

Task 4.4

BUSINESS AND INDUSTRY ANALYSIS

Summary Report

2010



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1. BACKGROUND

During the last few decades renewable energy sources (RES) are becoming more and more important in the world. According to data of International Energy Agency RES made up 12,7% (or 1528 Mtoe) of total primary energy supply in the world in 2007. More than 70% of these figures are the result of the use of biomass, which covers almost 1/3 of all energy consumption in less-developed countries.

Recently it is promoted internationally to increase use of biomass for energy production, particularly in industrialized countries. It is an important development both in the local and global environmental and an advantage for bioenergy as applied to the issue of global warming. Energy production towards cleaner, greener, smaller and by using more decentralized facilities is having a significant positive impact on the demand for biomass energy.

The purpose with this task for the partners involved is to evaluate different regional value added chains in conjunction with the biomass production, and to produce an assessment of the present business and industrial activities within the biomass and bioenergy sector in the region. This includes SWOT-analysis per sub-sector; Agriculture, Forestry, Other land use BE, Other not land use BE. Within the task the barriers for introduction or further development of bioenergy or biomass production should be analysed. As the different Work Packages and Tasks are closely linked and to certain extent also over-lapping it will be important to discuss priorities and issues that are more directly linked to business and industry development and how it is possible to learn from each other between countries and regions. To increase the industrial capacity and improve business possibilities in all regions models must be produced for sharing technical and business experiences, research & developments results and legislative matters that has impact on the development of the sector.

The partners involved in this task are dealing with different kind of basic conditions which makes the results difficult to compare and summarize but it is also challenging and exciting to be able to compare differences and similarities in the different regions and to learn from each other.

The responding partners are;

Partner 2: Sweden, Jämtland & Västernorrlands County,

Area: 55 700 km², Inhabitants: 371 800; density: 6.7 /km²

- The region has a long history of forestry and forest industry, 60 % is considered forestland, 1.8% is agriculture land while peat land stands for 10.3%.
- Private forest owner's stands for 50% of forested land, large scale companies about 25%, remaining forests are owned by the state or other public entities.

Partner 4: Germany, Region Rotenburg,

Area: 2.000 km², Inhabitants: 165.000; density: 79/km²

- Characterized by agriculture and forestry with high bioenergy potential
- Structural changes in agriculture will promote the bioenergy sector.



Partner 7: Germany, Region Brandenburg,

Area: 13,226 km², Inhabitants: 1,12 million; density: 85/km²

- The Federal State of Brandenburg is the size of Belgium and has more forests and lakes than any other state in Germany.
- Agricultural area: 50% and Forests: ca. 30%.
- It is very weak populated in German relations.

Partner 13: Estonia ,

Saaremaa county, Leisi municipality.

Area: 2,673 km², Inhabitants: 39 000; density: 15/km²

- Saaremaa is the largest island belonging to Estonia.
- The island is covered by over 40% with forests.

Jõgevamaa county, Saare municipality.,

Area: 2,604 km², Inhabitants: 40000; density: 15/km²

- Saare municipality measures about 21 000ha, about 12 000ha are forests.

Partner 16: Latvia,

Tukums area,

Area: 19650 km², Inhabitants: >19 000; density: 1/km²

- Forests grow on 40 % of district territory; agricultural land covers 42 % and bogs 4%.
- The most significant resources are grit, sand, peat, clay, therapeutic mud and mineral springs.
- In the end of 2008 this area had the fourth lowest unemployment rate in the country.

Jelgava area,

Area: 60 km², Inhabitants: 66 087; density: 1 102 /km²

- The area of Jelgava is located in the central part of Latvia and is one of 109 administrative areas in Latvia. It belongs to the Zemgale planning region, the distance between the capital city and the area centre is 42 km.
- Forests grow on 29% of district territory; agricultural land covers 56% and bogs 3%.
- The most significant resources are peat, sand, grant, dolomite, forests.
- There are 66 000 inhabitants in Jelgava city, and it is the fourth biggest city in the country. The region where the Jelgava area is located has the second highest population density, and the lowest demographics load in Latvia

Partner 20: Lithuania, Kaunas County,

Area: 8089 km², Inhabitants: 673 706; density: 83.3 /km²

- Natural conditions for biomass production in the Region are relatively good, because of the relatively high level of soil fertility, good water supply; however, socio-economic frame still must be optimised.
- In Kaunas region the private land cover 59.5 % all land.
- Preliminary biomass potential – preliminary evaluation of RES in Kaunas Region shows, that biomass is the main source of renewable energy in the region, tab. 1.



Table 1. Preliminary RES potential in Kaunas Region

Source of energy	Energy potential, GWh
Biomass	504
forestry biomass	464
agricultural biomass	147
municipal biomass	1115
Biomass subtotal	
Hydro energy	440
Wind energy	35
Solar energy	71
Total:	1661

Partner 22: Poland, Pomorskie Voivodeship,

Area: 18310 km², Inhabitants: 2,2 mill.; density: 120,3 /km²

- The forest cover indicator in the Voivodeship (36%) exceeds the national average value (30%) as well as European average value (32%).
- The region's agricultural space is well positioned for ecological and high-yield farming, because of its good environmental and soil assets as well as economic and social conditions, including the fact that there are numerous small and medium-sized family farms. Area: ca. 56%.
- Pomorskie Voivodeship is a significant energy/electricity importer at the national scale;
- Pomorskie has significant sources of renewable energy;

Partner 27: Belarus, Grodno PLHO,

Area: 25,000 km², Inhabitants: 1,123,400, Density: 45/km²

- Forests occupy one third of the territory of Grodno oblast.
- The agricultural sector of the region works in a stable regime. Taking in consideration the production of main types of agricultural products per capita, the region occupies a leading place not only in the republic, but also among neighbouring and distant countries.

Partner 30: Norway, the Innland Region,

Area: 52580 km², Inhabitants: 374359, Density: 8/km²

- The counties in the Innland region of Norway (Hedmark and Oppland County) have great access to raw materials, especially from the forest areas. There is an increasing focus on industry initiatives within renewable energy and bioenergy in Norway.
- Bioenergy use is estimated of total stationary energy consumption.

Partner 32: Sweden, Västra Götalandregionen,

Area: 24000 km², Inhabitants: 1,5 mill., Density: 65/km²

- Forestry: 50,6%
- Agriculture: 23,1%.



Partner 36: Denmark, the Region Zealand,

Area: 7237 km², Inhabitants: 811511, Density: 112/km²

- The key source of biomass in the Region Zealand is provided by the agriculture. 85% of the farms in the region are engaged in crop production and the rest with cattle or pigs.
- Agriculture: almost 70% of the area in the region.
- Total forestry area: 12% of the area in the region.

1.1 Purpose of the analysis

The main purpose of the business and industry analysis is to evaluate overall situation in the bioenergy sector in the regions and by the partners involved in Task 4.4. Such evaluation include collection and analysis of data and information about biomass resources in different branches of economy and main actors in the BE sector – biomass or biofuel producers and consumers, and organizations providing supporting services.

1.2 Methodology

Business and industry analysis in the regions were performed using three stages.

The first stage consists of collection of necessary information. Information was gathered from available sources – statistical data, reports, papers, etc. and by means of direct contacts.

The second stage consisting of revision and replenishment of collected information, categorizing according to BE Matrix and preparation of SWOT analysis was performed by some of the responding partners. The different partners have worked according to this methodology more or less.



2. AGRICULTURE BE

2.1 General description of the Agriculture BE sector

Of course Agriculture bioenergy sectors differ between the different partner regions, i.e. the agriculture in the region evaluated by partner 2 (Jämtland/Västernorrland, Sweden) is almost negligible while in partner 36 region (Region Zealand, Denmark) it is of more importance where the agricultural area represents more than 70%. In Jämtland/Västernorrland there are also very small chances that biomass from agriculture will develop since agricultural areas are decreasing, tab. 2.

Table 2. The estimated situation in Jämtland/Västernorrland region.

BE source	To 2020	Long term
Agriculture	39	70
Bio-waste	23	20
Total Agri/Bio-waste TWh:	62	90
Total TWh:	248	394

However, in other regions and countries there are great potential for increasing biomass from this sector.

For example, in *Lithuania*, as well as in Kaunas region, there is a strong focus mainly on production and use of liquid biofuels (bioethanol and biodiesel), production of biogas using agriculture residues, and production of solid biofuels using residues from agriculture or food industry, although it is has recently started. In a lot of countries these kind of focus is strongly influenced by various support schemes for agriculture development in the EU.

Also in the Pomeranian region, *Poland* cultivating crops and colza, gives the biomass as a by-product in form of straw and crops residues. About 710 thousand tons of this type of biomass per year is produced. Large amount of this kind of biomass is used for heating in farms or public buildings (e.g. schools, public offices).

In the Inland region of *Norway* the agricultural sector is based on traditional activities like growing of cereals or hay as a feeder for meat production. In this region most of the areas the farms are harvesting are average sized compared to the standard for Norwegian farms. In addition, there are industry like slaughter houses and different kinds of food industry. As the farmers have fixed prices from cereals the production for bioenergy is not relevant. However there is use of straw for heat production and a few farmers use straw for heating, though most of the straw is either ploughed back again or used as a feeder or bedside to animals kept at the farm.

In Pomerian agriculture, *Poland*, cultivating crops and colza, gives the biomass as a by-product in form of straw and crops residues. In the Pomeranian region about 710 thousands of tones of this type of biomass per year is produced. Large amount of this kind of biomass is used for heating in farms or public buildings (e.g. schools, public offices).



As for Region Zealand, *Denmark* there are three main sources for bioenergy production straw, slurry and slaughterhouse waste. On top of this there are additional by- and waste products from different agricultural based productions. Today straw is combusted in combined heating and power plants. These are both within the region and outside the Region Zealand. Hence there is a flux of bioenergy sources in and out of the region. In Region Zealand, there are 6 decentralised heat and power plants, 4 are running on straw consuming 134.000 tons of straw every year and producing 34,3MW of power and 82MJ/s of heat.

Like anywhere else in the country and Europe the tendency goes towards that the amount of fulltime farmers decrease whilst the farm size increases. A very important farmers group is the hobby farmers. This is an important point when developing support schemes, incentives and technology for the agricultural bioenergy sector. Development in Zealand region is focused on;

1. Combustion mainly of straw and bioenergy crops.
2. Fermentation of slurry and slaughter house waste.
3. Chemical-thermal processes e.g. Fisher-Tropsch processes for developing biodiesel.

Common for all of these new initiatives is that the raw material they use mainly comes from agricultural by-products and leftovers like straw, slurry and slaughter house waste.

In order to promote bioenergy production from agricultural based products there are a number of paths to follow not only in Denmark but in the rest of Europe as well a development of extending the capacity of existing and new CHP plants for combustion of straw, and equipment over all.

2.2 In figures

For Jämtland and Västernorrland, *Sweden* further development is most probable using forest resources and within bio-waste the resources will probably decrease. In Jämtland/Västernorrland there is production of biogas from waste and during 2008 there were 135 GWh produced, produced by two major companies one in Jämtland County and one in Västernorrland County, there is also one biogas reactor at a farm in Jämtland.

In *Lithuania*, currently there is one farming company, producing and using biogas farming residues (from manure of pig farm) although not in the Kaunas region. In Kaunas region biomass potential in agriculture from manure of animals and poultry for biogas production is approximately equal to 35 400 MWh/year. In addition, approximately 34 000 MWh/year of energy could be produced from at least 40 thousand tones per year of green mass of perennial grasses, there are great potential for increasing biomass for bioenergy in this area.

Regarding bioethanol and biodiesel there are several companies producing biodiesel from rapeseed (RME) and bioethanol from grain in Lithuania, while there are for example no production in Jämtland/Västernorrland but some in Västergötland region. In Lithuania production capacities for biodiesel are in total 204 thousand tones 2009 and for bioethanol 200 thousand tones

However, no companies – liquid biofuel producers exist in Kaunas county although there is significant potential of biomass suitable for production of liquid biofuels, an estimation is made to 275 000 MWh/year of energy. In Kaunas County, Lithuania, straw is one of the largest biomass resources in



agriculture. The estimated total volume of straw produced in 2008 was calculated equal to about 0,5 million tons. Bioenergy potential of straw in Kaunas county – 295 000 MWh/year was determined assuming that 15% of straw will be used for energy production. At present there are two straw-firing boiler-houses in Kaunas County.

The situation in Zealand areas, *Denmark*, is shown below, tab.3.

Table 3, source: Denmark statistics
*based on figures from 2001 from MST

Energy from agricultural production in Region Zealand(TJ)	2006	2008
Straw for combustion (TJ)	8.310	10.244
Straw not harvested (TJ)	6.135	5.753
Slurry (Pigs) (TJ)	857	777
Slurry (Cattle) (TJ)	1.513	1.558
Slaughter house waste*	-	512
Agricultural energy in total	10.680	13.091

A summary table for agricultural companies within the partner regions is shown below, tab.4.

Table 4. The different letters means: u=mikro:<10 employed, S: 10-49 < 7 million €turnover, M: 50-250, employed < 40 million € turnover, L: >250 employed, > 40 million €turnover o-m: one-man companies

Partner	Production/processing	Supporting Service	Business and Industrial Data
2	u:1, L:2,	u:15, S:4, M:3, o-m:4, unknown:7	
4	N/A	N/A	
7	u:1, S:2, M:1	u:2, S:2	S:2, M:4, L:1
13	N/A	N/A	
16	N/A	N/A	
20	N/A	L:1, unknown:3	
22	u:4, S:3, M:1, L:1, o-m:1	u:2, S:q, M:1,	
27	N/A	N/A	
30	u:1, S:1, o-m:10	u:6	
32	u: 3, o-m:40	u:13, S:10, M:2, L:1, o-m:5	
36	N/A	N/A	

Other results that can be concluded are that biogas plants and bioliquid production plants have a high business trend as well as consulting and research in the area and that farm related activities have lower business trend but hopefully not negative which seems to be a similar trend in all countries where evaluated.

2.3 SWOT-analysis of the Agriculture BE sector

A comment to the SWOT-analysis is that the facts pointed out as a strength in one region might be the opposite i.e. a weakness in another and so on. In this summary the most globally interesting comments are shown. The comments are referred to the country/countries which have pointed it out.

Strengths

The strengths' are similar in all regions to a great extent

- Knowledge (all countries).
- Experiences (all countries)
- Focus on bioenergy (all countries).
- Increasing use (all countries).
- Main promotion for production of biomass for energy comes mainly and exceptionally from municipalities and private business; (*Lithuania*).
- Good farming possibilities (*Norway, Sweden, Lithuania*).
- Available centralized information on agriculture land resources (*Lithuania*).
- Promotion from the Government comes in the form of some legislation, related to favourable purchasing tariff for electricity from renewals and the reduced fee for connection to electricity grid; (*Lithuania*).
- Resource availability; relatively large area of land is available for bioenergy production. (*Lithuania, Denmark*).
- Straw and slurry (*Denmark*.)
- Existing infrastructure (*Denmark*).

Weaknesses; different in some regions

- There is limited generalized and specific data on biomass fuel and energy producers / consumers, which are private companies (such data is available for municipal and DH companies only) (*Lithuania*)
- Not sufficient investigations are performed and limited operational methods are used in biomass estimation during conventional forest inventory and agricultural lands assessment (just one Lithuanian-Swedish project in 2001-2002 but not in Kaunas County, (*Lithuania*).
- Infrastructure (*Lithuania*).
- There are technological and environmental problems, related to straw incineration; high investment costs for straw burning boilers (*Lithuania*).
- No tradition, lack of information exists for straw fuel usage for energy needs (*Lithuania, Sweden*)
- little utilisation of slurry and only utilizing 2/3 of the available straw resource (*Denmark*)



- Short harvesting season for cereals, quite often receiving heavy rainfalls making it difficult to produce straw which is dry enough for heating purposes. (*Norway, Sweden*).
- Too small farms given the amount of manure produced. (*Norway, Sweden*).

Opportunities

- EU Structural funds provide opportunities for transfer to renewable fuel – both on supply and demand sides (*Lithuania, Sweden*).
- Technical Committee TC 71 “Solid biofuels” is created under the Lithuanian Standards Board. Newly elaborated EU standards are adopted as national standards (*Lithuania*).
- The development and importance of bioenergy sector (RES Directive, etc.) (*all countries*).
- International cooperation in education, technologies transfer - conferences, green energy events, international projects, studies, which means new ideas, new proposals etc. (*Lithuania*).
- Closure of the 2nd unit at Ignalina Nuclear Power Plant (INPP) in December 2009 and growing prices for electricity and heat provide new opportunities for BE sector (*Lithuania*).
- International environmental agreements and protocols promote transfer to renewable energy with regard to the reduction of greenhouse gases (*Lithuania*).
- Biomass fuel adds to diversification of fuels, security of energy supply, increases and introduces greater competition in prices (*Lithuania*).
- Decentralized biogas plants (*Denmark*).
- Connection to existing natural gas web (*Denmark*).

Threats

- Institutional barriers (*Denmark*).
- Reducing soil carbon level (*Denmark*).
- Increasing bureaucracy inside and outside all components, needed for the success of the bioenergy project (*Lithuania*).
- Large-scale participants enter into the biofuel market (threat of monopoly) (*Lithuania*).
- Rather small resources for such activities – money, skills, experience (mainly private initiative and lack of support at national level) (*Lithuania, Sweden*).
- Available technological experience is not used operationally (the same mistakes are repeated) (*Lithuania*).
- Biomass fuel production business does not envisage high profits (*Lithuania*).
- Currently we observe the growth of prices for biomass fuel (*Lithuania*).
- Support for thermal energy generation from biomass is insufficient; (*Lithuania*).
- “Green” and “Environment conservation” movements start to develop a negative attitude towards the incineration of biomass. (*Lithuania, Sweden*).
- Low electricity prices (*Norway*).
- Tax on biodiesel. (*Norway*).

2.4 Barriers for further development of the Agriculture BE sector

<i>Institutional</i>	<i>Technical</i>	<i>Economical</i>
Prohibitions Enforcements incentives	Do something smarter than today	Cost of raw material + technical + institutional

Institutional

In *Denmark* there is no free choice of fuel for CHP plants because of a consolidated act 1115 of November 8th 2006. It concerns power supply and results in that it is not possible for any CHP plant to make major changes like switching to combustion of straw or other biofuels without special permission. The same regulation apparently applies for when establishing new plants. This constitutes an important barrier for an increased use and a further development of the agricultural bioenergy sector.

Furthermore, another very important potential barrier for the further development of the agricultural bioenergy sector will be the success of the governmental scheme “green growth” which is every true for every country in Europe. This scheme contains a number of ideas from the Danish partners on how to promote production of bioenergy in the agricultural sector here among:

- Better conditions for placing biogas plants
- Funding for establishing biogas plants
- Tax deduction for perennial energy crops
- Secure possibilities for leading biogas into the natural gas web

Other possible barriers pointed out by the partners may be:

- Uncertainties due to dramatic price fluctuations, CAP reform, WTO negotiations, etc. (*Lithuania*).
- Large variation among farms in size, education, future plans, etc. (*Norway, Lithuania, Sweden*).
- Lack of vertical and horizontal cooperation in agriculture in general and BE sector in particular (*Lithuania*)
- Limited cooperation between Ministry of Agriculture and Energy (*Lithuania*).
- Strategies and legislature lack well tailored detailed measures and clear guidance for farmers (*Lithuania*).
- The gaps between policy, society, science and farmers were not properly bridged and incentives still must be shifted to compromise economy and ecology benefits (*Lithuania*).
- Price, objective and subjective limitations for purchasing and rent of land (*Lithuania, Sweden*)

3. FORESTRY BE

3.1 General description of the Forestry BE sector

The forestry BE sector concerns the partners overall in a higher degree since the chosen areas to a great extent are covered with forests, i.e. the forest percentage varies between 30% to 60% for all regions except Zealand in *Denmark* where the forest area is 12%.

In *Jämtland/Västernorrland, Sweden* the region has a long history of forestry and forest industry, 60 % is considered forestland, although bioenergy from forestry is an expanding industry in the region, both as residues from saw- and pulp-mills but even more from wood slash recovered from final felling. Generally in Sweden bioenergy represents 20 % of Sweden's energy consumption. In the southern part of Sweden there is also a lot of forest covering the area, 51% in *Västra Götaland* region which provides the bioenergy sector in this region with a lot of opportunities for biomass in both agricultural and forest aspects.

The bioenergy from forestry in Germany has very high bioenergy potential in both *Rotenburg and Brandenburg* region and the bioenergy sector has a priority in this areas. Traditionally, the energy sector is very strong – based on lignite in the past, more and more on renewals now. *Brandenburg* is an energy exporter.

In *Estonia*, *Saaremaa*, the largest island belonging to Estonia, is covered by over 40% with forests. Extraordinary for Estonia is the share of private forests in *Saaremaa*, which amounts to 90%. State forests are mostly (strictly) protected nature conservation areas. This results in huge potential of unused forest resources (from pre-commercial thinning and nature conservation activities), which remain so far unattractive to use. In addition, *Saaremaa* is rich in reed and bushes, as potential bioenergy resource. In *Jõgevamaa* County, *Saare* municipality measures about 21 000ha, about 12 000ha are forests.

In this county the forests are to 45% in private ownerships, while the rest is state forest. The first findings showed that the wood resources in *Saare* municipality are sufficient to supply the livelihoods with heat (and energy, although the implementation would be too expensive so far). *Saare* municipality has a string interest in developing a regional initiative towards a holistic development of the region.

For *Latvian* conditions the *Tukums* area, forests grow on 40 % of district territory. Wood chip heat plants located in the Town of *Tukums* accounts for lion's share of bioenergy use in *Tukums* area. The use of bioenergy is growing in the region, especially in terms of energy produced with wood and wood waste. The *Jelgava* area, on the other hand consists of 29% forest in territory.

Concerning *Lithuania* the production at present of heat and electricity from forestry biomass is fast-growing branch of economy in. A number of measures and supporting policies have been implemented for development of this sector. The bioenergy potential of a country is defined by natural resource availability, as well as expertise and managerial capacity to organize a reliable and sustainable biomass supply chain and energy generation. During conversion of the heavy oil fuel boilers in district heating and industry the demand for biofuels was enhanced, this was because of the Conversion process adapting fossil fuel boilers for biomass started in Lithuania since the end of 1993. Forests provide a good base for biofuels supply. District heating sector is the main sector, involved in development of forestry bioenergy



in Lithuania. During the period of 1990-2008, the share of biofuels in this sector developed from 0 to 18%, and is being strongly promoted via Lithuanian District Heating Association, and Lithuanian Association of Biofuel Producers and Users. The conditions and potentials for Kaunas County are shown in the table below, tab. 5.

Table 5. Preliminary RES potential in Kaunas Region

Source of energy	Energy potential, GWh
Biomass	504
forestry biomass	464
agricultural biomass	147
municipal biomass	1115
Biomass subtotal	
Hydro energy	440
Wind energy	35
Solar energy	71
Total:	1661

In *Poland* the forest cover indicator in the Voivodeship (36%) exceeds the national average value (30%) as well as European average value (32%). Renewable energy sources, biomass and wind in particular, constitute an opportunity for the region to improve its security of energy supply. Among all the renewable energy sources, biomass plays the most important role. There exist a number of installations utilizing solid biofuels (mainly wood, waste wood and straw) in the Pomorskie Voivodeship. Interestingly, 4 biogas-fueled CHP plants were built recently in the west-southern area of the Voivodeship.

In *Belarus* the forests occupy one third of the territory of Grodno oblast and the bioenergy sector is increasing but there are lack of knowledge and equipment.

In *Norway*, in the Innland region, the counties Hedmark and Oppland have great access to raw materials, especially from the forest areas. There is an increasing focus on industry initiatives within renewable energy and bioenergy in Norway. Quite a large area of the inland region is covered by forest. However, due to geographical, technical and economical reasons not all of it can be harvested for industry or bioenergy. The forestry industry is producing a lot of by-products and uses them for producing their own heat. In addition a lot is transported to Sweden. Some logging residues are being collected and used today, but the market is at the moment too small to make it profitable for large investments. Bioenergy is estimated to cover 20 % of the total stationary energy consumption in the region.

In region Zealand, *Denmark*, 5 privately held forest properties dominate the region. As the region is located in the eastern part of Denmark the soils are generally very rich and broadleaves dominate the tree species composition. This species choice also means longer rotation ages. Due to the private ownership status short term production economy will have a high impact compared with state owned forests. The privately held forest estates will on the other hand not have the same obligation towards creating

recreational attractions and will hence have the ability to emphasise the focus more on the economical aspect of the sustainability triangle. The situation in Zealand is shown below, tab. 6.

Harvest of energy wood in Region Zealand (1000m ³)	2006	2007	2008
Total harvest	315	408	383
Timber	158	268	211
Fuel wood	107	96	93
Wood chips	16	19	39
Energy wood round timber	34	26	40
total energy wood	157	140	172
source: Denmark's statistics Table 6			

3.2 In figures

A summary table for forest and bioenergy related companies evaluated within the partner regions is shown below, tab.7.

Table 7: The different letters means: u=mikro:<10 employed, S: 10-49 employed < 7 million euro turnover, M: 50-250, < 40 million euro, L: >250, > 40 million euro, o-m: one-man companies

Partner	Production/processing	Supporting Service	Business and Industrial Data
2, JiLU	u:20, S:5, M:5, L:2, o-m:4, unknown:8	u:15, S:4, M:3, o-m:4, unknown:7	
4, Rotenburg	u:7, o-m:1702	u:5	
7, Brandenburg	S:1	u:2, S:2	
13, Estonia	u:2, S:2, o-m:13+many unknown:2	N/A	
16, Latvia	N/A	N/A	
20, Lithuania	u:2, S:6, L:1, o-m:1 unknown:32	u:3, S:2, M:1, L:3 o-m:3, unknown:4	
22, Pomorskie	u:8, S:6, M:2, L:2, o-m:6	u:1, M:1,	
27, Belarus	u:1, L:1,	N/A	u:1
30, Norway	u:1, S:5, o-m:265	u:14	
32, Västra Götaland	u:10, S:7, M:3, L:2, o-m:6	u:17, S:9, M:1 o-m:6	
36, Zealand	N/A	N/A	

This table reflects the use of forest for bioenergy in a larger extent in the partner regions, there are more companies in the forest sector than in the agricultural sector, and also reflects the resources. In for example, Lithuania, forest resources are relatively large in providing good basis for the development of bioenergy systems. Forests cover 32% or some 2 million hectares (ha), of the Lithuanian territory. The forest sector, including forest industries, accounts for almost 4% of the country's GDP. In Lithuania the share of private forests in the total forest area has reached 31% while the wood produced from private forests amounts to 42% of the total harvest. For Kaunas region the potential for forest biomass usable for energy needs is shown below, tab. 8.

Table 8. The potential for forest biomass for energy in Kaunas County, Lithuania.

County	Small diameter trees from thinning cuts	Logging residuals from all type of felling	Stumps from final felling
	Tons		
Kaunas county	15,539	99,505	87,818
Total in Lithuania	88,957	759,686	610,179

In Norway there are a number of large scale companies (Norwegian conditions) using bioenergy for district heating today, and also one producer of electricity based on recycled chips. Two of the companies have ambitious goals of reaching 1 TWh in bioenergy production. The business is therefore growing rapidly and it is likely to believe that in 2020 every town or village will have some kind of district heating based on bioenergy in Norway. There are also a number of farmer based heat entrepreneur companies. Those companies are usually covering central heating or small scale district heating market. Their annual heat production is not in the same scale as for the large companies, but on the other hand they represent some other very important factors: Local business and encouragement and achieving experience in wood chip production, logistics, operation of heat centrals, etc. These circumstances resemble the conditions in Jämtland/Västernorrland region. The potential for bioenergy production in Sweden is estimated as below, tab. 9;

Table 9. The estimated potential for bioenergy production in Sweden.

BE source	To 2020	Long term
From forest resources	129	190
Spent liquor from pulp mills	45	50
Agriculture	39	70
Peat	12	64
Bio-waste	23	20
Total TWh:	248	394

From the partners reports it is also possible to conclude that the business trends in the forest related categories are stable or increasing rapidly except for wood fuel in traditional way at least in the subregions.

3.3 SWOT-analysis of the Forestry BE sector

A comment to the SWOT-analysis is that the facts pointed out as a strength in one region might be the opposite i.e. a weakness in another and so on. In this summary the most globally interesting comments are shown. The comments are referred to the country/countries which have pointed it out.

Strengths

- Stakeholders (*Lithuania, Sweden*).
- Knowledge (*Lithuania, Sweden, Norway*)
- Statistics about forestry Available centralized information on forests land resources (State Forest Survey Service, etc.); (*Lithuania, Sweden*)
- Densified fuel production and usage experience (production of briquettes and pellets from wood waste of processing industry) exists in the region (*Lithuania, Sweden*).
- Local boiler, furnaces and auxiliary equipment designers and producers (*Lithuania, Sweden, Norway*).
- Main promotion for production of biomass for energy comes mainly and exceptionally from municipalities and private business; (*Lithuania, Sweden*)
- Depending in region a comparatively large share of deciduous tree species grows in the forests, which can be used for energy needs as they are less attractive for timber users; (*Lithuania*)
- New strategies for the use of renewable energy sources, including biomass. (*Sweden*).
- Resource availability (*Denmark, Sweden*).
- Plenty of biomass available from forest. (*Norway, Sweden*).

Weaknesses

- Expertise and know-how in large-scale use of forests felling residues for energy use are used insufficiently; (*Lithuania*).
- There is limited generalized and specific data on biomass fuel and energy producers / consumers, which are private companies (such data is available for municipal and DH companies only); (*Lithuania*).
- Dependent in region not sufficient investigations are performed and limited operational methods are used in biomass estimation during conventional forest inventory and agricultural lands assessment (just one Lithuanian-Swedish project in 2001-2002); (*Lithuania, Sweden*).
- Currently small-size saw mills and wood processing companies, which were the main suppliers of wood residues, are replaced by large sawmills, using modern efficient “no waste” technologies, (*Lithuania*).
- Nearly all traditionally used birch fire-wood in the Baltic Sea Region is now being exported as pulp wood, mainly to Scandinavian countries; (*Lithuania*).
- Wood from the forests is used mainly as fire-wood in individual boilers (75 percent), while on industrial scale only 25 percent is used; (*Lithuania*).
- Industrial production of wood fuel from felling residues is not developed at large scale enough; (*Lithuania*).

- A large share of wood pellets and briquettes produced is exported (app. 98%), since incineration of such fuel is too expensive for local inhabitants, because of low purchasing ability and willingness to pay; (*Lithuania*).
- Biomass production in energy plantations is costly (high investment and operation costs). (*Lithuania*).
- Dependant on timber prices (*Denmark*).
- At the moment too small market to make investment in equipment for harvesting of logging residues profitable. (*Norway*).
- Lack of information and competitiveness for project execution. (*Norway*).

Opportunities

- Forestry authorities and forest governors need forests management planning to be linked with biomass fuel demand and supply; (*Lithuania*).
- EU Structural funds provide opportunities for transfer to renewable fuel – both on supply and demand sides; (*Lithuania, Sweden*).
- Demand for such type of fuel (biomass pellets and briquettes meet the demand in Germany, Sweden, Denmark, Canada, etc); (*Lithuania*).
- The development and importance of bioenergy sector (RES directive, environmental documents.); (*Lithuania, Sweden*).
- International cooperation in education, technologies transfer - conferences, green energy events, international projects, studies, which means new ideas, new proposals (*Lithuania, Sweden*).
- International environmental agreements and protocols promote transfer to renewable energies with regard to the reduction of green-house gases; (*Lithuania*).
- There are many examples of existing practices (positive or even negative) in Nordic countries that are suitable for other conditions; (*Lithuania*).
- Increase of energy efficiency in energy systems and energy generation units. (*Lithuania, Sweden*).
- Forest owners associations are ready to invest in equipment for increased bioenergy production. (*Norway*).
- Every municipality have possible projects for small scale district heating or central heating like schools, home for elderly people, etc. (*Norway*).
- Energy crops on 10% on the forested area (*Denmark*).

Threats

- Globalization of bioenergy markets; (*Lithuania*).
- Increasing bureaucracy inside and outside all components, needed for the success of the bioenergy projects; (*Lithuania*).
- Large-scale participants enter the energy biofuel market (threat of monopoly); (*Lithuania*).
- There is no assessment of the wood volumes, which must be left in the forest as biologically valuable trees, dead wood or felling residues; (*Lithuania*).
- Available technological experience is not used operationally (the same mistakes are repeated). (*Lithuania*).



- Currently we observe the growth of prices for wood fuel; (*Lithuania*).
- Emerging of large-scale wood fuel consumers increase fuel prices and endanger the viability of small boiler-houses; (*Lithuania*).
- Soil prices, (*Denmark*).
- No free choice of fuel at CPH plants, see explanation in 2.4 (*Denmark*).
- Too low electricity prices making investment costs not profitable (*Norway*).
- Large pulp companies decide what to grow. (*Sweden*).

3.4 Barriers for further development of the Forestry BE sector

<i>Institutional</i>	<i>Technical</i>	<i>Economical</i>
Prohibitions Enforcements incentives	Do something smarter than today	Cost of raw material + technical + institutional

Institutional

Support schemes for bioenergy plantings

In Danish heat and power plants there is lack of free choice fuel source is a barrier for a further development also of the forest bioenergy sector in the Region Zealand as well as in the rest of the country. In addition, organizing bioenergy production requires significant logistical solutions including transport systems, coordination of a variety of fuel producers and their integration with production systems of other industries.

Technical

The development of BTL technologies will have great impact on the forestry sectors potential for developing its bioenergy portfolio further.

In Lithuania, for example, the main barriers for further development of the Forestry BE sector are that the maximal total installed capacity of solid biofuel boiler-houses is limited to 700 MW, which is currently nearly reached. In a whole actual promotion system (promoting only production of “green” electricity) is not efficient in development of BE sector. One important issue is also the availability of silvicultural knowledge for production of solid biofuel: forestry cutting residues, non-forest wood, grey alder wood, production of biofuel from short-rotation forests.

There might also be a lack of available statistics on production and use of biomass for energy (including forestry BE), which would help to improve business investment opportunities in the sector, which might be barrier to some extent in every region.

Other barriers may be that the timber prices will influence on how much wood will be used for construction purposes, in the paper industry and how much will be cut into wood chips and also how much will be accounted for as waste and hence be available for bioenergy production.

4. OTHER LAND USE BE, RENEWABLE BIOMASS

4.1 General description of Renewable biomass BE sector

The renewable biomass sector includes among other things reed fuel, biomass from hedges, residues from household and commercial gardens.

However, this sector is not very developed and in most countries there is no statistically information about the use of such biomass.

4.2 Barriers for further development of Renewable biomass BE sector

No information is available.

5. OTHER NOT LAND USE BE, WATER RELATED

5.1 General description of Water related BE sector

The Water related BE sector includes for instance sea weed and water waste sludge.

Within the Region Zealand as well as in other parts of *Denmark* there are experiments going on with growing of the Macro algae species Seaweed. The experiments are promising as production rates can reach up till 45 tons of dry matter/ ha.

In Latvia there are waste water treatment systems for waste water sludge, which is for example sufficient for establishment of about 650 ha of willow plantations with annual growth capacity 36-62 th. LV m³. Mainly envisages energy from incineration of municipal waste, biogas from landfills and water treatment plant sites, as well as from industry.

5.2 In figures

Lithuania produces nearly 1 mill tons of municipal waste during the year. Biodegradable waste in this makes about 0,3 – 0,5 mill tons. Since municipal waste sorting is in initial stage, most of it gets to the landfills and can be used for production of 15-20 mill m³ of landfill gas with energy value approximately 100 GWh/year.

There are approximately 1000 units of water treatment system, which are cleaning municipal sewerage, which is about 170 mill m³. 47% of this amount is partly treated with biological installations, 15% treated with mechanical installations, and full cleaning with additional removal of nitrogen and phosphorus is in 38% of total sewerage. This makes additional resource for biogas production.

5.3 SWOT-analysis of Water related BE sector

This is information originating from the *Lithuanian* report mainly, some facts originates from *Denmark* which will be stated.

Strengths'

- There will always be resources. Use of food waste and manure for biogas production could be another solution how to enchain waste management and bioenergy production.
- Waste management system is under reconstruction, new polygons will be produced and former closed – recultivated.
- There are different informative activities targeted to all residents -kids and adults. 6.3 Barriers for further development of the biowaste sector.
- Promotion from the Government comes in the form of some legislation, related to favourable purchasing tariff for electricity from renewals and the reduced fee for connection to electricity grid;
- Very high production potential (Denmark).

Weaknesses

- Smell to neighbours
- There is no experience of maintenance of MSW incineration plants;
- Not adequate sorting, recycling and composting of biodegradable residues;
- Not sufficient public awareness regarding MSW incineration technologies and pollution prevention measures.
- High content of ashes and salts causing corrosion (*Denmark*).

Opportunities

- Everything is being used, no waste
- EU Structural funds provide opportunities for transfer to renewable fuel – both on supply and demand sides;
- International cooperation in education, technologies transfer and public awareness - conferences, green energy events, international projects, studies, which means new ideas, new proposals...;
- Fast and unpredicted prices for indigenous fuel (prices jump for imported natural gas and oil), which should bring new opportunities for biomass fuel;
- Closure of the 2nd unit at Ignalina Nuclear Power Plant (INPP) in December 2009 will also provide new opportunities for indigenous fuels;
- International environmental agreements and protocols promote transfer to renewable energies with regard to the reduction of green-house gases;
- Investments and EU subsidies for the promotion of renewals;
- Large scale production of biogas, bioethanol and biodiesel in combination with production of high value products (cosmetics) (*Denmark*).



Threats

- Increasing bureaucracy inside and outside all components, needed for the success of the bioenergy project.
- Rather small resources for such activities – money, skills, experience (mainly private initiative and lack of support at national level)
- Biomass fuel production business does not envisage high profits;
- Support for thermal energy generation from biomass is insufficient;
- Technical and environmental problems, related to biomass incineration, increase heat and electricity generation costs;
- Green” and “Environment conservation” movements start to develop a negative attitude towards the incineration of municipal waste.
- Not fully developed production technology (*Denmark*).

5.4 Barriers for further development of Water related BE sector

1. Installation of methane tanks in waste water treatment plans is very expensive for small towns and settlements.
2. Low consciousness and lack of economic incentives for primary sorting of municipal waste in residential areas.
3. Negative public opinion towards installation of MSW incineration plants near residential locations.
4. There is no experience in adequate primary sorting of municipal waste among waste management companies.
5. Burning of not sorted MSW is dangerous from environmental point of view.

6. VALUE ADDED CHAIN DERIVING FROM THE BE SECTOR IN THE REGION

The Bioenergy sector within the regions of the different countries involved in the Bioenergy Promotion project employs a number of people in different areas and with any kind of connection to bioenergy. This results in a number of companies in rural areas as well as in the cities which is of great importance to the countries. For instance there are companies taken care of district heating, heat centrals, supply of equipment, accounting, catering, etc as well as companies harvesting the resources and/or processing them. In the rural areas the cultivation and harvesting takes place as well as feedstock transport and maybe processing. Furthermore, fuel manufacture; plant construction and maintenance; fuel storage and distribution, creates considerable amount of new job places both in the countryside as well as in the cities. The development of bioenergy results in energy systems less sensitive to crises, technical breakdown, changes in prices.

These facts are true for most of the regions and especially the rural regions which are covered with lot of forests are dependent of bioenergy development and production, because it increases the possibilities to employment.



Appendix

1.3 BE Matrix Task 4.4

Main groups, categories and sub-categories		examples of BE products
1. Agriculture		
1.1 Agriculture biomass	1.1.1 products that can have other use	oats
	1.1.2 products only for BE	ethanol
	1.1.3 agriculture residues	straw
	1.1.4 manure	manure from pigs processed to biogas
1.2 Industrial bi-products	1.2.1 vegetable by-products	residues from mill production
	1.2.2 animal by-products	slaughter waste
1.3 Recycled or waste from agriculture based products	1.3.1 food waste	food waste from restaurants & households
	1.3.2	
2. Forestry		
2.1 Forest biomass	2.1.1 wood that can have other use	logs, stem parts
	2.1.2 logging residues	slash, stumps
	2.1.3 wood that have no industrial use	wood from pre-commercial thinning
	2.1.4 wood from short rotation plantations	salix for BE
2.2 Industrial bi-products	2.2.1 solid	sawdust
	2.2.2 liquid	black liquor
2.3 Recycled forest based products	2.3.1 recycled paper	household newspaper
	2.3.2 recycled wood	demolition wood, packaging wood

	products	
3. Other land use BE		
3.1 Renewable biomass	3.1.1 biomass from other land use	reed fuel, biomass from hedges
	3.1.2 biomass from gardens	residues from household and commercial gardens
3.2 Biomass slowly renewable		
4. Other not land use BE		
4.1 Water related	4.1.1 water related	sea weed

