Baltic Sea Region Programme 2007–2013

Universität Rostock Traditio et Innovatio

Bioenergy Promotion

Bioenergy Promotion

Task 3.4

Policy guidance paper

Promoting Sustainable Bioenergy Production and Consumption on a Sub-Regional Level

Good Practice Policy Showcases and Policy Lessons Learned

Rostock, July 2011

CBSS-BALTIC 21 LIGHTHOUSE PROJECT eu.baltic.net

Part-financed by the European Union (European Regional Development Fund and European Neighbourhood and Partnership Instrument)

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1 Background and Purpose of the Paper

Next to national, supra-national and international policies, local policy plays a key role for the promotion of bioenergy. It can be expected that local governments can act and react faster to the needs of their region than national policy makers and therefore are able to accelerate the implementation of bioenergy projects. From experiences of pioneer regions and successful examples others can learn and follow.

Bioenergy is an alternative and renewable energy source and by promoting bioenergy production and use municipalities can gain energy autonomy and ensure local energy supply, reduce greenhouse gas (GHG) emissions, save money and create jobs. On the other hand, over the past years bioenergy came under criticism since it can have adverse effects on biodiversity and environment and cannot necessarily be regarded as CO_2 neutral. Hence, when bioenergy is promoted, some basic principles for its sustainable production and consumption should be considered.

Therefore, within the frame of the *Bioenergy Promotion* project, this guidance document has been elaborated. It provides findings from good practice policy showcases from 8 countries of the Baltic Sea Region (BSR) illustrating how bioenergy production and consumption can be promoted on a local level in a largely sustainable way. Special emphasis is given to the integration of sustainability criteria for bioenergy production into sub-regional and municipal activities. Lessons are drawn from the experiences in the presented regions and municipalities and we derived recommendations for the planning and implementation of future bioenergy promotional policies and projects. It should be kept in mind that this paper is based on a selection of showcases and for this reason it cannot cover all aspects in detail. However, this document addresses local policy makers and stakeholders of the bioenergy sector in the BSR and beyond and its purpose is to provide inspiration and orientation regarding local policies and measures supporting sustainable bioenergy production and utilization.

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2 Project Frame and Methodology

The *Bioenergy Promotion* project is part of the Interreg IV B programme for the Baltic Sea Region (BSR) 2007-2013, and is coordinated by the *Swedish Energy Agency*. The consortium consists of 33 partners from 10 countries of the BSR, representing public authorities, agencies, research institutes, chambers of industry and agriculture and related organisations. The *Bioenergy Promotion* project aims to strengthen the development towards a competitive and territorially integrated BSR in the field of sustainable bioenergy production and use. In the four work packages *Policy*, *Sub-Regions*, *Business* and *Information Dissemination* the partners develop assessments, tools, plans and recommendations which shall help to promote a sustainable bioenergy production in the BSR. This guidance paper has been elaborated within the frame of work package *Policy*, task 3.4 "Sub-regional and municipal policy strategies promoting sustainable bioenergy". The rationale of the work package *Policy* is to elaborate principles and criteria for a sustainable bioenergy production in the BSR and to derive policy guidance on how these principles and criteria can be translated into supranational, national and sub-regional policy framework (Figure 1). Task 3.4 focuses on the sub-regional level and aims to identify sub-regional good practice policy showcases for the promotion of sustainable bioenergy production and to derive policy guidance for local policy makers. Additionally, the findings of task 3.4 will serve as input for task *4.6 Strategic Management Plans*. Task 4.6 aims to elaborate and implement management plans for an integrated an optimized use of bioenergy for a selected sub-region.

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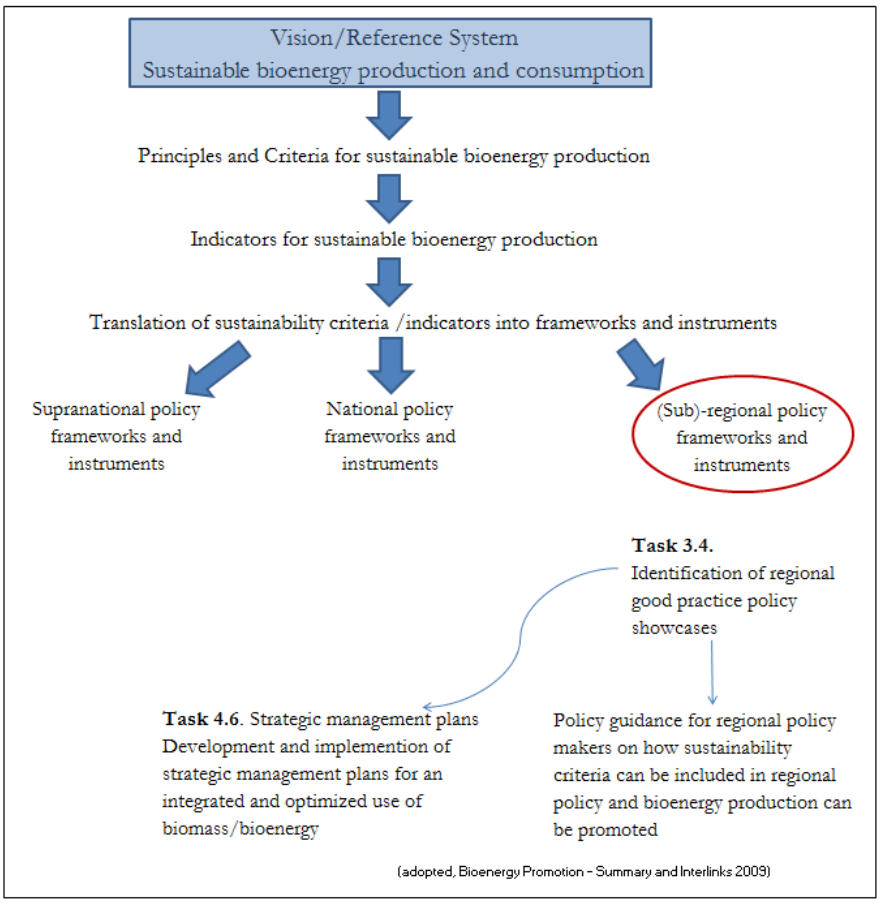

Figure 1. Rationale of work package *Policy* and the role of sub-task 3.4 – good practice policy showcases

What is a good practice policy showcase?

In general, good practice showcases can be described as innovative projects that have been successfully implemented within regions and municipalities and which show practical solutions to specific problems[1]. Because they can be transferred to other regions and to other countries, they form references that should be taken into account.

In the *Bioenergy Promotion* project, task 3.4, good practice policy showcases have been defined as successful examples from sub-regions in the BSR where local strategies, policies and measures were adopted and preferably implemented to effectively support sustainable bioenergy production and/or utilization. Moreover, environmental, social and economical sustainability

[1] RUSE (2010): What is a good practice. http://www.ruse-europe.org

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criteria should have been explicitly taken into consideration during policy development and/or implementation.

What are sub-regions?

The term sub-regions has been introduced in order to differentiate between the Baltic Sea Region as the superordinate macro-project region and the smaller regions in each country selected for the policy showcases. Sub-regions represent administrative units (geographical region with an administrative body) or associations of administrative units below national level. Hence the term sub-regions comprise counties, districts, municipalities or cities as well as associations among them. However, since the terms counties or districts may be used in a different way in each country, depending on national structures, the EU-NUTS classification (Nomenclature of territorial units for statistics)[2] was used to define the level of the sub-region chosen for the policy showcases (Table 1).

What are local policy instruments?

Possible local policy instruments for the promotion of bioenergy which were considered for the selection of the showcases were classified as follows (adapted from Martinot 2009[3]):

- Regulations and laws (municipality statutes)
- Target setting
- Economic instruments (taxes, grants, subsidies, municipal guarantees etc.)
- Voluntary agreements
- Municipal ownership and leadership by example
- Urban planning, spatial planning
- Organizational instruments (bioenergy cluster, local energy agencies etc.)
- Demonstration projects
- Education, information, promotion
- Networking

[2] European Commission, Eurostat (2007): Regions in the European Union. Nomenclature of territorial units for statistics. NUTS 2006/EU-27. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-07-020/EN/KS-RA-07-020-EN.PDF

[3] Martinot, E.; Zimmermann, M.; van Staden, M.; Yamashita, N. (2009): Global Status Report on Local Renewable Energy Policies. REN21 Renewable Energy Policy Network for the 21st Century, ISEP Institute for Sustainable Energy Policies ICLEI Local Governments for Sustainability. http://www.martinot.info/REN21_LRE2009_Jun12.pdf.

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Selection and evaluation of the showcases

In the first step guidance was developed for the selection of the showcases. The selected showcases were supposed to comply with the following minimum criteria:

- Sub-regional policy actors and/or public authority played a major role in supporting bioenergy production and/or consumption
- Consideration of environmental, social and economical sustainability criteria
- Contribution to optimized matter and energy flows
- Contribution to closed substance cycles and utilization of regional resources
- Contribution to keep the financial flows within the region
- Transferability to other sub-regions (with similar conditions)
- Cost and time efficient implementation

As a first step, ten good practice policy showcases were identified by the project partners. Most of the showcases selected are closely related to specific projects. They illustrate how sub-regional and municipal policy actors can pro-actively support sustainable production and consumption of bioenergy. Available information about the showcases was gathered and a short description of each showcase was developed and published on the project homepage[4]. In the second step, a questionnaire was developed in order to assess to what extent sustainability principles were taken into consideration. The sustainability principles developed in task 3.1 of the Bioenergy Promotion[5] project were used as a basis and the showcases were analyzed regarding the following points:

- Which sustainability principles were considered during the planning and implementation phase?
- How were the principles considered and which measures were taken to implement them?
- Was the measure taken to realize the principle in practice successful?
- What are the strengths and the weaknesses of the showcase?
- What are the needs for policy optimization?

In a workshop which took place on 3rd of November 2010 in Bispgården, Sweden, the showcases were presented by the partners. Particular emphasis was placed on the sustainability

[4] www.bioenergypromotion.net
[5] Hjulfors, L.N. and Hjerpe, K. (2010): Sustainable Bioenergy Production. Defining Principles and Criteria. www.bioenergypromotion.net/project/publications/task-3.1.-final-report-on-sustainable-production-of-bioenergy.

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criteria highlighted in task 3.1 as well as on success/non-success of different policy instruments. In small groups the partners discussed the strengths and weaknesses of the showcases in regard to the sustainability criteria and how information and recommendations could be derived from the showcases. The results from the questionnaire and the discussions served as a basis for the elaboration of the guidance paper and can be found in the Annex.

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3 Promoting Sustainable Bioenergy Production on the Sub-Regional Level - Good Practices

3.1 Short Description of the Good Practice Policy Showcases

Ten good practice policy showcases have been identified for the promotion of sustainable bioenergy production from eight countries of the Baltic Sea Region during the work of the *Bioenergy Promotion* project (Figure 2).

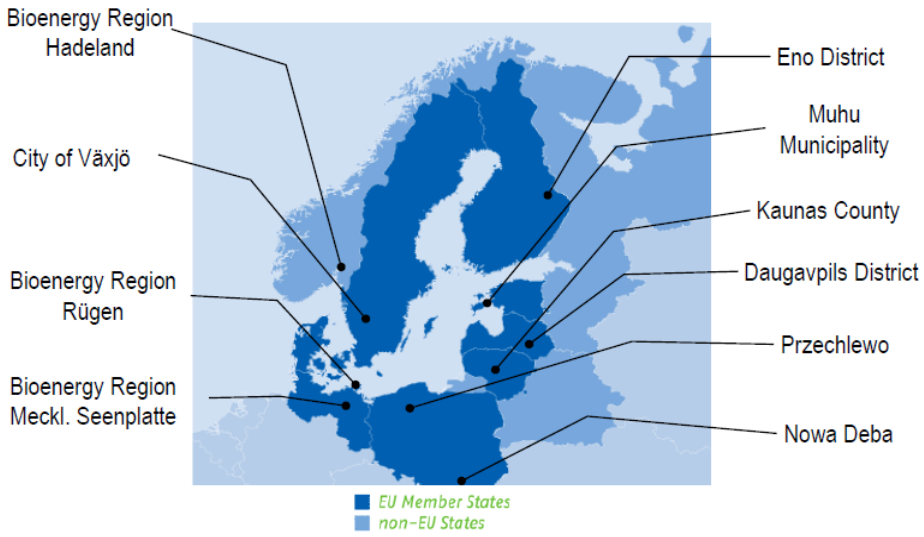

Figure 2. Location of the selected policy showcases

The selected showcases cover small municipalities (LAU 1, LAU 2) like Nowa Dęba and Przechlewo in Poland with an area of about 200 km² but also counties or districts (NUTS 3) with an area up to 8,089 km² such as Kaunas County in Lithuania. The selected showcases demonstrate the use of a broad range of biomass for bioenergy production, from municipal waste to agricultural crops and residues as well as woody biomass. However, according to the typical structure in the BSR, most of the showcases use forest biomass for energy generation. In some of the selected showcases activities in the field of bioenergy just started, in others the activities are already under implementation or already completed (Table 1). Hence, lessons can be learned about every step in the management process of bioenergy projects on the sub-regional level.

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Table 1. Area, population, biomass used and status of the selected policy showcases

Showcase	Area km²	Population	Administrative unit[6]	Biomass used		Status
				Biomass from	in detail	
Mecklenb. Seenplatte DE	5,800	300,000	3 districts (NUTS 3) plus 1 city (NUTS 3)	forestry	landscape management residues	just started
				agriculture	arable crops, other energy crops, straw, manure	
				waste	biodegradable fraction of municipal soild waste, biowaste	
Rügen DE	974	69,716	district (NUTS 3)	forestry	landscape management residues	just started
				agriculture	arable crops, other energy crops, algae	
				waste	biodegradable fraction of municipal soild waste, biowaste, sewage sludge	
Muhu EE	206	1,926	municipality (LAU 2)	forestry	residues from fellings (brushwood, coppice)	completed
Eno FI	1,088	7,000	municipality[7] (LAU 2)	forestry	fellings of small diameter trees, residues from fellings	completed
Kaunas LT	8,089	673,706	county (NUTS 3)	agriculture	arable crops	implementation
				waste	landfill gas	

[6] Administrative unit according to national structure at the time of showcase initiation and implementation, in brackets current EU-NUTS level (Status 2011)
[7] since 2009 consolidated with municipality of Joensuu

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Daugavpils LV	2,525	39,851	district[8]	forestry	residues from sawmilling (pellets from sawdust)	completed
Hadeland NO	1,992	28,000	cooperation of 3 muncipalities	forestry	fellings, residues from fellings	implementation completed
				waste	biodegradable fraction of industrial waste (paper, cardboard, pallets)	
Nova Dęba PL	142	19,500	municipality (LAU 2)	agriculture	short rotation croppice (willow)	almost completed
Przechlewo PL	244	6,300	municipality (LAU 2)	agriculture	byproducts (straw, manure)	completed
Växjö SE	1,925	83,000	city (LAU 2)	forestry	residues from fellings	implementation
				agriculture	arable crops (FAME), byproducts (straw, manure)	
				waste	sewage sludge	

[8] With the administrative-territorial reform from 2009 the districts were eliminated

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The municipality of **Muhu** is located in Western Estonia, in Saare County. In 1996 the district heating system which is owned by the municipality was renovated and imported coal was replaced by locally harvested biomass, especially wood chips. The same is true for the (former) municipality of **Eno,** since 2009 part of Joensuu municipality, located in the province of Eastern Finland in North Karelia. The administration of the municipality decided to switch from a fossil fuel driven district heating system to a system based on wood chips. The Eno district heating scheme is still today a success story of developing small and medium scale wood fuel supply chains.

The two showcases selected from Poland also used this strategy and replaced old systems for local heating by systems based on locally available biomass. The first one refers to the urban-rural municipality of **Nowa Dęba**, in the northern part of the Podkarpackie Voivodship (a province situated in the far south-east of Poland) and the other one to the municipality of **Przechlewo** located in the south western part of the Pomorskie Voivodship (a province in north central Poland). The municipal development plan of Nowa Dęba envisaged the construction of a wood chips fired boiler plant connected to the district heating system, along with a fuel preparation plant and launching of willow biomass production. It is the first project in Poland, which joins biomass production on plantations, utilization of green wastes and sludge from local sewage treatment facility as fertilizer and utilization of the acquired biomass as a fuel in a district heating system. The municipality of Przechlewo has been selected as a showcase for *Bioenergy Promotion* for its energy and environmental policy giving highest priority to renewable energy and energy saving projects. The project initiated and implemented by the authorities of the municipality resulted in the construction of a modern straw-fired boiler plant that replaced an inefficient and environmentally harmful coal–fired boiler. Due to the activities in the municipality Przechlewo, the Polish-Danish enterprise Poldanor S.A, the largest pig producer in Poland, has built two modern biogas plants producing electricity and heat by utilizing animal liquid manure and other types of biomass.

Also from Germany two good practice policy showcases were selected. First, the sub-region **Mecklenburgische Seenplatte** located in north-eastern Germany, more precisely in the south of the federal state of Mecklenburg-West Pomerania. The Mecklenburgische Seenplatte comprises three districts and one independent city. Second, the island of **Rügen**, which is the

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smallest district of Mecklenburg- West Pomerania. Both sub-regions just started their activities in becoming a "bioenergy region" within the frame of a corresponding national contest launched by the German Federal Ministry of Food, Agriculture and Consumer Protection in 2008[9].

The showcase selected in Latvia was initiated and implemented by the authorities of (former) **Daugavpils district**, located in southern Latvia. Daugavpils district started its activities in 1998 in cooperation with the Ministry of Economy of Republic of Latvia, the Danish Ministry of Environment and the municipal energy cooperation. The project aimed to establish a Heat Plan for the municipalities in Daugavpils district and comprised a feasibility study for different options such as the rehabilitation of boiler houses, district heating pipe networks, boiler rooms in buildings and individual heating systems. Recommendations were drawn for the 26 municipalities in Daugavpils district[10]. The Energy Planning Work Group established by authorities of Daugavpils district was responsible for the implementation of the Heat Plan. So far, 13 projects have been realized and in most cases the projects feature the conversion from using coal and heavy fuel oil to wood waste such as pellets from sawdust[10]. The showcase of Daugavpils district is up to now the largest by scale district heating development project in the rural area of Latvia and the most successful example of cooperation between municipal, state and international bodies. With the administrative-territorial reform of 2009 the districts lost their previous administrative status. Nowadays, the former Daugavpils district is part of Latgale Region (NUTS 3) with its largest city Daugavpils.

From Lithuania the example of **Kaunas County** was selected, which is one out of 10 counties in the Lithuanian Republic. Kaunas County decided to promote biofuel production and the production and use of other kinds of bioenergy. The most important projects were the

[9] The "Bioenergy Region" contest was launched by the German Federal Ministry of Food, Agriculture and Consumer Protection in 2008. In this contest sub-regions were asked to elaborate a rural development concept on how bioenergy production and consumption can be promoted. The contest supports networks which provided innovative concepts for an efficient bioenergy utilization. The aim is to increase regional value added chain, to create jobs and to contribute to rural development. 25 sub-regions in Germany, amongst others the Mecklenburgische Seenplatte and Rügen, were successful in qualifying for financial support. For more information see www.bioenergie-regionen.de

[10] Madsen, K.; Strazdins, U. (2001): Heat planning in Latvia. News from DBDH 3/2001. http://dbdh.dk/images/uploads/pdf-abroad/heat-planning-latvia.pdf.

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installation of biomass boilers in existing boiler-houses, the use of landfill gas for energy purposes and the thermo insulation of public buildings and residential blocks.

The region **Hadeland** lies approximately 60 km north of Oslo in Norway and covers the three municipalities Gran, Lunner and Jevnaker. In 2003 the regional council for Hadeland established the Bioenergy Region of Hadeland Project ("BIOREG") with the ambition to double the use of bioenergy and to contribute to industrial and commercial development in the field of bioenergy.

Finally, the city of **Växjö** situated in the southern part of Sweden was selected as a showcase. The municipally owned energy company started using biomass like wood chips, pellets and straw for heat and electricity production already in the 1980ies. In 1996 the city launched the Fossil Fuel Free program, meaning that Växjö is committed to no longer contribute to global warming. Växjö's strategy comprises various measures such as increase of energy efficiency, transition to renewable energy in heating, power and transport as well as change of consumer behavior. Nowadays, 90-95 % of the district heating is based on biomass.

More detailed information about each showcase and about the integration of sustainability principles into local planning can be found in the Annex.

3.2 Getting Started - Initiation of Sub-Regional Bioenergy Strategies and Policies

Supra-national (EU) and national policy frameworks as well as local conditions like community size, local resources and the commitment of local authorities play a key role for the initiation of bioenergy projects. Sub-regional administrative bodies can only act in the frame of national policy and legislation. In Germany the national Renewable Energy Sources Act (EEG) and the Market Incentive Program for Renewable Energy (MAP) are important cornerstones for the promotion of individual bioenergy projects, but the national contest "Bioenergy regions" launched by the Federal Ministry of Food, Agriculture and Consumer Protection of Germany in 2008 was the starting point for the activities in whole sub-regions such as the island of Rügen and the Mecklenburgische Seenplatte. In **Poland** the national Energy Law of 1997 with its latest amendment in April 2009 defines the principles of state energy policy development, principles in

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terms of supply and use of fuels and energy, including heat and operation of energy enterprises, and also determines organs appropriate in issues of fuels and energy economy. According to the Act the municipalities are obliged to plan and organize their energy supply. The strategic development plans prepared by the municipalities must be consistent with the national energy policy and thus they have to include tasks and duties to promote and develop renewable energies and energy efficiency. In **Norway** the municipalities had to prepare a climate and environment plan before July 2010 to lift the work in the municipalities to a strategic level. The Green Municipalities Program which was initiated in 2007 by the Norwegian Government and the Norwegian Association of Local and Regional Authorities further stimulated the activities in the sub-regions. In **Latvia** the National Public Investment Program was enacted to accelerate the implementation of renewable energy projects in the municipalities. In **Sweden** no national policy forced municipalities to have local climate/energy targets and thus the showcase of **Växjö** illustrates that local authorities can achieve good results also without any national or international agreement. Nevertheless, the Regulation on Tax for Carbon (CO_2) Emissions which came in force in 1991 in Sweden was supportive for activities in the city of Växjö. This indicates the importance of an optimized national framework for bioenergy promotion on the sub-regional level. For more information about national policy frameworks of BSR countries which aim in the promotion of bioenergy see the country policy assessment reports prepared in the frame of Bioenergy Promotion[11].

National policy measures ("policy behind the showcase") can have supporting character, nevertheless, for the initiation and the success of bioenergy projects the commitment and the motivation of local policy and decision makers but also of other relevant stakeholders like the producers and consumers of bioenergy is of paramount importance. Other factors like the community size can also play a role for the initiation of bioenergy projects. Martinot (2009)[3] for example found that mid-sized cities can start easier than large cities. In terms of local renewable energy policies it was observed that cities and towns between 100,000 and 500,000 inhabitants tend to be the most active.

[11] To be published during summer 2011 on the Bioenergy Promotion website

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To get started with a bioenergy project requires an initiator or a driver. This role could be taken over by local authorities or by other relevant stakeholders of the bioenergy sector. In **Rügen (DE)** for example, the local association of craftsmen took the initiative and applied for the national "Bioenergy Region" competition. In the sub-region **Mecklenburgische Seenplatte (DE)** four regional companies (municipal energy supply company of Neustrelitz, Working Group Bioenergy Bollewick, Gutswerk Varchentin, center of excellence Regiostrom Ivenack GmbH) acted as the driving forces. In **Hadeland (NO)** the Energy Farm (Energigården) is the one important driving force for bioenergy development in the area. The Energy Farm, which is a private consulting and information platform disposes of various demonstration facilities for the production and the handling of biomass as a energy carrier. That way the idea of bioenergy production spread quickly to local decision makers. According to Lunnan (2002) the Energy Farm is involved in advising most of the bioenergy projects realized in Hadeland and is the engine of the local bioenergy network[12]. During the next step in the Bioenergy Region of Hadeland project a climate specialist was employed, who is acting as an initiator and consultant for environment and bioenergy projects in the region. In the municipality of **Eno (FI)** local decision makers aimed to find new ways for the use of the vast amounts of forest resources and acted directly as initiators of the bioenergy project. For the municipalities **Nowa Dęba (PL)** and **Przechlewo (PL)** the strong involvement of local authorities created the basis to get started with bioenergy projects. The Fossil Fuel Free Progamme of the city of **Växjö** (SE), which was the cornerstone for the promotion of renewable energy, was worked out in cooperation between the authority of the city, NGO's, companies, the university and citizens.

[12] Lunnan, A. (2002) Contribution from bioenergy to local economic development – a Norgwegian case study. IEA Bioenergy Task 29. Workshop in Cavtat, Croatia
http://www.task29.net/assets/files/streatley_papers/Lunnan_2003.pdf.

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Table 2. National policy framework which was supportive for the sub-region to promote bioenergy and initiators of the bioenergy projects in the selected sub-regions

Showcase	National Framework	Initiator of the activities
Mecklenburgische Seenplatte DE	"Bioenergy Region" contest launched by the German Federal Ministry of Food, Agriculture and Consumer Protection in 2008	association of four regional companies
Rügen DE		association of craftsmen
Muhu EE	The project was carried out in the frame of national boiler conversion program	authority of the municipality
Eno District FI	The project was carried out in the national framework of reducing CO_2 emissions, promotion of bioenergy and achieving energy self sufficiency at local scale. Various national policies could be linked	authority of the municipality
Kaunas LT	Lithuanian Strategies on the Use of EU Structural Funds 2007-2013 Lithuanian Rural Development Strategies and Programs for 2007-2013	authority of the municipality and regional company
Daugvapils LV	National Public Investment Program for implementation of projects in district heating sector	municipal, national and international bodies
Hadeland NO	Green Energy Municipalities program (2007)	cooperation of three municipalities, and the county authority, the Energy Farm
Nova Dęba PL	Energy Law- the Act of 1997 and its later amendments, National Programs and Funds supporting initiatives for RES promotion	authority of the municipality
Przechlewo PL		authority of the municipality, private company
Växjö SE	Regulation on CO_2 Tax supported the activities	authority of the city, in cooperation with local NGOs, companies, university, citizens

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In order to promote bioenergy, a biomass potential study to investigate the available biomass resources in the region is an important/necessary step to develop any bioenergy project. It is principally important to know the conditions predominating in the region. A biomass potential study can even reveal biomass resources which are not yet in use like in the case of **Rügen (DE).** In this case, the study on local biomass potential revealed that a high amount of organic wastes and several tons of sea weed and algae are available for bioenergy production. The potential study carried out by the sub-region **Mecklenburgische Seenplatte** showed that electricity production from biogas could be increased up to 160 GWh which would account for 20 % of the final energy consumption in the region. With an improved use of waste heat during biogas generation, 191 GWh could be produced, accounting for 8 % of the total heat supply in the region. An improved use of landscape maintenance material could increase the bioenergy potential by 20 GWh[13]. Thus, the study on biomass potential can give early signals on which biomass resources the region should focus.

Moreover a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis can be a useful instrument for the identification of sustainability risks and conflict potentials of the planned project, as demonstrated by the region **Mecklenburgische Seenplatte (DE)**. From the strengths and deficits identified, needs for and fields of action can be derived. A SWOT analysis was also required for the strategic development plans which had to be prepared by the Polish municipalities. As learned from the showcase of **Växjö (SE)** a good knowledge of the statistics of the bioenergy sector and beyond is also important in order to understand where the challenges are. In that case, statistics revealed that around 80 % of the emissions come from transport sector. Therefore, the key activities of the city focused on making transport more environmentally sound, e.g. by promoting the use of biofuels in cars. As a consequence of the first activities concrete targets should be formulated and a strategy for further development of the region can be elaborated.

[13] Landwerke Energie Mecklenburgische Seenplatte (2008): Regionalentwicklungskonzept Mecklenburgische Seenplatte. http://www.seenplatte-bioenergie.de/images/stories/pdf/antrag.pdf.

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3.3 Target Setting and Strategy Development

Target setting is one of the most important policy instruments[3], and hence, we identified this measure for all selected policy showcases. Target setting means that any sub-regional government, or in the case of our showcases, also stakeholders of the bioenergy sector establish a target (goal) for some future share of renewable energy in the sub-region's energy balance. It is an imperative measure to adopt policies and actions.

We identified many different targets set by the authorities of the municipalities or by the responsible persons, however, often addressing the promotion of bioenergy indirectly. Emission reduction targets were identified in all showcases. For a successful control, emission reduction targets can be formulated in a measurable way, as it is demonstrated by **Kaunas County (LT)** and **Rügen (DE)** (Table 3)**.** Another type of emission reduction target is the emissions per capita[3] as found for the city of **Växjö (SE)**. The City of Växjö for example set targets like the reduction of CO_2 emissions per capita by 55 % between 1993 and 2015 or to reduce energy consumption per capita by 15 % between 2008 and 2015. Only few showcases like **Nowa Dęba (PL)**, **Przechlewo (PL)** and **Rügen (DE)** directly addressed bioenergy or renewable energy sources in their targets. Rügen (DE) for example directly set the target to cover 1/3 of its primary energy demand by energetic use of biomass until 2020. Nowa Dęba (PL) and Przechlewo (PL) aimed in promoting heating and electricity systems based on renewable resources. Some cities also target the share of electricity consumed by the local government itself, for its own buildings, vehicle fleets, and operations (so called "own use targets")[3]. Such targets could be identified for the city of **Växjö** (SE) that aimed to reduce the energy used in the municipality owned localities by 17 % between 2005 and 2015.

An important step is not only to clearly identify targets, but to include them in a development plan or a strategy. All of the selected municipalities and sub-regions integrated renewable energy or bioenergy as well as CO_2 reduction targets into Regional Development Strategies or Environment Programs. Integration of bioenergy targets into regional concepts and strategies gives the targets a quasi-binding character. As recommended by the showcase from **Vaxjö** (SE) it is also necessary to dare to take decisions on long-term targets that go beyond the next election

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date. An overview of the targets formulated in the development plans and strategies of some of the selected showcases is given in Table 3.

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Table 3. Policy targets formulated by the local authorities and/or stakeholders of some of the selected showcases

Showcase	Target	Strategy/Plan
Rügen DE	• Reduce CO_2 emissions by 40% until 2020 • Reduce the demand of primary energy by 30 % until 2020 • Increase the use of renewable resources for energy generation, cover 1/3 of primary energy demand by energetic use of biomass • Increase the amount of waste used for bioenergy production • Increase the efficiency in the whole lifecycle of bioenergy • Reduce private transport and switch to public transport operated with biofuels • Increase awareness and acceptance of bioenergy in the region and beyond	Regional Development Concept
Muhu EE	• Improve energy efficiency with installing new boiler • Switch from imported coal to locally produced biomass • Reduce pollutions (CO_2, NOx, SO_2, solid particulars) • Utilize biomass available from non-agricultural land	Regional Development Concept
Kaunas LT	• Reduce emissions from stationary installations from 16.5 kg in 2008 to 15.2 kg per person in 2020 • Increase the share of recycled wastes from 6.75 to 8.78 % • Increase forest area from current 29.6 % to 30.1 % • Increase share of renovated public buildings and residential houses from 1 to 15 % • Modernize existing boiler-houses through installation of biomass boilers • Use of gas from Lapes landfill for electricity production	Development Plan of Kaunas County 2007-2013
Nowa Dęba PL	• Promotion of heating systems based on renewable energy sources • Reduction of emissions and air pollution (CO_2, SO_x, NO_x) • Promotion of energy crops and renewable resources • Protection of air, soil, water, prevention of soil degradation • Reclamation of degraded land	Strategy for Sustainable Development of Nowa Dęba Municipality 2004-2013 Program for Environmental Protection for Nowa Dęba Municipality 2009-2012

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	• Improve energy efficiency, reduction of heat losses	
Przechlewo PL	• Development of renewable energy systems based on local resources • Promotion of agricultural biogas installations and wind farms • Modernization of district heating systems • Development of systems reducing air pollution and emissions • Actions for biodiversity conservation • Good practice in ecological agriculture • Rational use and protection of natural resources • Increase ecological awareness among local society	Strategy for Sustainable Development of Przechlewo Municipality 1999-2010, 2006-2020 Program for Environmental Protection for Przechlewo Municipality 2006-2013 Program for Local Development of Przechlewo Municipality 2006-2013
Växjö SE	• Reduce the fossil CO_2 emissions per capita by 55 % between 1993 and 2015, and by 100 % until 2030 • Reduce the use of energy per capita by 15 % between 2008 and 2015 • The electricity use per capita shall be reduced by 20% between 1993 and 2015 • The energy supply per capita shall be reduced by 15 % between 2008 and 2015 • The energy use in the municipally owned localities and dwellings shall be reduced by 17 % between 2003 and 2015	Fossil Fuel Free program 1996 Environmental program (revised 2010)

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3.4 Implementation of Sub-Regional Bioenergy Strategies and Policies

For the implementation of bioenergy strategies various policy instruments could be employed by local governments. This may depend on different factors like financial issues, relationship to state and national governments, local regulatory authority and legal jurisdiction, existence of stakeholder groups or local business interests[3]. Larger regions with a high number of inhabitants such as **Rügen (DE)**, **Mecklenburgische Seenplatte (DE)** and **Hadeland (NO)** mainly used policy instruments such as *Networking and Clustering* as well as *Information and Education* to realize their strategies. In the frame of the national contest "Bioenergy Regions" the sub-regions Rügen (DE) and the Mecklenburgische Seenplatte (DE) are participating in, the money available cannot be used for investments in the bioenergy sector but for coordination and networking as well as for information dissemination. *Networking* is supposed to bring together suppliers and consumers of bioenergy and tries to find investors for bioenergy projects. Thus, it has the potential to create enduring structures along the entire bioenergy value chain. It is reasonable that this instrument is most effective when some structures in the bioenergy sector already exist. However, networking also requires a small team of people, coordinating the work in a long term perspective. As learned from the showcase of Rügen (DE), it is favorable if the coordinating persons are strongly aligned to the region and are fully accepted by the inhabitants and stakeholders. *Information dissemination* is a measure that mainly targets the public and aims to make people familiar with new technologies and with their possible applications but also to raise awareness and acceptance. The weak knowledge of public but also financing institutions about bioenergy seems often to be a barrier for the implementation of bioenergy projects[12]. Hence, targeted *Training* and *Education* of decision-makers and employees from public institutions can be regarded as an important measure for the promotion of bioenergy on the local level.

In the smaller and less populated municipalities like **Nowa Dęba (PL)**, **Przechlewo (PL)**, **Eno (FI)** and **Muhu (EE)** *municipal ownership* was crucial for the implementation of the respective bioenergy project. Municipal ownership means that the municipality invests into a bioenergy installation and/or owns or partially owns the local energy utility (e.g. district heating company investing in bioenergy installations). Often the municipality acts at the same time as the consumer of the bioenergy produced.

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For example this was true for the municipality of **Eno (FI)**. The municipality invested into a new biomass fired boiler plant and in the beginning used the thermal energy to heat public buildings. Such an investment requires, next to reliable national policy framework, adequate funding sources. Funding sources used by the showcases selected are given in Table 4. To finance investments in bioenergy installations and to realize targets set in the development plan, *private-public partnership* can be a successful instrument as demonstrated by the county of **Kaunas (LT)**. In cooperation with the privately owned company UAB Ekoresursai Kaunas County realized the project to use landfill gas from Lapes landfill for energy generation.

Table 4. Funding sources and funding schemes which supported the activities of selected regions

Showcase	Funding Source
Mecklenburg. Seenplatte DE	Networking activities supported by national Bioenergy Regions program, financial support for networking activities
Rügen DE	Networking activities supported by national Bioenergy Regions program, financial support for networking activities
Muhu EE	Investment supported by soft loan from World Bank secured by Estonian Government
Eno District FI	Funded by the municipality and private forest owners
Kaunas LT	Funded by county, municipality and EU structural funds
Daugvapils LV	National Public Investment Program, up to 50 % of the investment costs were covered by the program, National warranties for bank loans, national grants
Hadeland NO	Development of projects funded by primarily two National sources; Innovation Norway (mainly farm based projects) and ENOVA (public and private enterprises and households). Regional development funded by National programmes such as the Green Energy Municipalities.
Nova Dęba PL	National and Regional Funds supporting initiatives for rural area development and RES promotion and implementation
Przechlewo PL	National and Regional Funds supporting initiatives for rural area development and RES promotion and implementation
Växjö SE	Subsidies from the government and the EU, Local Investment Program (LIP) from 1997 initiated by the Government of Sweden

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Further local policy instruments to implement renewable energy strategies include the use of *regulations* or *economic instruments*, such as *urban planning, building codes* or *local taxes*[3]. *Local taxes* can be regarded as economic instruments which have a quasi-regulatory character. With the help of building codes the use of renewable energies in buildings can be legally required. This policy instrument was, amongst others, used by the city of **Växjö (SE)** when land was sold by the city for construction purposes. In the context of urban planning privileged zones for bioenergy generation can be designated which encourages the construction of bioenergy facilities. However such measures can also counteract bioenergy promotion. Economic instruments such as *subsidies* can also be an effective instrument to promote bioenergy production and use. The city of **Växjö (SE)** introduced free parking for environmentally friendly cars and a subsidy to everyone who bought such cars, e.g. ethanol driven cars. The subsidy is now available on national level illustrating the pioneering role of sub-regional policy.

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4 Integration of Sustainability Criteria into Sub-Regional Strategies

To be regarded as sustainable, bioenergy production and consumption as well as the promotion of bioenergy has to take into account several critical aspects. There is evidence that intensified biomass production for bioenergy purposes can go to the expense of soil and water bodies and biodiversity or can cause land use conflicts and at the same time does not contribute to mitigate climate change or is not energy efficient at all.

Many initiatives have been launched to prevent unsustainable development of the bioenergy sector. The development of minimum standards for bioenergy generation, so called sustainability principles or sustainability criteria, have been pushed by various initiatives[14] such as the *Cramer Commission*[15] , the *Round Table on Sustainable Biofuels* (RSB)[16] the *WWF* study by Fritsche et al. 2006[17] and the *Global Energy Partnership* (GBEP)[18] and finally the EU-Renewable Energy Directive (RED) from 2009[19] which formulates legally binding minimum criteria for biofuels and bioliquids. However, for solid and gaseous biomass used in electricity, heating and cooling there are currently no legally binding EU criteria[20]. The *Technical Committee CEN TC 383* of the European Committee of Standardization (CEN)[21] is currently working on the development of standards to check for the sustainability laid down by RED. Furthermore, the *Project Committee ISO PC 248* of the International Standardization Organization (ISO)[21] is working on the

[14] For more information about initiatives on sustainable bioenergy production and certification schemes see Martikainen, A. (2010): Sustainable bioenergy production. Identification and description of sustainability initiatives and certification systems in the BSR. http://www.bioenergypromotion.net/extranet-1/publications/sustainable-bioenergy-production-identification-and-description-of-sustainability-initiatives-and-certification-systems-in-the-bsr.
[15] Cramer, J. (2006): Criteria for sustainable biomass production. Final Report of the project group "Sustainable production of biomass". Energy Transistion Task Force. http://www.globalproblems-globalsolutions-files.org/unf_website/PDF/criteria_sustainable_biomass_prod.pdf.
[16] For more information see http://rsb.epfl.ch
[17] Fritsche, U. R.; Hünecke, K.; Hermann, A.; Schulze, F.; Wiegmann, K. (2006): Sustainability Standarts for Bioenergy. WWF Germany
[18] For more information see http://www.globalbioenergy.org
[19] Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.
[20] European Commission (2010): Report from the Commission to the Council and the European Parliament on sustainablitly requirements for the use of solid and gaseous biomass source in electricity, heating and cooling. http://ec.europa.eu/renewables/transparency_platform/doc/2010_report_0011_3_report.pdf. Accessed: 31.08.2010
[21] For more information see http://www.ecostandard.org/?p=117

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international standardization of sustainability criteria for production, supply and application of bioenergy. Also in the frame of the *Bioenergy Promotion* project, partners have developed principles and criteria for a sustainable bioenergy production in the Baltic Sea Region, taking into consideration or even going beyond the requirements formulated by other sustainability initiatives or the EU-RED[5]. In the respective project document the partners of *Bioenergy Promotion* suggest sustainability principles and criteria covering ecological, economical and social dimension affected by bioenergy production (Figure 3). Those principles are regarded as guidance for the promotion of sustainable bioenergy on the local level in this paper.

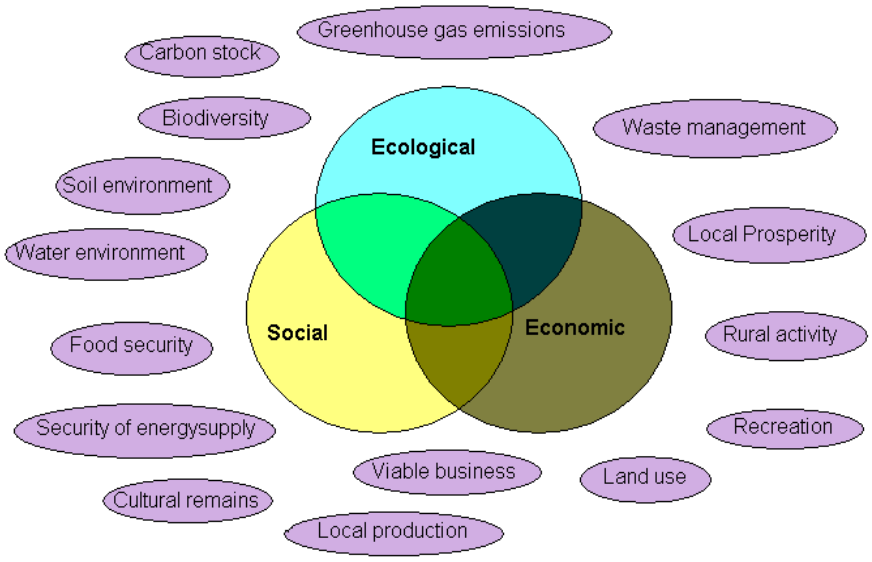

Figure 3. Dimensions affected by bioenergy production and related sustainability principles (Source: Bioenergy Promotion: Sustainable Bioenergy Production - Defining principles and criteria)[5]

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4.1 Biodiversity and Environment

Principle according to findings of Bioenergy Promotion:
(1) Biomass production and extraction shall not endanger biodiversity at the landscape level. However, special considerations to threatened species shall be taken at the local level. Biomass production shall whenever possible strengthen biodiversity by contributing to landscape variability.

(2) Natural resources such as soil, water and land shall be used efficiently and biomass production or extraction shall not endanger soil status or cause further deterioration of water quality or quantity.

Biodiversity is defined as the variability of living organisms in ecosystems and biodiversity protection can be regarded as the cornerstone for sustainable development[15]. The promotion of bioenergy can contribute to both, to the maintenance but also to the endangerment of biodiversity. An increased clearance of forests, the expansion of silvicultural or agricultural land as well as monocultures of energy crops can jeopardize the sustainability of bioenergy systems. Thus the protection of biodiversity as well as natural resources like soil, water and land in connection with bioenergy promotion is of paramount importance.

From the selected policy showcases we could only identify few concrete measures taken by sub-regional policy makers or authorities for the protection of biodiversity and environment (e.g. Polish showcases, see Annex). In general sub-regional policy instruments and measures seem to focus more on social and economical criteria than national and international regulations, which on the other hand strongly deal with ecological aspects. For example the designation of nature protection areas on national and international level meets the concerns related to environmental protection and biodiversity issues. All of the selected showcases hold nature protection areas, whose management is subjected to strong regulations. Most of the evaluated showcases avoid the extraction of biomass for energy purposes from protected areas. Additionally, binding international and national regulations for silvicultural and agricultural activities exist, assuring the protection of biodiversity and environment. The **Norwegian** Forest Act for example, formulates high requirements for biodiversity protection. According to the Forestry Act forest owners have to provide an overview of the environmental and biological important areas of their own forest, and act according to this knowledge. The inventories of environmental values shall be publicly accessible (cf. Act related to the right to environmental information) to ensure public participation in decision-making processes relating to the environment. The Forestry Act and

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regulative also provide direct regulations on forestry activities to ensure a sustainable forestry (e.g. requirement of environmental measures during harvesting such as buffer zones and retention trees). Another example is the National Forest Regulation in **Latvia** which contains restrictions for harvesting nearby natural water bodies to avoid water pollution, as well as regulations on forest management in protected areas.

In addition to national legislation, international forest certification systems exist which may even have tighter restrictions. For example, 50 % of the total forest area in **Latvia** is certified according to the Forest Stewardship Council (FSC, FSC-Latvia). Another widely applied certification system is the Program for the Endorsement of Forest Certification (PEFC) which has been in force since 1993. PEFC certified forests meet the needs of a biodiversity and environment preserving production of timber. All the woody biomass used in **Eno (FI)** for the district heating system is/has to be certified by PEFC (PEFC-Finland). This is also the case for all **Norwegian** timber resources. The requirements following the Norwegian Living Forest Standard (PEFC-Norge) provide strong restrictions to safeguard social and environmental sustainability. For agricultural production the Common Agricultural Policy (CAP) with its Cross Compliance rules (CC) is in force for the EU Member states. The CC rules stipulate minimum requirements regarding environmental protection to agricultural production.

Hence, sustainability principles like biodiversity and environment are strongly considered on national and international level via laws or certification schemes reducing the necessity of additional measures on sub-regional level. Nevertheless, especially in Germany bioenergy production from biogas came under severe criticism and complementary local measures can affect biodiversity but also the reputation of bioenergy positively. Still, maize is the most effective crop for biogas generation and the area under maize cultivation rapidly increased in Germany with a corresponding increase of biogas installations. The island of **Rügen (DE)** promotes next to biogas production also the establishment of flower stripes in the fields. The strategy pursued is to motivate farmers to establish flower stripes and to convince them, that flower stripes are a surplus value. In the first year of the activities seeds and extra work were financed from project funds and by sponsors. The demonstration and presentation of alternative cropping systems and plant species suited for bioenergy generation belongs to the strategy of the bioenergy region **Mecklenburgische Seenplatte (DE)** in order promote sustainable bioenergy production.

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Moreover, to focus on the use of by-products from silvicultural and agricultural production or wastes helps not only to prevent conflicts of bioenergy production with biodiversity and environmental aspects but also with land use. For strategies on how to promote the use of waste and by-products for bioenergy generation see section 4.3.

4.2 Climate Mitigation Efficiency (Greenhouse Gas Balance)

Principle according to findings of Bioenergy Promotion:
(1) Greenhouse gas emissions (i.e. emissions of CO_2, CH_4 and N_2O in CO_2 equivalents) from bioenergy production and use shall be minimized. […]

(2) Biomass production shall not endanger important carbon stocks. Greenhouse gas emissions caused by land-use change shall be low in relation to the amount of greenhouse gas emissions that can be saved in a long-term perspective.

The reduction of greenhouse gas (GHG) emissions is one of the main reasons for the use of renewable energy sources and the key objective for many municipalities initiating bioenergy projects. Hence, this aspect was considered in all showcases selected and is integrated more or less detailed as a target in the sub-regional strategies. GHG reduction targets were accomplished mainly by the (re-) construction of district heating plants which use biomass instead of fossil fuels for heat generation. For example, by switching from fossil fuel driven boiler plants to boiler plants using wood pellets (from a saw mill) in the municipalities involved, the CO_2, NO_x and SO_x emissions were reduced by 75 %, 50 % and 90 % in **Daugavpils district (LV**). In the municipality of **Przechlewo (PL)** CO_2 and SO_2 emissions were reduced by 45 % and 90 % respectively, by replacing an old coal fired boiler plant by a straw fired boiler plant. In the municipality of **Muhu (EE)** the CO_2 emissions from combustion were reduced by 900 tons CO_2 per year by replacing the old coal fired boiler by a biomass boiler firing woody biomass, wood chips, brushwood and coppice.

Different strategies to reduce GHG emissions have been adopted on the island of **Rügen (DE).** Rügen is a popular resort for tourists in Germany and has to grapple with a high traffic volume especially in the summer. The project's strategy focuses inter alia on the reduction of the individual traffic and the improvement of the public transport system as well as the operation of public transport with biogas driven buses. The Regional Development Concept of Rügen follows

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the idea of the development of sustainable tourism, meaning the connection of climate protection targets with rural end economical development.

However, in most of the showcases GHG emission reduction is not measured or calculated at all or only for the conversion step of the bioenergy chain, meaning by comparing emissions from the old boiler with the emissions from the new biomass fired boiler. To control the success in reducing GHG emissions by switching from fossil fuels to biomass the whole supply chain should be considered, including production, extraction, transport and conversion of the biomass. For the production step of biomass GHG emissions are negligible when industrial wastes or by-products and residues from agricultural or silvicultural production are used. A more sophisticated approach to assess GHG emissions can be learned from the **City of Växjö (SE)**. Every year, there is made an energy balance and a CO_2 inventory, in order to follow-up the energy and climate goals of the city. The input to the energy balance is statistics from national agencies, local energy companies etc., mixed with estimations on the development for some energy sources. All of this generates an energy balance including 16 energy sources, which are then calculated into emissions of CO_2 equivalents. However, the other GHG are not measured locally.

For evaluating climate mitigation efficiency not only direct emissions from production, transportation and conversion of biomass should be considered. CO_2 emissions from carbon stocks in soils should also be taken into account. Soils act as a sink of CO_2 which may be released when management practices are changed (e.g. bioenergy production on land previously used as grassland). For example, GHG emissions for bioethanol production from wheat in Europe could increase by 26.2 CO_2 equivalents if going along with direct land use change[22]. Indirect land use changes, meaning the displacement of the previous agricultural production to other areas can further increase GHG emissions of a bioenergy system.

The showcases almost completely rely on silvicultural and agricultural residues or waste streams as biomass sources, and direct or indirect land use change was not an issue to be addressed by policy. Another reason for this is that most of the showcases were realized several years ago, when this was not a current topic. However, by following the PEFC or the FSC

[22] Cf. the German Biofuel Sustainability Ordinance. (Entwurf einer Verordnung über Anforderungen an die nachhaltige Erzeugung von Biomasse zur Verwendung als Biokraftstoff (Biomasse-Nachhaltigkeitsverordnung)). http://www.clearingstelle-eeg.de/files/private/active/0/BioNachV_Entw.pdf

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standards for silvicultural production carbon stock changes are considered indirectly e.g. in **Eno (FI)**, **Kaunas (LT)** and **Hadeland (NO).**

4.3 Land Use

Principle according to findings of Bioenergy Promotion:
(1) Natural resources, such as soil, water and land, shall be used efficiently and biomass production or extraction shall not endanger soil status or cause further deterioration of water quality and quantity.
(2) […] bioenergy production shall not endanger food security or production of biomass for other purposes.

An increased use of biomass for energy purposes can jeopardize other uses of biomass. An increased use of wood for energy production for example may compete with the production of timber and, more severely, other wood based products such as paper, cardboard and chipboard. Conflicts between the expansion of biomass production for energy purposes and the production of food and fodder can occur in agricultural areas. These conflicts of goals can be solved by preferring wastes, residues and by-products from agricultural or silvicultural production and related industries or by preferring fallow or marginal land for biomass production. To avoid such conflicts, the authorities of **Daugavpils district (LV)** decided to use pellets from saw dust for the small scale district heating systems in the municipalities, which can be regarded as a waste from timber industry. The wood used in the wood fired boiler of the district heating system of **Nowa Dęba (PL)** is supposed to come from an energy willow plantation. A pilot project on the development of an energy willow plantation was initiated and adopted by the local government as a part of the program for the new district heating system for the city of Nowa Dęba. The willow plantation was established during 2001-2003 on an area of 60 ha on fallow lands. The increase of the willow plantation up to 200-300 ha is planned in order to cover about 80-90 % of needs for the biomass fuel for the district heating plant. Sludge from the municipal sewage treatment plants is used for fertilizing the willow plantation. In **Przechlewo (PL)** the straw which is used for the biomass boiler plant of the municipality is surplus straw from agricultural production of the municipality, which was burnt on the fields before. The wood used in the district heating boiler plant of **Muhu municipality (EE)** comprises wood residues (brushwood, coppice, cutting residues collected from local farmers) which cannot be used for other purposes. Also in **Norway** much of the increase in bioenergy is based on logging residues (mainly branches and tops), but

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also from tending of young stands and early thinning. In addition new areas, like edge zones in the agricultural landscape and areas under power lines can be utilized to produce woody biomass for energy purposes. These are resources not being utilized today.

A completely different concept to avoid land use conflicts has been applied by **Kaunas County (LT)**. Kaunas started a project to use gas from landfill as a part of its energy mix. The project developer and owner is a privately owned company, UAB Ekoresursai. A landfill gas extraction system at the landfill, including extraction, gas cleaning, pumping and flaring components was constructed. A combined heat and power (CHP) plant with an electrical capacity of 1.1 MW_{el} and heat capacity of 1.4 MW_{th} was installed. A 12 km pipeline connection has been constructed between the landfill and the CHP unit, which is used as heating source in nearby Domeikava settlement. Natural gas is being used as a support fuel in the gas engine. The flaring system will be used when the engine is not running and for safety reasons. The Lapes Landfill Gas Utilisation project achieves GHG emissions reduction through the avoidance of methane emissions from the landfill and the displacement of CO_2 from heat and electricity production.

The island of **Rügen (DE)** which is surrounded by the Baltic Sea discovered in a potential study next to 7,550 tons per year (t/y) municipal bio-wastes, 2,150 t/y sewage sludge and 900 t/y wood from landscape management another so far unexploited biomass source. About 2,000 tons of sea weed and algae become washed up to some beach sections every year and could be used as a co-substrate in biogas plants. Small scale experiments were conducted in co-operation with the University of Hannover and showed positive results. The work in Rügen is focusing now on finding an investor to start a pilot project.

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4.4 Energy Efficiency

Principle according to findings of Bioenergy Promotion:
(1) For a sustainable production and use of bioenergy the energy balance shall be considered, and the use of fossil energy sources during production of bioenergy should preferably be avoided.
(2) Input energy shall be minimized throughout the whole production chain and be distributed and accounted for all products (main and co-products) based on an average product value proportion basis.

Given that in many cases more energy is needed to produce bioenergy than generated at the end, special attention should be paid on energy efficiency of bioenergy projects. Energy efficiency can be assessed by different concepts, e.g. cumulative energy demand, energy yield ratio, petroleum energy ratio, energy conversion efficiency and energy end use efficiency. Most showcases considered energy conversion efficiency and energy end use efficiency. Conversion efficiency can be increased by switching to new and efficient boiler plants for district heating or to co- or poly-generation plants where the surplus heat is used. Further energy efficiency measures include the reduction of heat losses during the transportation of heat to the end users and the reduction of final energy consumption.

In order to increase energy efficiency of the bioenergy system the municipality **Nowa Deba (PL)** renewed its pipe network in combination with the modernization of the boiler plant. Moreover, thermal insulation of public buildings was performed in order to reduce heat losses. **Kaunas County (LT)** implemented the same measures and supported the renovation of approx. 20 multi-storey residential houses in Kaunas City and 4 schools will be renovated during the years 2009-2012. The replacement of heating networks and the installation of heat substations allowed to switch from a 4 pipe to a 2 pipe network, which considerably reduced heat losses during transportation due to reduction of the surface of the pipes. By this, a reduction of thermal energy losses in the pipelines from 23.5 % to 17.5 % should be achieved. The city of **Växjö (SE)** focussed on energy efficiency in the new Energy Plan developed in 2010. Practical implementation has been for example that the buildings constructed by the municipal housing companies in the last five years have had stronger targets on energy demand. Passive houses have also been built. When the municipality sells land to companies who want to exploit the land for constructing buildings, there are restrictions in the sales contract stipulating that new buildings must use less than a certain amount of energy per m^2 and year. The effects in the new houses are

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measured. Also the annual energy balance gives an idea of the development in energy use. Compared to 2002, when the energy use per capita was highest, the energy use per capita has been reduced by 11 % in 2010. In order to increase the energy conversion efficiency of the bioenergy systems, the island of **Rügen (DE)** focuses in its strategy on an efficient use of waste heat from biogas installations.

Information and education as well as awareness rising among the local population can also contribute to a more efficient use of energy. The municipality of Röbel located in the region **Mecklenburgische Seenplatte (DE)** used such instruments and tried to set a good example by starting a project regarding energy saving in municipal facilities. Municipal facilities were analysed from a technical point of view as well as the user dependent behaviour regarding energy use. Based on this analysis the staff should be trained regarding energy efficiency and energy saving. The new founded consumer advice centre shall furthermore inform locals concerning bioenergy and energy saving. The employment of the mutual climate specialist/adviser for the three municipalities within the project BIOREG **Hadeland (NO)** has been aimed also towards awareness raising among the population. One of the tasks of the climate advisor is to target both the local population and the local businesses inspiring them to reduce their energy consumption and change to renewable sources.

4.5 Social Aspects

Principle according to findings of Bioenergy Promotion:
(1) Bioenergy production should not endanger the conservation of cultural remains and heritages or prosperity of local communities and cultures. […]
(2) Local acceptance and avoidance of conflicts should be reached through regional and local planning instruments, and preferably comprise multi-stakeholder dialogues.
(3) Bioenergy production should be carried out with consideration to local communities and cultures.
(4) Biomass production should not violate the basis of existence for the indigenous population

The planning and implementation of bioenergy projects may raise fears, skepticism or conflicts of interest among the local community which, if remained unsolved/unconsidered, can jeopardize their success and sustainability. There may be doubt if the odour will increase due to a new biogas installation close-by or residents fear the noise of the co-generation plant around the corner. Taking fears and doubts serious, well-directed information and the inclusion of all

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stakeholders into the decision making processes (multi-stakeholder-dialogues) will help to avoid conflicts. Information of the inhabitants about the ongoing activities is one of the most important cornerstones leading to the success of a project and in almost all selected showcases such measures were taken.

The employment of the mutual climate specialist/adviser for the three municipalities within the project BIOREG **Hadeland (NO)** acting as contact person for all questions about bioenergy and environment/climate protection was an important step. However, Hadeland still accentuates the need for more information and competence about bioenergy among consumers, producers and entrepreneurs but also financing institutions.

In the two Polish municipalities **Nowa Dęba and Przechlewo (PL)** all plans and decisions important for the municipality were subject of public consultation. Such measures are not only suitable for information dissemination, but inhabitants get directly involved into the decision process and conflicts, fears and doubt become obvious in the early stage of the project and may be resolved immediately in a long term perspective. However, such a measure seems only to be working for small municipalities with a manageable number of inhabitants. The creation of environmental education centers, the introduction of environmental and ecological education in school programs, the arrangement of competitions or other events on environmental protection topics as well as editing and dissemination of information material are other strategies used in Nowa Dęba and Przechlewo to raise awareness and inform inhabitants.

Before starting its activities, the region **Mecklenburgische Seenplatte (DE)** conducted an acceptance study. An acceptance study is a survey among the inhabitants about their attitude to bioenergy. The results of the study showed a positive attitude of the inhabitants regarding the use of renewable energy from their region, as long as no increases in energy prices take place. Hence, such a study can give early signals about the potential success of bioenergy projects and identify critical issues or fears. A regional consultancy for bioenergy in agriculture and forestry, a mobile offering information and education about sustainable energy use (ANU-Mobil), as well as a teacher's regular table discussing bioenergy issues also help to reach all stakeholders. The region **Mecklenburgsiche Seenplatte** as well as the island of **Rügen (DE)** created a website informing locals but also interested stakeholders beyond about the progress of the activities. Rügen informed about its activities towards a bioenergy-region with events like the Climate Day

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2010; RÜGANA 2010, the Harvest Festival 2010 and the Wood and Energy Exhibition Putbus 2010.

4.6 Local Prosperity

Principle according to findings of Bioenergy Promotion:
Bioenergy production, extraction and use should contribute to an increase in rural activity and to the development of viable business and security in energy supply.
(1) Activities shall have generally positive effects on social welfare and accessibility to rural areas.
(2) Development of local energy systems that enable combinations of different renewable energy sources shall be encouraged.
(3) Bioenergy systems should preferably give positive effects on local economy.

The promotion of bioenergy is, especially in rural areas, often linked up with expectations like the creation of new jobs or at least the maintenance of the job level in the region, the creation of new income opportunities and future perspectives for young locals to stop migration, in short, to positively affect the value added chain in the sub-region. One example for successful realisation is the municipality of **Eno (FI)**. According to its Natural Resource Strategy from 1997 the municipality invested in a new district heating plant based on wood chips from nearby forests. The forests in the region are mostly owned by private forest owners, who should provide wood chips to the heating plant. The basis of the economical success of the bioenergy project was the foundation of the Eno Energy Cooperative (EEO) by the forest owners and the contract between the EEO and the municipality which regulated the operation of the plant by the EEO and the purchase of the heat by the municipality. In the first step, the thermal energy was used to heat public buildings like municipal office buildings, health centres and gyms. The EEO was responsible for the whole biomass production chain from harvesting, transportation and chipping of the wood to storage and combustion. In general, the Finnish municipalities have been privatizing the municipal heating service since the early 1990s and played a key role to promote and establish the so-called heat-entrepreneurship (for heating public buildings)[23]. Nowadays, two more heating plants were built and operated by the EEO cooperative, which has

[23] Okkonen, L.; Puhakka, A.; Suhonen, N. (2005) Management models of heat energy entrepreneurship in Finland. 14th European Biomass & Bioenergy Conference and Exhibition Proceedings. Paris, France.

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44 members by now. The heat is not only sold to the municipality but also to private housing. The wood energy heating resulted in saving 4 million kg CO_2 annually and it replaces about 1.8 million litres of oil per year. About 1.4 million Euros (2010) were saved by the local economy. Switching to local energy sources created jobs for more than 20 persons. Moreover, the local energy source brings safety and independence in times of a possible energy crisis.

The reconstruction of district heating systems towards the use of wood pellets instead of heavy fuel oil and coal in the municipalities of **Daugavpils district (LV)** allowed to reduce heat tariffs after some years and secured the survival of the district heating system and better comfort conditions in apartment houses. However, since residues from forest like saw mill pellets are used which are produced by big companies not located in the surrounding, the biomass for the district heating plants mainly comes from other places and not from local suppliers. Consequently most of the profit from bioenergy production leaves the region.

By ensuring that all biomass needed for the wood chip fired boiler plant is collected from the own territory of the municipality of **Muhu (EE)**, 15 new jobs were created and rough calculations indicate total saving of 32,000 € per year for the municipality compared to the old fossil fuel driven district heating system. The city of **Växjö (SE)** recognized that at the same time as there was a 34 % reduction of CO_2 emissions per capita, the GDP (gross domestic product) per capita has increased by 70 %. It is very difficult to say anything how much these two figures are related. Important is to show that it is possible to have increased economic growth and reduced environmental impact at the same time. In **Hadeland (NO)** the reduction in demand for paper production has raised many concerns. But the activities in the bioenergy sector attracted a number of private investors to the region that may contribute to set stability in the production market in the future. In the early 1990's two companies were established in the region aiming to produce heat (Økovarme-1996-2002) and biofuel (Habiol - 1994).

The island of **Rügen (DE)** follows the strategy to connect its activities on the bioenergy sector with its most important business sector - tourism. The concept of a sustainable tourism should attract more tourists and strengthen local economy and at the same time reduce its environmental impact. Moreover, in Rügen an analysis of added value will be done by the German Biomass Research Centre (DBFZ), Leipzig, in order to investigate whether networking and activities in the bioenergy sector was creating value.

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5 Synopsis – Policy Lessons and Recommendations for Sub-Regional Policy Makers

From the work with the policy showcases selected within the INTERREG project *Bioenergy Promotion* and discussions between the partners, the following policy lessons and recommendations can be drawn for local policy makers aiming to promote sustainable bioenergy production and use.

5.1 Lessons Learned from the Sub-Regions on how to Promote Sustainable Bioenergy Production and Consumption

•For the initiation and implementation of bioenergy projects it is important to have one or several committed "drivers". Local administrative bodies may assume this role and act as "leaders by example".

•Besides initiating bioenergy projects themselves, local administrative bodies can be pro-active and if not the initiators themselves, they should encourage and motivate other actors/initiators and facilitate networking among stakeholders. This requires well trained and competent staff in the field of bioenergy in public institutions.

•There is need for mentoring and exchange of good practices between the (sub)-regions and countries. Official visits by the stakeholders from less developed regions in terms of bioenergy to more developed ones are important to have clear demonstration effects.

•The showcases indicate that there is no single successful policy instrument to promote sustainable bioenergy production and consumption. The way to success is rather to have a policy mix of different mutually reinforcing national and sub-regional instruments.

•Biomass potential studies are necessary steps to get a realistic assessment of the energy which can be provided from biomass and to discover unused biomass sources. A strong involvement of relevant stakeholders like the suppliers of biomass could further help to estimate available biomass resources. The biomass potential study should consider scenarios

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which take into account principles for sustainable biomass production and other national or regional biodiversity targets and environmental goals.

•Moreover, a SWOT (Strengths, Weakness, Opportunities, Threats) analysis helps to discover conflict potentials in the region which may arise from bioenergy promotion and to identify fields of action.

•Depending on the institutional framework of each country, municipal and regional policy makers and authorities have multiple levels to promote sustainable bioenergy production and consumption and integrate sustainability principles and criteria into policy making. Spatial planning, urban planning, and permitting of bioenergy facilities are among the responsibilities often allocated to regional and municipal authorities enabling them – within the scope of their legal possibilities – to steer biomass production and supply or siting of bioenergy facilities in a sustainable way. Through municipal utility ownership and public procurement local actors can directly integrate sustainability principles. Regional and municipal governments and authorities might consider sustainability principles and criteria into their own support schemes or enter into voluntary agreements with energy supply companies referring to sustainable procurement of biomass or bioenergy production.

•In many BSR countries sub-regional and municipal governments are (co)-owners of local energy supply companies and hence can exert direct influence on sustainable bioenergy production. As owners of public buildings they are strategic consumers of electricity, heat and transport fuels. Hence, municipal ownership of energy supply companies and sustainable public procurement can be effective tools enabling local authorities to promote sustainable (bio-) energy systems.

•Public private partnerships and other innovative businesses, organizational and financing models can help to overcome financial restrictions.

•Some of the showcases illustrated that renovation and retrofitting of buildings and of the pipe network, as well as the use of waste heat help to save energy and increase the overall energy efficiency of the bioenergy system

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•Promoting networking and clustering of stakeholders is an essential task for sub-regional governments, provided that some bioenergy structures already exist. Active networking brings together producers, suppliers and consumers of bioenergy and helps to create efficient and sustainable bioenergy chains.

•Bioenergy projects are most successful if they are supported by the local population. The information and integration of the public at an early stage of the planning phase of bioenergy project is therefore urgently needed. Suitable instruments are public consultation, surveys, days of action or the edition and dissemination of information material.

5.2 Recommendations for the Promotion of Sustainable Bioenergy Production and Consumption on the Sub-Regional Level

• Make the promotion of sustainable bioenergy production and consumption an integral element of the energy or development strategy of your region. This strategy should, next to sustainable bioenergy production and consumption, prioritize energy saving measures to reduce overall energy demand at first. The "best" energy is that which is not used and which therefore has not to be generated!

• As an early signal local governments should set clear but realistic policy targets and disseminate examples of best practices.

•Support the development of biomass potential studies taking into account sustainability principles and criteria and combine those assessments with SWOT analysis (Strengths, Weakness, Opportunities, Threats) to discover conflict potentials in the region which may arise from bioenergy production and identify fields of action. The SWOT analysis should be dynamic in nature to take into account a change in circumstances.

• Biomass potential studies and the SWOT analysis should be used, to define achievable, realistic and measurable targets for the sub-region or municipality. Integrate targets into local development plans or strategies. Targets need to take into account sustainability constraints. A strong involvement of local authorities is needed to give the strategy related to the

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bioenergy development a binding character. MUNICIPALITIES THAT WORK DETERMINED REACH GOALS!

•Integrate sustainability principles into local planning and action. For being sustainable the bioenergy project should contribute to reduce lifecycle GHG emissions, be energy efficient, avoid land use conflicts, be accepted by local population and contribute to local welfare. Sustainability principles, especially GHG emissions and energy efficiency, should be considered along the full life-cycle of bioenergy.

•Act as a leader by example and establish energy monitoring and management systems for public buildings and properties and where appropriate use municipal ownership and public procurement as tools to directly promote sustainable bioenergy supply.

•Prioritize the use of residues and by-products from silvicultural and agricultural production and related industries. This provides the chance to effectively reduce GHG emissions, to avoid land use conflicts, to improve the efficiency of the system and to purchase biomass at reasonable prices.

•Promote the use of regional biomass sources which has the advantage that value creation is kept within the region and that transport routes are shortened. This also contributes to close nutrient- and substance cycles, being cornerstones of sustainable bioenergy systems.

•Support the development of business models and financing concepts which increase (sub-) regional added value and extend the value chain (public-private partnerships, energy supply contracting, heat entrepreneurship).

•Wherever feasible, promote concepts which enable multiple and integrated uses of biomass (at first as food, fodder or material, at least energetic use).

•Inform and involve the public at an early stage of the planning phase of the bioenergy project and use communication tools such as public consultations, surveys, days of action or the edition and dissemination of information material.

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•Offer and promote advisory services for forest owners and farmers on sustainable biomass production systems.

•Make sure that relevant sectors and stakeholders of the local economy and the corresponding administrative units (e.g. forestry, industry, waste management, tourism) are effectively interlinked to promote production and consumption of bioenergy. Establish cross-departmental working groups and coordinating units in the administration (e.g. network manager, cluster manager, renewable energy offices/agencies/network points).

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