Report „Business und industry analysis“

Agriculture BE sektor

Partner Nr. 6

Partner Name: Landkreis Nordwestmecklenburg – County of North West Mecklenburg

Country: Germany

January 2010

Part-financed by
the European Union

eu.baltic.net

1. Background

1.1 Purpose of the analysis

The project partner County of North West Mecklenburg is a rural region with homogeneous socio-economical and biogeographic characteristics. The region is linked to the nearby metropolitan region of Hamburg. This linkage is determined by the function of the region as a local recreation area and by the importance of the metropolitan region of Hamburg for the labour market in the region.

Apart from the importance of the region as a tourist destination, in particular with regard to the Baltic coast, agriculture is a significant economic factor. Biogeographic conditions are especially suitable for agricultural crop production. Biomass originating from agricultural crop production can be used for the production of heat, electrical energy, and biofuel.
Usable biomass produced in other economic sectors like forestry as well as organic matter originating from the use of aquatic ecosystems can be neglected in comparison to the volume of biomass from agricultural production. The biggest effects for the economy can thus be expected from the use of biomass from agriculture. Accordingly, the sector „Agriculture BE“ will be examined in detail in this report.

The analysis takes a closer look into the biogeographic and economic characteristics of the agricultural sector. Core energy crops, resources from livestock farming, further processing and end products from production processes will be identified (q.v. bioenergy potential assessment). A SWOT analysis and an assessment of constraining factors that influence the use of bioenergy potential in the agricultural sector round off this report.

Bioenergy potentials of the County of North West Mecklenburg are identified to compare them with potentials in the partner regions. The results will facilitate the discussion on the utilization of regional bioenergy potentials and will enable regions to ensure a long term improvement of the quality of life by coordinating regional development.

1.2 Methodology

The status analysis of biomass potentials and their energetic use is based on statistical data from different sources. Analytical findings could be substantiated by expert interviews.

Part-financed by the European Union
eu.baltic.net

The results of the potential analysis are described in detail and integrated into the bioenergy resource matrix and bioenergy potential assessment and can be discussed within the project „Bioenergy Promotion“.

2. Agriculture BE

2.1 General description of the Agriculture BE sector

The region is characterized by glacial types of landscape, a moderate climate, sufficient rainfall (600 to 650 mm), and fertile soil. Soils (brown soil, gley) with agricultural comparative figures[1] between 40 and 60 points prevail in the area. Therefore the County of North West Mecklenburg is one of the best suited areas for agricultural use in the Federal Land Mecklenburg-West Pomerania.

Table 1: Type of land use in the County of North West Mecklenburg

Usage	County of North West Mecklenburg [ha]	Proportion [%]
forest area	27.152	13
agricultural area: thereof cropland	(152.328) 126.039	(74) 61
grassland area	16.487	8
area for settlement and transportation	14.992	7,5
water area	8.902	4,5
total:	207.578	100

Source: www.statistik-mv.de

The *technical biomass potential* can be regarded as very high due to very good biogeographic conditions and efficient production and business organization. Table 1 indicates that an average of 87 % of the regional area is suitable for biomass production. About 74 % thereof originate from agricultural production. Agricultural land use prevails because the soils are predominantly very fertile. Only 6 % of the agricultural area is used as grassland. Forage produced from grassland use is needed for livestock farming.

[1] The figure provides a measure of the productivity of agriculture land in Germany. The spectrum reaches from 7 to 100 where a figure of 100 refers to ideal conditions for agriculture found e.g. in the region Magdeburger Börde. Basis for the measure are the factors type of soil, climate, and type of landscape.

Part-financed by the European Union
eu.baltic.net

Due to the relatively high percentage of fertile land in agricultural use the forest area is particularly small in the County of North West Mecklenburg (13 %). The energetic utilization of wood, e.g. for combustion in biomass heating power plants, is of relatively small importance in the region.

The biomass originating from *agricultural production* has therefore the highest significance for the County of North West Mecklenburg. The predomination proportion of this organic matter is produced in cash-crop cultivation for food and forage production. Only a small proportion of biomass is produced as energy crops especially for energy generation. Furthermore, biomass for the generation of energy is produced in the sector of livestock farming. This comprises primarily liquid and solid manure as by-products of livestock breeding. Due to the small proportion of grassland in the region, forage crop is cultivated on arable land (e.g. clover). Consequently, a competition results from the fact that agricultural land is not solely used for food production but must be available for forage production as well.

Biomass is produced cost-efficiently in the region due to efficient production, which is characterized by large cultivation areas, state-of-the-art agricultural technology, and highly qualified staff. 601 agricultural enterprises operated in the County of North West Mecklenburg in 2007 (latest research). 88 % of these enterprises are owned by individuals whereas 12 % are owned by legal entities. The average acreage of 240 ha (1991: 648 ha) significantly exceeds the national average in Germany of circa 40 ha. A large proportion of the enterprises in the region (30%) cultivate acreage of 200 to 500 ha. In comparison to other regions in the Federal Land Mecklenburg-West Pomerania there is a noticeable cumulation of very large enterprises (1.000 to 2.000 ha), which cultivate a total of 37 % of the agricultural area. This fact emphasises the economic capacity of agriculture in the region with regard to the size of enterprises and agricultural area determined by favourable natural conditions.

The regional economy is determined by a large-area agriculture, tourism, and traditional trade. The disproportionately high importance of agriculture is reflected in the distribution of labour force in relation to economic sectors. The primary economic sector (sector 1) provides a significantly higher number of jobs compared to the Federal Land Mecklenburg-West Pomerania.

Table 2: Regional employment in relation to economic sector (2007)

Sectors	County of North West	Mecklenburg-West Pomerania [%]

Part-financed by the European Union
eu.baltic.net

	Mecklen-burg [%]	
sector 1 (agriculture, forestry, fishery)	7,5	3,9
sector 2 (industry, mining, energy, construction)	31,5	36,8
sector 3 (trade, hospitality industry, transportation, service)	61,0	59,3

Source: www.statistik-mv.de

The industry sector provides a relatively small number of jobs in contrast to the primary sector. This results from the fact that a large proportion of agricultural products is delivered from the region as raw material and not as refined intermediate or end product (e.g. bioethanol, biofuel).

After a general description of the agricultural sector the following chapter 2.2 is dedicated to exploring in detail the bio energy potentials of the agricultural sector in the County of North West Mecklenburg on the basis of current statistical key figures. Statistical data includes information about agricultural areas, areas in relation to types of usage as well as data on live stock. A value-added chain is derived from this data which describes how through refining processes agricultural raw material is transformed into products that can be used for the generation of heat and electrical energy as well as for the production of biofuels.

2.2 In figures

Agricultural area in use without buildings and area for transportation as well as areas in relation to type of usage:

A total of 78 different agricultural crops (classified according to EU codes) are cultivated on an area of 133.682 hectare (arable land and grassland) in the County of North West Mecklenburg.

Agricultural crops include winter wheat, winter barley, winter canola, silage maize, grasses, and sugar beet. The following table shows crops that are used for energy generation.

Table 3: Important agricultural crops and their usage

EU code	Crop	Acreage [ha]	Proportion of acreage [%]	Energetic usage
115	Winter wheat	46.037	34,44	no

Part-financed by the European Union
eu.baltic.net

131	Winter barley	17.044	12,75	no
311	Winter canola	31.934	23,90	**yes**
411	Silage maize	10.024	7,50	**yes**
620	Sugar beet	2.384	1,78	no
421, 422, 423, 424, 428, 451, 452, 453, 454, 458, 459, 475, 480	Grasses*	18.683	13,98	no

***** The term grasses refers to clover, clover grass, lucernes, ley grass, grassland, meadows, hay meadows, pastures and mountain pastures, and other grassland usages.
Source: Ministry of Agriculture, Environment and Consumer Protection Mecklenburg-West Pomerania as of 31.05.2009

Winter wheat and winter barley are sold as bread grain for the food market and are thus not available for energetic usage.
Sugar beet crop is used almost exclusively for sugar production. Sugar beets are sold completely to the sugar industry. These sales are regulated by long-term contracts between farmers and sugar refineries. Therefore sugar beet crop is not available for energetic usage for the next five to seven years. There is also no evidence that the acreage for sugar beets and therewith the crop yield is being increased.
Ley grass and the crop yield from grassland are predominantly used as forage for live stock farming. Only a small proportion is available as silage for biogas plants.

Consequently, in the County of North West Mecklenburg only **winter canola** and **silage maize** are available on the markets in larger quantities. Hence this report and the bioenergy potential assessment focus on these resources.

The following table illustrates the value added chain and describes which bio energy related products are made from winter canola and silage maize. These products can be sold at a profit. Therefore it is reasonable for farmers to cultivate energy crops.

Value added chain:

Energy crop	Raw material	Refinement process	Product
winter canola	oleaginous parts of the plant (rape seed)	extraction (pressing)	biogenic liquid fuel: **biodiesel** (rape methyl ester; produced by transesterifica-

Part-financed by the European Union
eu.baltic.net

			tion) **rape oil** pure plant oil from decentralized facilities
silage maize	fermentable parts of plants (maize kernel, other parts of the plant)	fermentation (anaerobic decomposition with methane production)	biogenic combustion gas (bio methane) **electricity** and **heat**

Energetic usage (proportions) of energy crops:

The **rape** crop yield is partly available for energetic usage.

About **60 %** of the rape crop yield is used for the production of fuel and technical oil. Thus 40 % are available for food and forage production (edible oil). This proportion is based on consolidated data for Germany. Statistical data on Federal Land (Bundesland) or County (Landkreis) level is not available.

The approximate usage of maize can be quantified for the County of North West Mecklenburg. Maize is the primary energy source for biogas plants. About 10 % of the maize crop yield was used as feedstock for biogas plants in 2008[2]. Several new biogas plants, which are also using maize as feedstock, have been commissioned till the end of 2009. Although there is no statistical data available yet it can be pre-estimated that till the end of 2009 about **17 %** of the maize crop yield has been used in 11 biogas plants with a total connected load of 4.8 MW.

The following potential assessment clearly indicates ways to increase energy crop production and thereby produce more bio diesel, electricity, and heat.

Potential assessment:

Energy crop	Acreage [ha]	Proportion of acreage [%]	Influencing factors	Potential assessment
winter canola	31.934	24,0	crop rotation, phytosanitary reasons (infestation by pests)	yield increase by increase of acreage is not possible; yield increase by im-

[2] Calculation basis: ca 3 MW electric power installed, acreage of 10.024 ha, 360 ha maize needed per MW

Part-financed by the European Union
eu.baltic.net

				proved cultivation management is marginally possible; yield increase by increased oil yield rate is possible
silage maize	10.024	7,5	livestock (maize as forage crop), crop rotation, humus content of soil	yield increase by expanding proportion of acreage up to ca 15 % is possible

As of 2009

With an acreage share of currently 24% canola has already reached its cultivation maximum. With regard to crop rotation the proportion for canola should be between 20 and 25%. This means that canola may be cultivated at the same spot every four years at the earliest. This crop rotation must be observed to avoid infestation with canola-specific pests, e.g. pollen beetle.

Thus, significant increase rates in rape oil production can only be achieved by cultivating canola species with higher oil content and by increasing the efficiency of oil production in oil mills. An availability of new and improved canola varieties with an increased yield cannot be expected for the near future.

Therefore, the objective must be to increase the rate of oil yield. This can be achieved by centrally processing the predominant part of the canola yield in larger oil mills. These oil mills have a high rate of oil yield of 95% to 99%. Small local oil mills operated directly at farms have a relatively low rate of oil yield of maximal 80%. This difference is caused by different oil mill technologies.

This potential is already being exploited since 2009 due to economic reasons. With a steady rise in diesel prices and due to a new energy tax on the production of rape oil, local oil mills are not profitable any longer. Thus, farmers are closing down their mills and send their rape seed to large central oil mills for processing.

For this reason the yield increasing effects are expected to be negligible for the next five years.

The maize yield can be increased by expanding the area of cultivation up to 15% of the total agricultural area in use in the County of North West Mecklenburg. A further expansion up to 25%, which is the national average in Germany, is not possible for our region. Maize is

Part-financed by the European Union
eu.baltic.net

needed as forage. For farmers it is economically more advantageous to cultivate bread grain instead of maize due to good soils and high price level in direct sale.

Livestock farming:

Livestock farming including cattle breeding, pig feed, and poultry farming is of prime importance in the region[3]. The following table indicates by-products that are suitable for energetic usage.

Table 4: Important animals and usage of by-products

EU code	Farm animal	By-product	Energetic usage
1 to 8, 10, 11, 12, 14, 15, 16, 18	cattle	manure dung	**yes**
51, 52, 53, 55, 56, 57, 58, 59	pigs	manure	**yes**
63, 64, 70	poultry	dung	**yes**

* Farm animals are summarized. For sub-categories see EU codes..
Source: Ministry of Agriculture, Environment and Consumer Protection Mecklenburg-West Pomerania as of 31.05.2009

Thus, animal by-products are available for energetic usage as **manure** and **dung**.

The following table illustrates the value added chain and describes which bio energy related products are made from manure and dung.

Value added chain:

Farm animal	Raw material	Refinement process	Product
cattle pigs poultry	fermentable biomass (manure and dung as animal by-product)	fermentation (anaerobic decomposition with methane production)	biogenic combustion gas (bio methane) **electricity** and **heat**

Energetic usage (proportions) of animal by-products:

Manure and dung are used either as important basic substrata in biogas plants and directly as organic fertilizers on the field. The following table indicates which organic fertilizers are available in the County of North West Mecklenburg.

Farm animals	Number	LU*	Produced manure [t]	Produced dung [t]
cows, cattle older than 2 years	22.566	1,2	460.346	---

[3] Horses, sheep, ducks, and rabbits are considered to be of minor significance due to small numbers and low production of manure

Part-financed by the European Union
eu.baltic.net

female cattle 1 – 2 years	135	0,6	1.215	---
fed cattle 1 – 2 years	1.013	0,7	8.509	---
calves and cattle younger than 1 year	10.784	0,3	---	46.587
cattle total:			**470.070**	**46.587**
breeding sow	8.006	0,3	19.214	---
farrows	26.339	0,03	14.223	---
young pig	4.694	0,12	5.633	---
feeding pig	67.536	0,14	122.915	---
pig total:			**161.985**	**---**
laying hen	20.980	0,0034	---	514
chicken	45.505	0,0015	---	491
turkey	8.130	0,0117	---	1.029
poultry total:			**---**	**2.034**
total:			**632.055**	**48.621**

* Livestock unit

Source: Ministry of Agriculture, Environment and Consumer Protection Mecklenburg-West Pomerania as of 31.05.2009; own calculation

Taking into account current quantities of livestock a total of **680.676 t** of organic fertilizer is available. Ca 38.500 t thereof is used as additive in biogas plants as of 2009[4]. This equates to 5,7 % of available organic fertilizer.

The following potential assessment indicates ways to increase energy production from manure and dung.

Potential assessment:

Raw material	Proportion that is used energetically	Influence factors	Potential assessment
manure dung	5,7 %	quantity of livestock number of agricultural operations quality of soil	livestock will only increase marginally and so the production of manure and dung number of biogas plants will increase insignificantly

[4] Calculation basis; 11 biogas plants, each facility uses an average of 3500 t of manure/dung

Part-financed by the European Union
eu.baltic.net

Altogether, an increased energy output from available organic substance (manure, dung) cannot be expected in spite of high quantities that are available.

With the available organic substance of about 680,700 t it would be theoretically possible to operate 195 biogas plants with a connected load of 500 kW each. The energy production would be multiplied. However, this scenario is unrealistic. There are few regular agricultural operations in the County of North West Mecklenburg that could operate a biogas facility on a profitable basis. The majority of these agricultural operations have already built biogas plants.

Presently, there are no independent investors who merely finance biogas plants and manage manure supply chain. Facilities where raw material has to be transported over long distances are not profitable with regard to current market prices.
The supply side is already quite strong taking into account the total quantity of about 680.000 t. It is most likely that these quantities will not increase within the next years because there is no evidence for an increase in livestock. This is due to the fact that the pig stocking rate in the region is almost twice as high as in the Federal Land Mecklenburg-West Pomerania (101 units per 100 hectare agricultural area). The cattle stocking rate equates the average in the Federal Land Mecklenburg-West Pomerania. Thus, there will be no significant increase in manure and dung production.
Another reason for this is the high importance of cash crop cultivation in the County of North West Mecklenburg due to excellent soil quality. An increase of livestock quantities would imply to allocate more acreage to forage production. The cultivation of bread grain is more profitable on the other hand and for this reason farmers will not change their cultivation scheme significantly.

It can also be stated that biogas facilities will only be built where farmers could sell heat in addition to electricity. The majority of livestock establishments however is not located near settlements. Distances to settlements should not be too great to be able to sell heat produced in biogas plants to private households. Therefore only few new biogas plants will be established in the next years.
The development of larger biogas facilities (> 1 MW) could provide a higher potential given that they are able to further refine biogas and to feed it into existing gas distribution systems. This development depends on the price development in the substrate sector (maize silage)

Part-financed by
the European Union
eu.baltic.net

because there is a strong competition with regard to bread grain cultivation, e.g. winter wheat.

2.3 SWOT-analysis of the Agriculture BE sector

This SWOT analysis aims at summarising and presenting the basic bio energy potentials in the County of North West Mecklenburg with regard to the agricultural sector and to the socio-economic environment.

Strengths	**Opportunities**
▪ fertile soils ▪ efficient structures and production ▪ strong agricultural sector contributing to the integrity of rural areas - economically, socially, and ecologically ▪ high quantities of organic material (manure, dung) for energetic usage	▪ funding scheme changes towards bio energy usage ▪ increase of refinement rate by establishing more biogas facilities (by heat sale and feeding biogas into existing gas distribution systems) ▪ increase of maize yield by expanding areage (maize silage as most important additive for biogas plants)

Weakness	**Threats**
▪ low level of refinement of agricultural raw materials in the region (low capacities for refinement) ▪ livestock facilities and biogas plants are far away from settlements (result: local heat networks are not cost-efficient)	▪ nutrient contamination in surface water and aquifers due to intense agricultural usage ▪ danger of erosion due to agronomic impact on large areas ▪ funding scheme changes to the disadvantage of bio energy usage ▪ maximum rape crop yield already reached (raw material for bio diesel production)

Part-financed by the European Union
eu.baltic.net

	▪ acreage available for energy crops (canola, maize) could decrease if bread grain prices rise (competition between cash crop and energy crop)

2.4 Barriers for further development of the Agriculture BE sector

The following chapter is dedicated to describing main barriers for exploiting bio energy potentials in the County of North West Mecklenburg.

➢ Economic barriers

Funding schemes

Financial aid which is granted within the framework of the European Union's Common Agricultural Policy directly influences the agricultural market. For the sector of renewable primary products in Germany the Renewable Energy Sources Act has to be taken into account.

Farmers direct their economic activities to sectors which guarantee highest revenues. Cultivation structures and available crop quantities are aligned to funding schemes, too. The rape supply is therefore not stable but may fluctuate within a couple of years. An intermediate-term (4 - 10 years) potential assessment of the biomass supply for energetic usage is thus difficult.

This potential fluctuation is contrary to the stable supply of biomass from forestry where biomass is continuously available. An assessment of available biomass from densly wooded regions is hence possible also in the long term.

Market price development

Pricing in the sectors of cash cropping and livestock breeding involves food, forage and energy markets. Energy crop like canola, maize, or grain are produced for all the three markets. Farmers sell their products on markets which guarantee highest revenues. Fluctuations in the supply of e.g. sugar beets are avoided by long-term delivery contracts between farmers and industrial consumers (e.g. sugar refineries).

➢ Social barriers

Negative impacts on landscape

Part-financed by the European Union
eu.baltic.net

Monocropping of canola and maize accompanied by limited crop rotation is perceived as impairment of the natural scenery by a growing number of local citizens.

Many tourists, however, do not share this view. On the contrary, large monocrop fields are preceived as a special experience (yellow fields of rape) which cannot be found in other parts of Germany.

Impact on quality of life

In the biogas production sector these impacts include unpleasant odours but also noise pollution due to transportion of primary products using heavy agricultural equipment. If raw materials have to transported over long distances, the total energy balance deteriorates which lowers public support for such large biogas facilities.

Ethical objections

Ethical objections with regard to the cultivation of energy crops are increasingly discussed, too. There is conflict between food production and energy production. It can be observed that food prices are rising in developing countries which is caused by a shortage of food supply. This shortage is partly based on the shift from the cultivation of bread grain to energy crops.

- Ecological barriers

Negative impacts on natural resources

Energy crop cultivation especially as far as rape and maize are concerned uses high quantities of fertilisers and pesticides which could lead to ecological damages. To avoid negative impacts on water and land it is imperative to observe crop rotation. This means that canola may be cultivated at the same spot every four years at the earliest. This intensity and therewith the maximum crop yield is already reached in the County of North West Mecklenburg.

Crop rotation for maize may be shorter. Die Fruchtfolge beim Mais kann enger gehalten werden. A porportion of 30% to a maximum of 50% maize is recommended for crop rotation. A long-term cultivation intensity of 50% or more leads to soil erosion, development of resistant pest plants, nitrate loss, and herbicide discharge into ground water. These problems are not expected for the County of North West Mecklenburg because maize is cultivated on circa 10.5% of the total agricultural area in use only.

Total energy balance

The total energy balance of a specific product, e.g. bio gas, influences the usage of bio energy potentials. Production is economically and ecologically justified only if the energy yield

Part-financed by the European Union
eu.baltic.net

of biogas combustion (for generation of electricity and heat) is higher than the energy needed for cultivation. Energy spend in cultivation includes e.g. fuel consumption of agricultural equipment, fertiliser and herbicide production, energy input for transportation and storage of primary products, and energy required for operating the biogas facilities.

Part-financed by
the European Union
eu.baltic.net