports			:				
Biomass exports			:				

Polland

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	0,18	15.750.000	8.820.000	6.930.000	125
	Livestock waste	Wet cellulosic	1,05	14.904.045	5.603.590	9.300.456	59
		Dry cellulosic	:	542.310	0	542.310	7,6
	Energy crops	Dry lignocellulosic	0,02	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0,00	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	22,00	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	5,91	328.600	0	328.600	6
	Forestry byproducts	Dry lignocellulosic	26,33	1.462.800	0	1.462.800	26
Industry	Industrial residues	Dry lignocellulosic	12,50	2.827.600	848.280	1.979.320	36
		Wet cellulosic	:	5.403.773	0	5.403.773	46
		Black liquor	16,30	1.103.340	0	1.103.340	16
Waste	Regulated waste	Municipal waste	:	:	0	:	:
		Demolition wood	0,00	812.500	0	812.500	15
	Non-regulated waste	Landfilled waste	0,21	3.360.000	0	3.360.000	13
		Sewage sludge	0,75	347.814	0	347.814	2
Parks and gardens	Urban wood	Dry lignocellulosic	0,00	194.876	0	194.876	4
	Grass	Wet cellulosic	0,00	157.402	0	157.402	1
Biomass imports			1500 dry tons				0,03
Biomass exports			46000 dry tons				0,83

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	117.112	dry matter tons/ha/year	2-8
Oil containing crops	32	biodiesel t/ha/year	0,5
sugar rich crops	14.071.050	ethanol t/ha/year	2,7
Total arable land	130.000		
Set aside land	117.112		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,07	0,71	0,00	1,78	0,35
	Livestock waste	Wet cellulosic	0,0	0,0	0,0	0,0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	6,50	1,10	4,70	12,30	:
		Oil seeds for methylesters (rapeseed)	7,13	0,30	0,00	7,43	:
		Sugar/starch crops for ethanol	3,48	0,89	0,00	4,37	:
Forestry	Woodfuel	Dry lignocellulosic	2,60	< 10km 0.33	1,54		3.4-4
	Forestry byproducts	Dry lignocellulosic	0,00	> 10km <0.3	4,74		0.4-1.2
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	2,60	0,65	1,54	4,79	0-1.8
		Wet cellulosic	0,0	0,0	0,0	0,0	:
Waste	Regulated waste	Municipal waste	0,0	0,0	0,0	0,0	:
		Demolition wood	0,0	0,0	0,0	0,0	:
	Non-regulated waste	Landfill gas	0,0	0,0	0,0	0,0	:
		Sludge gas	0,0	0,0	0,0	0,0	:
Parks and gardens	Urban wood	Dry lignocellulosic	0,0	0,0	0,0	0,0	:
	Grass	Wet cellulosic	0,0	0,0	0,0	0,0	:
Biomass imports			:				
Biomass exports			:				

Hungary

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	3.408.824	1.969.981	1.438.844	25,90
	Livestock waste	Wet cellulosic	:	2.896.348	945.971	1.950.378	12,29
		Dry cellulosic	:	283.496	0	283.496	4,0
	Energy crops	Dry lignocellulosic	44,17	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0,00	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0,00	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	12,39	688.205	0	688.205	12,39
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	:
Industry	Industrial residues	Dry lignocellulosic	:	540.000	162.000	378.000	6,80
		Wet cellulosic	:	1.403.987	0	1.403.987	12,00
		Black liquor	0,00	0	0	0	0,00
Waste	Regulated waste	Municipal waste	0,57	98.560	0	98.560	1,18
		Demolition wood	0,00	187.234	0	187.234	3,37
	Non-regulated waste	Landfilled waste	0,07	1.160.880	0	1.160.880	4,30
		Sewage sludge	0,07	87.703	0	87.703	0,58
Parks and gardens	Urban wood	Dry lignocellulosic	0,00	52.000	0	52.000	0,94
	Grass	Wet cellulosic	0,00	42.000	0	42.000	0,35
Biomass imports			19000 dry tons				0,34
Biomass exports			89000 dry tons				1,6

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	150.000	dry matter tons/ha/year	16
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	4.902.000		
Set aside land	214792		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,0	0,6	0,0	1,6	:
	Livestock waste	Wet cellulosic	0,0	0,0	0,0	0,0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	6,1	1,2	3,6	10,9	:
		Oil seeds for methylesters (rapeseed)	6,2	0,2	0,0	6,4	:
		Sugar/starch crops for ethanol	3,1	0,8	0,0	3,9	:
Forestry	Woodfuel	Dry lignocellulosic	2,3	0,6	1,3	4,2	:
	Forestry byproducts	Dry lignocellulosic	0,0	0,6	4,2	4,8	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	2,3	0,6	1,4	4,3	:
		Wet cellulosic	0,0	0,0	0,0	0,0	:
Waste	Regulated waste	Municipal waste	0,0	0,0	0,0	0,0	:
		Demolition wood	0,0	0,0	0,0	0,0	:
	Non-regulated waste	Landfill gas	0,0	0,0	0,0	0,0	:
		Sludge gas	0,0	0,0	0,0	0,0	:
Parks and gardens	Urban wood	Dry lignocellulosic	0,0	0,0	0,0	0,0	:
	Grass	Wet cellulosic	0,0	0,0	0,0	0,0	:
Biomass imports			:				
Biomass exports			:				

Slovenia

Biomass resource supply

Sector	Resource	Fuel category	Current use for energy 2000 (PJ/year)	Technical biomass potential 2000 (dry tons/year) [a]	Biomass not available for various reasons 2000 (dry tons/year) [b]	Available biomass 2000 (dry tons/year) = [a] - [b]	Available energy potential 2000 PJ/year
Agriculture	Dry agricultural residues	Dry lignocellulosic	:	140.700	84.420	56.280	1,01
	Livestock waste	Wet cellulosic	:	994.625	442.636	551.990	3,48
		Dry cellulosic	:	46.603	0	46.603	0,65
	Energy crops	Dry lignocellulosic	0,00	n.a.	n.a.	n.a.	n.a.
		Oil seeds for methylesters	0,00	n.a.	n.a.	n.a.	n.a.
		Sugar/starch crops for ethanol	0,00	n.a.	n.a.	n.a.	n.a.
Forestry	Woodfuel	Dry lignocellulosic	2,54	140.980	0	140.980	2,54
	Forestry byproducts	Dry lignocellulosic	:	:	:	:	:
Industry	Industrial residues	Dry lignocellulosic	:	56.800	17.040	39.760	0,72
		Wet cellulosic	:	277.894	0	277.894	2,38
		Black liquor	2,51	169.830	0	169.830	2,51
Waste	Regulated waste	Municipal waste	0,23	39.200	0	39.200	0,47
		Demolition wood	0,00	36.973	0	36.973	0,67
	Non-regulated waste	Landfilled waste	0,16	274.400	0	274.400	1,00
		Sewage sludge	:	5.386	0	5.386	0,04
Parks and gardens	Urban wood	Dry lignocellulosic	0,00	5.388	0	5.388	0,10
	Grass	Wet cellulosic	0,00	4.352	0	4.352	0,04
Biomass imports			57000 dry tons				1,03
Biomass exports			22500 dry tons				0,41

Energy crops

Cultivated areas in 2000 (ha)		Yields	
Solid crops	0	dry matter tons/ha/year	12
Oil containing crops	0	biodiesel t/ha/year	0,73
sugar rich crops	0	ethanol t/ha/year	2,2
Total arable land	173.000		
Set aside land	10.000		

Delivery costs

Sector	Resource	Fuel category	Delivery cost (€/GJ)				
			Production (a)	Transport (b)	Other costs (c)	Total (=a+b+c)	Oportunity cost (if any)
Agriculture	Dry agricultural residues	Dry lignocellulosic	1,5	1,0	0,0	2,5	:
	Livestock waste	Wet cellulosic	0,0	0,0	0,0	0,0	:
	Energy crops	Dry lignocellulosic (triticale, miscanthus)	9,0	2,5	7,1	18,6	:
		Oil seeds for methylesters (rapeseed)	10,1	0,3	0,0	10,4	:
		Sugar/starch crops for ethanol	4,9	1,2	0,0	6,1	:
Forestry	Woodfuel	Dry lignocellulosic	3,8	1,0	2,2	7,0	:
	Forestry byproducts	Dry lignocellulosic	0,0	1,0	6,7	7,7	:
Industry	Industrial residues	Dry lignocellulosic (please specify the main type of industries)	3,7	1,0	2,2	6,9	:
		Wet cellulosic	0,0	0,0	0,0	0,0	:
Waste	Regulated waste	Municipal waste	0,0	0,0	0,0	0,0	:
		Demolition wood	0,0	0,0	0,0	0,0	:
	Non-regulated waste	Landfill gas	0,0	0,0	0,0	0,0	:
		Sludge gas	0,0	0,0	0,0	0,0	:
Parks and gardens	Urban wood	Dry lignocellulosic	0,0	0,0	0,0	0,0	:
	Grass	Wet cellulosic	0,0	0,0	0,0	0,0	:
Biomass imports			:				
Biomass exports			:				