



The Baltic Bioenergy Promotion Project
#018 Bioenergy Promotion

WP3 Policy
Task 3.2

Sustainable bioenergy production:

Comparative analysis of sustainability initiatives and certification systems



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2 Introduction

The project Bioenergy Promotion is a part of Baltic Sea Region Program 2007-2013 and co-financed by the European Union and the Government of Norway. Bioenergy Promotion aims to strengthen the development towards a sustainable, competitive and territorially integrated Baltic Sea Region in the field of production and use of bioenergy. The project will serve as a platform for cross-sectoral and transnational networking to facilitate information and knowledge exchange, coordinated policy development and design and application of bioenergy promoting instruments as well as regional development.

The project is coordinated by the Swedish Energy Agency and it consists of 33 partners from ten countries (Belarus, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland and Sweden).

The overall objective of the work package 3 “Policy” is to assess existing policies from a sustainability point of view and support development of coherent regional, national, sub-regional and municipal policy measures promoting the sustainable supply and use of biomass for heating and cooling purposes, electricity generation, and as a transport fuel. In the task 3.1, led by the Swedish Board of Agriculture, sustainability criteria for all types of bioenergy and a respective guidance report¹ for reaching sustainable systems for bioenergy production in the Baltic Sea Region were commonly developed. These outputs serve as a basic reference for this evaluation report. Existing sustainability initiatives and certification systems are compared with the requirements for a sustainable bioenergy production worked out in the task 3.1.

3 Analysis

In this chapter the certification systems presented in the first report “Identification and description of sustainability initiatives and certification systems in the BSR” are compared to the criteria formulated in the project Bioenergy Promotion. The aim is to find the differences and formulate recommendations how to improve existing certification systems and sustainability criteria. Only PEFC is not included in this analysis, because the PEFC-criteria are country specific.

During the last year the Swedish Board of Agriculture led the work in task 3.1, which resulted in a document that serves as guidance for reaching sustainable systems for bioenergy production in the Baltic Sea Region and possibly beyond. The work was closely linked to the sustainability criteria developed in the frame of a Nordic Council project “Sustainable Production of Bioenergy from

¹ Bioenergy Promotion, *Sustainable bioenergy production - Defining principles and criteria*, WP3 Policy Task 3.1 (2010).

Agriculture and Forestry in the Nordic Countries”² and the Renewable Energy Directive 2009/28/EC. Two workshops were organized, one in Jönköping, Sweden, in May 2009 and one in Helsinki, Finland in November 2009, the first one involving external experts. The workshops’ group discussions and open round table discussions resulted in suggestions for principles and criteria. Subsequently, drafts have been circulated and commented on by e-mail. The principles and criteria developed in the document can be used when planning and developing strategies for sustainable production of bioenergy and the EU Member States can use the report as an orientation to optimize their support schemes on a voluntary basis. Besides principles and criteria indicators for compliance are suggested. The indicators are used to provide information on trends and developments and whether or not the principles are fulfilled.

The BP criteria cover six areas, which are affected by the bioenergy production and for which principles were formulated. These areas comprise biodiversity, resource efficiency, energy efficiency, climate mitigation efficiency, social aspects and economic issues. In the following sections the criteria of the analysed systems are compared to the criteria developed in the Bioenergy Promotion project.³

3.1 Biodiversity

The United Nations Environment Programme (UNEP) defines biodiversity as “variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”.⁴ UNEP has formulated the core objectives of biodiversity to be the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of the genetic resources⁵. The negative effects for biodiversity can be both direct and indirect⁶. The direct effects can be for example that intact ecosystems and areas with high biodiversity values are converted into production areas. Indirect

² Sustainable Production of Bioenergy from Agriculture and Forestry in the Nordic Countries, project launched by the Swedish Forestry Agency and the Swedish Board of Agriculture and sponsored by the Nordic Council of Ministers.

³ The analysed standards are:

Better Sugarcane Initiative, *Better Sugarcane Initiative Production Standard: July 2010* (July 2010); Forest Stewardship Council, *FSC International Standard: FSC Principles and Criteria for Forest Stewardship*, FSC-STD-01-001 (Version 4-0) (Approved 1993, amended 2002), International Sustainability and Carbon Certification, *ISCC 202 Sustainability Requirements for the Production of Biomass*, ISCC Draft 10-01-19 V 1.13 (2010a); Nordic Ecolabelling, *Swan-labelling of Biofuel pellets: Version 2.0 - 13 December 2007-31 December 2012* (13 December 2007); Nordic Ecolabelling, *Nordic Ecolabelling of fuels: Version 1.1 -- 25 June - 31 December 2011* (8.6.2009); Jacqueline Cramer et al., *Testing framework for sustainable biomass: Final report from the project group "Sustainable production of biomass"* (March 2007); Roundtable on Sustainable Palm Oil, *RSPO Principles and Criteria for Sustainable Palm Oil Production* (October 2007); Roundtable on Sustainable Biofuels, *RSB Principles and Criteria for Sustainable Biofuel Production: Version 1.0*, RSB Reference Code: RSB-STD-01-001 (23.02.2010); Round Table on Responsible Soy Association (RTRS), *RTS Principles and Criteria for Responsible Soy: Field Testing Version* (28 May 2009); SEKAB, *Verified sustainable ethanol - Requirements for sustainable ethanol*.

⁴ United Nations Environment Programme (UNEP), *Convention on Biological Diversity* (Treaty), 5 June, 1992., Article 2

⁵ See above, Article 1.

⁶ Cramer et al., *Testing framework for sustainable biomass.*, p. 9.

effects mean secondary impacts of some actions, e.g. if roads and other infrastructure are built for harvesting biomass and they make it possible for immigrants to move in and cultivate the land⁷.

The first principle of the criteria formulated by the project Bioenergy Promotion is:

Principle:

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.

Criteria:

- i. Biomass production or extraction shall have neutral or positive effects on biodiversity at the landscape level
- ii. Biomass production or extraction can only be performed in protected areas or areas with high conservation values if it is part of a management plan to protect biological values
- iii. The integrity of relevant ecosystems and habitats for rare and endangered species shall be maintained
- iv. Alien species shall be cultivated under conditions of careful control and monitoring to avoid unintended dispersal
- v. Biomass plantations shall, preferably, be located and designed to contribute to a varied landscape
- vi. Biomass extraction shall, if possible, be conducted in relation to other management practices in the landscape so as to sustain or enhance biodiversity, for example by avoiding unnecessary disturbance and the creation of refuges
- vii. Buffer zones or vegetation filters between biomass production areas and waters and wetlands shall, if needed, be used to reduce the risk for damage on water and near water zone qualities

In all of the analysed initiatives biodiversity is a key issue considered.

Initiative	Biodiversity	Reference Date
Bioenergy promotion	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	No reference date
BSI	4.: Actively manage biodiversity and ecosystem services (one of indicators: percentage of areas defined internationally or nationally as legally protected or classified as High Conservation Areas planted to sugarcane after the cut off date of 1 January 2008 standard: 0) BSI EU: 6.2 To protect land with high biodiversity value, land with high carbon stock and peatlands	1 January 2008

⁷ Sampo Soimakallio, Riina Antikainen, and Rabbe Thun, *Assessing the sustainability of liquid biofuels from evolving technologies*, VTT Tiedotteita - Research Notes 2482 (VTT Technical Research Centre of Finland, 2009), p. A20.

FSC	<p>P 6: Environmental impact - Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.</p> <p>P 9: Maintenance of high conservation value forests - Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.</p>	No reference date
ISCC	Principle 1: Biomass shall not be produced on land with high biodiversity value or high carbon stock and not from peat land. HCV areas shall be protected.	January 2008
Swan pellets	If virgin raw materials are used to manufacture the pellets, the pellets manufacturer must ensure that raw materials do not originate from forest environments meriting protection due to their high biological and/or social value.	No reference date
Swan fuels	R8: The licence holder must: (...) -ensure that the raw material does not originate in areas in which biodiversity or values worthy of protection for social reasons are under threat.	No reference date
Cramer Commission	Principle 4: Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity.	1 st of January 2007
RSPO	Principle 5: Environmental responsibility and conservation of natural resources and biodiversity	November 2005 (Criterion 7.3: New plantings since November 2005, have not replaced primary forest or any area required to maintain or enhance one or more High Conservation Values)
RSB	Principle 7: Biofuel operations shall avoid negative impacts on biodiversity, ecosystems, and other conservation values	1 st of January 2009 Standard for EU market access 1 st of January 2008

RTRS	P 4: Environmental responsibility 4.4 Conservation and compensation of native vegetation -local peoples' lands	4.4.1 Expansion for soy cultivation during field test period may not take place on land cleared of native habitat after May 2009. Exception: Producers who want or plan to clear native habitat after the cut-off date of May 2009 must produce scientific evidence from a comprehensive and professional third-party assessment of the area concerned that identifies the absence of : -all primary forest -other High Conservation Value Areas (HCVAs)
SEKAB	Zero tolerance for felling of rain forest	No reference date
RES Directive	Article 17.3 Biofuels and bioliquids (...) shall not be made from raw material obtained from land with high biodiversity value (...).	January 2008

The RES Directive requires that the raw material for biofuels shall not be obtained from land with high biodiversity value, and defines primary forest, protected areas and highly biodiverse grasslands as such areas. RSPO states that the conservation of rare, threatened or endangered species and high conservation value habitats has to be taken into account and new plantings are not allowed on areas required to maintain or enhance primary forest or HCVs. Cramer Criteria, RTRS, BSI, FSC and ISCC all require that biomass production does not lead to destruction or damage of such areas. Swan standard requires raw material which does not originate in areas in which biodiversity or values worthy of protection for social reasons are under threat. SEKAB shows no tolerance for felling of rain forest and refers to the Brazilian national laws, which require (in other than rain forests) the replanting of 25 new trees for every tree cut down.

The Bioenergy Promotion criteria states that "biomass production or extraction can only be performed in protected areas or areas with high conservation values if it is part of a management plan to protect biological values", but does not define what are high conservation values. Cramer Criteria, RTRS, RSPO and BSI refer to the six main types of HCV areas of HCV Resource Network⁸, based on the

⁸ HCV Resource Network, *The High Conservation Values*, Webpage (2010), <http://www.hcvnetwork.org/site-info/The%20high-conservation-values-folder>.

definition originally developed by the Forest Stewardship Council for certification of forest ecosystems, but now increasingly expanded to apply to assessments of other ecosystems. ISCC uses its own definition, which is based on the definitions in the Article 17.3 of the RES Directive 2009/28/EC and §4 to 6 of the German Biomass-electricity-sustainability ordinance (BioSt-NachV). Also RSB uses its own definition, but has also, like BSI too, adopted the definition of the RES Directive for its standard for EU Market Access.⁹

The Bioenergy Promotion criteria do not set a cut-off date for conversion of high biodiversity areas. The analysed certification systems differ in their reference dates: while Swan, FSC and SEKAB have set no cut-off- dates, BSI and ISCC follow the requirement of the RES Directive and have set the reference date to January 2009. RSB sets two dates: in the basic criteria “no-go-areas” shall not be converted after the 1st of January 2009 and in the standard for EU market access land with high biodiversity value should not be used for primary production of biomass for biofuels/bio liquids after 1st of January 2008.

3.2 Resource efficiency

In the definition of the Nordic Council of Ministers for sustainable production of bioenergy from agriculture and forestry, resource efficiency “means high biomass production per hectare, high utilization of existing residues and by-products, minimization of waste production and efficient nutrient recycling”.¹⁰ To maintain the high biomass production it is necessary to preserve or even improve the quality of the environment, but the production and processing of biomass for bioenergy can have negative impacts on soil, water and air. Irrigation of agricultural areas can lead to water scarcity, lowering the water tables and water level in rivers and lakes, and to salinisation of the fields. Use of fertilizers and pesticides can pollute surface and ground water. The competition between different uses of water and land between agriculture, urban land use and nature can cause social conflicts.¹¹ Monocultures, especially of arable crops requiring annual tillage, are typically associated with high rates of soil erosion and intensive cultivation depletes soil nutrients and requires energy-intensive fertilisers to maintain year-on-year yields.¹²

The principle of the project regarding resource efficiency is:

Principle:

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.

⁹ Roundtable on Sustainable Biofuels, *RSB Standard for EU market Access: Version 1.0*, RSB Reference Code: RSB-STD-11-001 (15.06.2010).

¹⁰ Nordic Council of Ministers, *Report from the project: Sustainable Production of Bioenergy from Agriculture and Forestry in central/eastern Nordic Countries*, p.5.

¹¹ Uwe R. Fritsche et al., *Sustainability Standards for Bioenergy* (WWF Germany, 2006)., p.19

¹² International Risk Governance Council, *Policy Brief: Risk Governance Guidelines for Bioenergy Policies* (Geneva, 2008), p.29.

Criteria:

- i. Methods shall be chosen to minimize the risk for permanent physical damage to the soil
- ii. Methods that cause a net depletion (after compensatory measures) of humus, nutrients and minerals in the soil below levels necessary for the maintenance of the long-term soil production capacity shall be avoided
- iii. Nutrient rich waste products and co-products should preferably be recycled
- iv. Residues from forestry and agriculture should be used for energy production or other purposes
- v. Biomass production and extraction shall be conducted in a way that prevents further deterioration, for example by erosion or nutrient leakage, and protects (or enhances) the status of aquatic ecosystems
- vi. Water shall be used efficiently without endangering water supply
- vii. Land shall be used efficiently, and practices that optimize productivity shall be used
- viii. The use of the land should be optimized through locating, managing and designing the production in the best suitable way and where synergistic effects are at the best

Initiative	Resource Efficiency
Bioenergy promotion	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.
BSI	5.3 To continuously improve the status of soil and water resources
FSC	<p>P 5: Benefits from the forest - Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.</p> <p>5.5 Forest management operations shall recognize, maintain, and, where appropriate, enhance the value of forest services and resources such as watershed and fisheries</p> <p>P 6: Environmental impact - Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.</p>
ISCC	Principle 2: Biomass shall be produced in an environmentally responsible way. This includes the protection of soil, water and air and the application of Good Agricultural Practices
Swan pellets	Not covered
Swan fuels	Not covered
Cramer Commission	<p>Principle 5: In the production and processing of biomass, the soil, and soil quality must be retained or even improved</p> <p>Principle 6: In the production and processing of biomass ground and surface water must not be depleted and the water quality must be maintained or improved</p>
RSPO	<p>Criterion 4.2: Practices maintain soil fertility at, or where possible improve soil fertility to, a level that ensures optimal and sustained yield</p> <p>4.3 Practices minimise and control erosion and degradation of soils</p> <p>4.4 Practices maintain the quality and availability of surface and ground water</p>

RSB	<p>Principle 8: Biofuel operations shall implement practices that seek to reverse soil degradation and/or maintain soil health</p> <p>Principle 9: Biofuel operations shall maintain or enhance the quality and quantity of surface and ground water resources, and respect prior formal or customary water rights</p>
RTRS	<p>5.1 The quality and supply of surface and ground water is maintained and improved</p> <p>5.3 Soil quality is maintained and improved and erosion is avoided by good management practices</p>
SEKAB	<p>Ecological consideration in accordance with UNICAs environmental initiative</p> <ul style="list-style-type: none"> •Protection of forests close to water areas •Protection of water resources • Program for reuse of water in industrial processes and for conservation of water quality •Implementation plan for soil conservation • Plan for reduction of environmental impacts from production
RES Directive	<p>17. 6</p> <p>Agricultural raw materials cultivated in the Community and used for the production of biofuels and bioliquids (...)shall be obtained in accordance with the requirements and standards under the provisions referred to under the heading 'Environment' in part A and in point 9 of Annex II to Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers and in accordance with the minimum requirements for good agricultural and environmental condition defined pursuant to Article 6(1) of that Regulation.</p> <p>17.7</p> <p>The Commission shall, every two years, report to the European Parliament and the Council, in respect of both third countries and Member States that are a significant source of biofuels or of raw material for biofuels consumed within the Community, on national measures taken to respect the sustainability criteria set out in Article 17.2 to 17.5 and for soil, water and air protection. The first report shall be submitted in 2012 [...]. The Commission shall, if appropriate, propose corrective action, in particular if evidence shows that biofuel production has a significant impact on food prices.</p> <p>(EC) No 73/2009 Article 6</p> <p>Good agricultural and environmental condition</p> <p>1. Member States shall ensure that all agricultural land, especially land which is no longer used for production purposes, is maintained in good agricultural and environmental condition.</p> <p>Member States shall define, at national or regional level, minimum requirements for good agricultural and environmental condition on the basis of the framework established in Annex III, taking into account the specific characteristics of the areas concerned, including soil and climatic condition, existing farming systems, land use, crop rotation, farming practices, and farm structures. Member States shall not define minimum requirements which are not foreseen in that framework.</p>

While soil conservation, sustainable water use and air pollution are mostly issues covered by national and European law and regulations and all certification systems require compliance with all applicable laws and agreements, it is nevertheless important to underline the relevance of these issues by

mentioning them among the criteria. Only the Swan standards do not have any requirement on resource efficiency. The European Directive refers to the minimum requirements for good agricultural and environmental condition from the Council Regulation (EC) No. 73/2009. These requirements apply only for raw materials cultivated in the area of the European Union. The Directive requires the Commission to report every two years to the European Parliament and the Council on measures taken for soil, water and air protection when producing biofuels in the Member States and in third countries.

In addition to soil and water which are issues of the Bioenergy Promotion criteria, air quality is a matter of concern in RSB, Cramer criteria and ISCC. BSI requires reductions of pollution and emissions and sets limits for herbicides and pesticides to minimise i.e. air contamination. RSPO requires plans to reduce pollution and emissions.

3.3 Energy efficiency

In a study by the NREL¹³ the life cycle energy efficiency is defined as “simply the ratio of fuel product energy to total primary energy:

$$\text{Life Cycle Energy Efficiency} = \text{Fuel Product Energy} / \text{Total Primary Energy}^{14}$$

It is a measure of the amount of energy that goes into a fuel cycle, which actually ends up in the fuel product. This efficiency accounts for losses of feedstock energy and additional process energy needed to make the fuel.”¹⁵

The energy efficiency should be evaluated by measuring all relevant direct and indirect energy inputs during production of biomass and conversion of energy. The crop type, how it is grown and harvested, and efficient conversion technologies influence the energy efficiency. Cascading systems, where biomass is used as material first, then as energy, enhance the energy efficiency as well as the use of waste and residues for energy production. Combined heat and power (CHP) applications reach high conversion efficiencies in conditions where both electricity and heat are utilized.¹⁶

Principle:

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.

Input energy shall be minimized throughout the whole production chain and be distributed and accounted for on all products (main and by-products) based on an average product value proportion basis.

¹³ John Sheehan et al., *Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus: Final Report* (May 1998).

¹⁴ Energy efficiency can be explained by different, but inter-related input/output concepts too: energy conversion efficiency, energy end use efficiency and cumulative energy demand/energy yield ratio.

¹⁵ *Ibid.*, p. 11.

¹⁶ United Nations Environment Programme (UNEP), *Towards sustainable production and use of resources: Assessing Biofuels* (2009).

Criteria:

- i. Residues and co-products should be used for energy or other applications in order to increase efficiency
- ii. If reuse or recycling of waste is not possible, use for energy shall be preferred over dumping
- iii. The energy input in production, extraction and conversion of biomass to bioenergy should be minimized
- iv. Efficient conversion technologies shall be used
- v. Long-distance transports of non-processed raw materials shall be avoided
- vi. Use of waste heat shall be encouraged
- vii. Combined production of heat, electricity and other products (cooling, steam) should be promoted whenever possible

Initiative	Energy Efficiency
Bioenergy promotion	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. Input energy shall be minimized throughout the whole production chain and be distributed and accounted for on all products (main and by-products) based on an average product value proportion basis.
BSI	5.4 To promote energy efficiency
FSC	Not covered
ISCC	4.2.21 Energy Efficiency 4.2.21.2 The producer can show monitoring of energy use on the farm Energy use records exist. For example, farming equipment shall be selected and maintained for optimum consumption of energy. The use of non-renewable energy sources should be kept to a minimum.
Swan pellets	R 14 Energy consumption during manufacture: The manufacture of the pellets must not consume more than 1200 kWh of primary energy per ton of pellets
Swan fuels	R7 Energy consumption: Energy consumed in the production and transport of a Nordic Eco labelled fuel must not exceed 1.4 MJ per MJ of fuel produced. Energy consumption associated with raw material production, production of the fuel and transport must be included in the calculations.
Cramer Commission	Not covered
RSPO	Principle 5.4: Efficiency of energy use and use of renewable energy is maximised
RSB	11.e.2 Progress requirements For others than small scale operators, by-products or wastes shall also be reused by the processing/production unit or transferred to other sectors whenever their use may improve the overall system's energy balance, greenhouse gas emissions, and/or economic viability without impairing the other principles and criteria in this standard

RTRS	Not covered
SEKAB	Not covered
RES Directive	Not covered ¹⁷

Energy efficiency is not covered by FSC, Cramer Criteria, RTRS, SEKAB and RES Directive. RSB comments only regarding the management of waste, that the by-products and waste shall be reused in a way, which improves the energy balance of the overall system. The requirements of the Swan-criteria for pellets apply only for the manufacture, not for the whole production chain and the criteria for fuels is very weak, the maximum energy consumption for production and transport of 1 MJ biofuels is 1,4 MJ.

Only BSI of the analysed certification systems complies with the indicator for this criterion of Bioenergy Promotion which says that “for the production of biofuels the energy input in biomass production, extraction and conversion should preferably be less than 50 % of the energy output”. BSI requires that total net primary energy usage per kg product stays under 3000 kJ/kg.¹⁸ Other analysed systems do not have any measurable indicators for energy efficiency.

3.4 Climate mitigation efficiency

The most significant source of GHG emissions caused by human activities is the use of fossil fuels. One of the aims of using and promoting bioenergy is the reduction of the emissions. The production, downstream processing and transport of bioenergy however can reduce the CO₂ emission savings. Nitrous oxide emissions from fertilizer production and application or ineffective use of by-products from bioenergy cultivation can partially offset the CO₂ neutrality of the bioenergy.¹⁹

Principle I:

GHG emissions (i.e. emissions of CO₂, CH₄ and N₂O in CO₂ equivalents) from bioenergy production and use shall be minimized.

Criteria:

- i. The GHG emission savings of the production chain - including production, extraction, conversion and transport - shall be maximized and compared to a reference scenario with fossil fuels. Both long and short term gain and losses shall be evaluated
- ii. The use of waste, residues and co-products shall be encouraged and accounted for when calculating greenhouse gas emission savings
- iii. Special consideration shall be taken to biomass production on organogenic soils

¹⁷ The recent EU COM report regarding the sustainability requirements for solid and gaseous biomass includes energy efficiency: “To stimulate higher energy conversion efficiency, MS should in their support schemes for electricity, heating and cooling installations differentiate in favour of installations that achieve high energy conversion efficiencies. (European Commission. "Report from the Commission to the Council and the European Parliament on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling" (February 25, 2010), p. 9).

¹⁸ Calorific value of ethanol according to Wikipedia 29,7 MJ/kg (<http://de.wikipedia.org/wiki/Heizwert>).

¹⁹ Fritsche et al., *Sustainability Standards for Bioenergy* (2006).

- iv. Bioenergy production that leads to a reduction of GHG emissions, for example usage of manure for biogas production, shall be promoted
- v. Bioenergy production from waste should be encouraged

Initiative	Climate Mitigation Efficiency
Bioenergy promotion	GHG emissions (i.e. emissions of CO ₂ , CH ₄ and N ₂ O in CO ₂ equivalents) from bioenergy production and use shall be minimized.
BSI	3.2 To monitor global warming emissions with a view to minimising climate change impacts
FSC	Not covered
ISCC	System basics: 4.2.3 Requirements concerning the GHG emission savings: To qualify for this certification system, the produced liquid biomass respectively biofuel must grant GHG emission savings of 35 percent
Swan pellets	R 15 Fuels influencing the greenhouse effect Fuels that are used during pellets production must produce a maximum GHG contribution of 100 kg CO ₂ per ton of pellets. The requirement covers the following processes: boiling and drying.
Swan fuels	R6 Emissions of GHG Over the course of the whole life cycle, emissions of GHG must not exceed 50 g of CO ₂ equivalents/MJ of fuel. ²⁰
Cramer Commission	Principle 1: The GHG balance of the production chain and application of the biomass shall be positive
RSPO	Criterion 5.6: Plans to reduce pollution and emissions, including GHG, are developed, implemented and monitored
RSB	Principle 3: Biofuels shall contribute to climate change mitigation by significantly reducing lifecycle GHG emissions as compared to fossil fuels
RTRS	4.3 Efforts to reduce emissions of GHG are made
SEKAB	At least 85% reduction in fossil carbon dioxide compared with petrol, from a well to-wheel perspective
RES Directive	Article 17.2 The GHG emission saving from the use of biofuels and bioliquids (...) shall be at least 35%.

²⁰ GHG emissions associated with changes in land use must not be included in the calculations. However, criterion R10 requires, that "if the cultivation of biomass has resulted in a change in land use since November 2005, any emissions of carbon must be repaid, using the fuel in question, within a period of no more than 20 years". Nordic Ecolabelling, *Nordic Ecolabelling of fuels* (2009), p.8.

GHG emissions are topics of all analysed certification systems except FSC. All other certification systems require the reduction of GHG emissions, but the system boundaries for how the gas balances are calculated, differ. For example the Swan standard for pellets covers only the processes of boiling and drying and some certification systems do not mention emissions resulting from land use change. In the following tables the criteria regarding land use change and the GHG reduction threshold value are shown.

Plants and soil are important carbon sinks and through land use change for bioenergy crop cultivation significant amounts of greenhouse gases can be released into the atmosphere. The changes in aboveground and underground carbon stocks need to be considered and included into the GHG balance calculation.

Principle II:

Biomass production shall not endanger important carbon stocks. GHG emissions caused by **land-use change** shall be low in relation to the amount of GHG emissions that can be avoided in a long-term perspective.

Criteria:

- i. Biomass (used for heating, cooling or electricity) shall only be produced on land where the loss of carbon stock caused by the land-use change can be compensated for by the accumulated GHG emission savings from substituting fossil fuels with produced biomass within a period of 20 years. Within a period of 50 years, the GHG emission savings should be at least 80 %. Emission savings from usage of co-products can also be accounted for
- ii. Land with high carbon stock such as wetlands and continuously forested areas should not be used for the production of biofuels or bioliquids if it implies a permanent change in land status

Initiative	Climate Mitigation Efficiency
Bioenergy promotion	<p>Biomass production shall not endanger important carbon stocks. GHG emissions caused by land-use change shall be low in relation to the amount of GHG emissions that can be avoided in a long-term perspective</p> <p>Biomass (used for heating, cooling or electricity) shall only be produced on land where the loss of carbon stock caused by the land-use change can be compensated for by the accumulated GHG emission savings from substituting fossil fuels with produced biomass within a period of 20 years. Within a period of 50 years, the GHG emission savings should be at least 80%. Emission savings from usage of by-products can also be accounted for.</p>
BSI	<p>Standard for indicator of Criterion 4.1: 0 % areas defined internationally as legally protected or classified as High Conservation Value Areas. Also includes soils with a large risk of significant soil stored carbon such as peat lands, mangroves, wetlands and certain grasslands.</p> <p>BSI EU: 6.2 To protect land with high biodiversity value, land with high carbon stock and peatlands (Standard: Percentage of land with high biodiversity value, high carbon stock or peatlands planted to sugarcane after the cut off date of 1 January 2008 = 0%)</p>
FSC	Not covered

ISCC	ISCC: Principle 1: Biomass shall not be produced on land with high biodiversity value or high carbon stock and not from peat land. HCV areas shall be protected.
Swan pellets	Not covered ²¹ .
Swan fuels	R10 CO ₂ -balance in the production of biomass Biomass must not be cultivated on land that binds up large quantities of carbon. If the cultivation of biomass has resulted in a change in land use since November 2005, any emissions of carbon must be repaid, using the fuel in question, within a period of no more than 20 years. This means that the total net reduction in emissions of fossil carbon achieved by replacing the equivalent fossil fuel with the fuel over a 20-year period is greater than any non-recurring emission resulting from the change in land use.
Cramer	Principle 2: Biomass production shall not be at the expense of important carbon sinks in the vegetation and in the soil
RSPO	Not covered ²²
RSB	Principle 3, Criterion 3b: Lifecycle GHG emissions of biofuel including land use change including above- and below- ground carbon stock changes
RTRS	4.3 Efforts to reduce emissions of Greenhouse Gases (GHGs) are made. (in Guidance is mentioned that “other issues which are relevant to GHG emissions are covered in other principles” e.g. Maintaining soil carbon levels criterion 5.3) 5.3 Soil quality is maintained or improved and erosion is avoided by good management practices 5.3.3 Appropriate monitoring, including soil organic matter content, is in place.
SEKAB	Field-to wheel perspective, total CO ₂ -emissions from Brazil to Sweden
RES Directive	Art. 17.4 Biofuels and bioliquids (...) shall not be made from raw material obtained from land with high carbon stock (...), namely land that had one of the following statuses in January 2008 and no longer has that status: (...) wetlands (...) continuously forested areas (...) land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 %, or trees able to reach those thresholds in situ (...).

GHG emissions through land use change are not an issue in the criteria of FSC, Swan pellets and RSPO. SEKAB calculates CO₂ according to RTFO- principles, which include the impact of land use change. RTFO (The Renewable Transport Fuels Obligation is a regulation in Great Britain which requires suppliers of fossil fuels to ensure that a specified percentage of the road fuels they supply in the UK is made up of renewable fuels and companies to submit reports on the carbon and sustainability of the biofuels).

²¹ The Swan-requirement for pellets on greenhouse gas emissions covers only the processes boiling and drying, not cultivation.

²² A working group was established in 2009, but during its meeting in November 2009 the Executive Board of RSPO delayed the greenhouse gas (GHG) criteria until its new working group comes up with the methodology in a year. Environmental Impact assessment: Assessment of above and below ground carbon storage is important but beyond the scope of an EIA (7.1).
Only “planting on extensive areas of peat soils and other fragile soils should be avoided” (7.4).

Before the RES Directive is implemented into UK law, if no information is provided (i.e. 'unknown' is reported) the calculation does not require the use of default values for land use change impacts.

The Bioenergy Promotion criteria define as a minimum requirement that compared to fossil fuels the GHG emission savings should be at least 80% for heating, cooling and electricity production and 35 % for biofuels.

Initiative	GHG reduction threshold value
Bioenergy promotion	The GHG emission savings from the production and use of biomass for heat, cooling and electricity production should preferably be at least 80 % compared to if fossil fuels had been used The GHG emission savings from the production and use of biofuels should, compared to if fossil fuels had been used, preferably be at least 35 %. From 1 January 2017 it shall be 50 % and from 2018 60 % for new plants
BSI	Global warming burden per unit mass product Field to gate emissions: Total < 0.4 t CO ₂ eq/t sugar or Total <24 g CO ₂ eq/MJ (only used if ethanol is produced) BSI EU: Total <50 g CO ₂ eq/MJ Default values and calculation method after EU Directive
FSC	No threshold value
ISCC	The produced liquid biomass or biofuel must grant GHG emission savings of 35 percent
Swan pellets	Fuels that are used during pellets production must produce a maximum GHG contribution of 100 kg CO ₂ per ton of pellets. The requirement covers the following processes: boiling and drying.
Swan fuels	Over the course of the whole life cycle, emissions of greenhouse gases must not exceed 50 g of CO ₂ equivalents/MJ of fuel. GHG emissions associated with changes in land use must not be included in the calculations. However, criterion R10 requires, that "if the cultivation of biomass has resulted in a change in land use since November 2005, any emissions of carbon must be repaid, using the fuel in question, within a period of no more than 20 years".
Cramer Commission	Indicator 1.1.1 The emission reduction of GHG amounts to at least 50-70% for electricity production and at least 30% for biofuels Indicator 2.1.1 The installation of new biomass production units must not take place in areas in which the loss of above-ground carbon storage cannot be recovered within a period of ten years of biomass production.
RSPO	No threshold value
RSB	No threshold value ²³

²³ The RSB-standard is still going through a pilot testing phase and in the standard it is stated that "during the pilot test period, not to exceed 9 months, testing will be done against minimum GHG emission reduction thresholds set at 10%, 40% and 70%. At the conclusion of the pilot test period, the initial minimum GHG emission reduction shall be set such that it is significant and ambitious"(Roundtable on Sustainable Biofuels, *RSB Principles and Criteria for Sustainable Biofuel Production.*, p. 1).

	<p>RSB Standard for EU market access: 3.6 Following the calculation of the GHG emission savings of the final biofuels/bioliquids product the final processor shall only assign one of the compliance claims (...)if:</p> <p>(...) 3.6.4. The GHG emissions savings of the final biofuels/bioliquids product are at least: 1) 35% or 2) 35% on 1 April 2013, if the production of the biofuels/bioliquids involved facilities which were in operation on 23 January 2008, or 3) 50% on 1 January 2017, or 4) 60 % on 1. January 2018, if the production of the biofuels/bioliquids involved facilities which started operation on or after 1 January 2017</p>
RTRS	No threshold value
SEKAB	At least 85% reduction in fossil carbon dioxide compared with petrol, from a well-to-wheel perspective
RES Directive	<p>Article 17.2</p> <p>The GHG emission saving from the use of biofuels and bioliquids (...) shall be at least 35%.</p> <p>With effect from 1 January 2017, the GHG emissions saving from the use of biofuels and bioliquids (...) shall be at least 50%. From 1 January 2018 that GHG emission saving shall be at least 60% for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017.</p>

ISCC and RES Directive fulfil the GHG-threshold value for biofuels with the minimum reduction of 35 %. A minimum reduction of 35 % has been recommended by the EU COM also for heating, cooling and electricity, and adopted by ISCC which is less ambitious than the Bioenergy Promotion threshold value. To avoid distortions in the market, the EU COM in its respective report, recommended for solid and gaseous biomass minimum GHG savings requirements of 35% increasing to 50% from 2017 for existing plants and 60% for new plants from 2018, being consistent with the RES Directive. The EU COM also argues that to assess the GHG performance of biomass, the LCA methodology should be extended so that conversion of the biomass fuel to electricity, heating or cooling is included in the GHG emissions calculations. For consistency, it would be desirable for similar extensions to be made to the method for bioliquids, since these are also used for the production of electricity and heat/cooling. Such an extension would, however, require amendments to Annex V of the RES Directive.

RSB has no limiting value in the basic standard, but in its EU-standard it has adopted the GHG-emission saving requirements of the RES Directive. It plans to include a GHG emissions reduction threshold value in the basic standard too, but wants to test different minimum GHG emission reduction threshold values set at 10%, 40% and 70%. When the pilot test period is concluded, the initial minimum GHG emission reduction threshold value will be set such that it is significant and ambitious.²⁴

The Cramer criteria require a reduction of 50-70% for electricity and at least 30% for biofuels and SEKAB has set the threshold value at a reduction minimum of 85%.

²⁴ Ibid., p. 11.

Swan uses absolute limits instead of relative. For pellets the emission maximum is 100 kg CO₂ equivalent for boiling and drying of one ton pellets. The GHG emissions of fuels must not exceed 50 g of CO₂ equivalents/MJ of fuel over the course of the whole life cycle. Land use change is not included into the calculation. Both do not cover the whole production chain and are not in accordance with the BP criteria.

Also BSI uses absolute threshold values and requires that the GHG emissions must stay under 50 g CO₂ eq per MJ. This fulfils the requirement of the BP criteria for biofuels (reduction of 35%), but not the requirement of reduction of 80% for heating, cooling and electricity.²⁵

3.5 Social aspects

The cultivation of bioenergy crops and production of biofuels can create jobs and improve well-being through increased income and economic vitality, but there exist also concerns regarding social aspects. Energy crop cultivation can have negative effects on local peoples' access to land and natural resources. Competition for land can lead to higher food prices and to limited availability of other products produced from biomass, e.g. cattle feed or construction material.²⁶ Failure to take account of property rights and land use issues can lead to social conflicts.

Workers' rights have to be respected and working conditions must comply with ILO standards. The use of pesticides and burning of fields can cause health risks not only for workers, but also for surrounding regions.²⁷ The bioenergy production should be carried out with consideration to local communities and cultures and it should not violate the basis of existence for the indigenous population.²⁸

Principle I:

The production and use of biomass for energy shall not endanger food security or local production of biomass for other applications.

Criteria:

- i. The production of biomass for energy shall only occur at sites where it does not threaten local/regional food supply
- ii. Negative effects of competition between energy, food, fodder and material use should be minimized
- iii. The possibilities of a secured long-term supply of biomass shall be considered and demonstrated when establishing a heat or power plant

²⁵ As emission value for fossil fuels used for the calculation: values from 2009/28/EC Annex V, C . 19.: for emission reduction for biofuels 83,8 gCO₂eq/MJ, for electricity production 91 gCO₂eq/MJ, for heat production 77 gCO₂eq/MJ and for cogeneration 85 91 gCO₂eq/MJ.

²⁶ Cramer et al., *Testing framework for sustainable biomass.*, p.8.

²⁷ Fritsche et al., *Sustainability Standards for Bioenergy.*, p.21.

²⁸ Bioenergy promotion.

Principle II:

Bioenergy production should not endanger the conservation of cultural remains and heritages or prosperity of local communities and cultures.

Criteria:

- i. Production of biomass for energy should not influence the possibility for recreational activity in a negative way
- ii. Local acceptance and avoidance of conflicts should be reached through regional and local planning instruments, and preferably comprises multi-stakeholder dialogues
- iii. Bioenergy production should be carried out with consideration to local communities and cultures
- iv. Biomass production should not violate the basis of existence for the indigenous population

Initiative	Social aspects
Bioenergy promotion	Principle I: The production and use of biomass for energy shall not endanger food security or local production of biomass for other applications Principle II: Bioenergy production should not endanger the conservation of cultural remains and heritages or prosperity of local communities and cultures.
BSI	1.2 To demonstrate clear title to land in accordance with national practice and law 5.7 For Greenfield expansion or new sugarcane projects, to ensure transparent, consultative and participatory processes that address cumulative and induced effects via an environmental and social impact assessment 5.8 To ensure active engagement and transparent, consultative and participatory processes with all relevant stakeholders
FSC	Principle 2 Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established Principle 3: The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected Principle 4: Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities
ISCC	4.4.8 All impacts for surrounding communities, users and land owners taken into account and sufficiently compensated for. 4.4.23 the biomass production does not impair food security 4.5.1 The producer can prove that the land is used legitimately and that traditional land rights have been secured
Swan pellets	Not covered ²⁹

²⁹ The social criterion of Swan pellets is "(R8) Laws and regulations- The manufacturer must guarantee adherence to safety regulations, working environment legislation, environmental legislation and condition/concessions specific to the operations at all sites where the Swan-labelled fuel is manufactured", but it doesn't have any criteria for securing of food supply, conservation of cultural heritages and prosperity of local communities.

Swan fuels	R 8: The traceability and documentation of vegetable raw materials. The licence holder must: (...) -ensure that the raw material does not originate in areas in which biodiversity or values worthy of protection for social reasons are under threat.
Cramer Commission	Principle 3: The production of biomass for energy must not endanger the food supply and local biomass applications (energy supply, medicines, building materials) Principle 9: The production of biomass shall contribute towards the social well-being of the employees and the local population
RSPO	Principle 6: Responsible consideration of employees and of individuals and communities affected by growers and mills Criterion 6.1 Aspects of plantation and mill management, including replanting, that have social impacts are identified in a participatory way, and plans to mitigate the negative impacts and promote the positive ones are made, implemented and monitored, to demonstrate continuous improvement. Criterion 7.1 A comprehensive and participatory independent social and environmental impact assessment is undertaken prior to establishing new plantings or operations, or expanding existing ones, and the results incorporated into planning, management and operations. Criterion 7.5: No new plantings are established on local peoples' land without their free, prior and informed consent, dealt with through a documented system that enables indigenous peoples, local communities and other stakeholders to express their views through their own representative institutions
RSB	Principle 6: Biofuel operations shall ensure the human right to adequate food and improve food security in food in secure regions Principle 12: Biofuel operations shall respect land rights and land use rights
RTRS	1.2 Legal use rights to the land are clearly defined and demonstrable 3.1 Channels are available for communication and dialogue with the local community on topics related to the activities of the soy farming operation and its impacts 3.2 In areas with traditional land users, conflicting land uses are avoided or resolved 3.4 Fair opportunities for employment and provision of goods and services are given to the local population. 4.1 On and off site impacts (both positive and negative, both social and environmental) of large new infrastructure being built on the farm have been assessed and appropriate measures taken to minimize and mitigate any negative impacts.
SEKAB	Not covered ³⁰
RES Directive	Not covered (only reporting requirements)

The sustainability requirements of the European Union are the only system, which does not include any explicit social criteria.

The Bioenergy Promotion criteria do not explicitly mention certain social aspects, which are part of all other certification systems, e.g. child labour and labour conditions. It can be assumed, that the

³⁰ SEKAB formulates also social criteria; “Zero tolerance for child labour” and “ Rights and safety measures for all employees in accordance with UN guidelines”, but doesn’t include the Bioenergy Promotion criteria.

indicators of local acceptance and avoidance of conflicts contain also such aspects, but the formulation gives the impression, that the intention is rather to avoid difficulties than to ensure the wellbeing of the workers. The aspects, which Bioenergy Promotion emphasizes, are food security and consideration of local communities and cultures. These themes are generally difficult to quantify, because evaluations are inherently subjective and require detailed knowledge of the local context.³¹ The Cramer Commission states that sometimes it is impossible to use quantitative indicators and that “in these cases the advice confines itself to the requirement of reporting on a certain aspect of a theme, such as on the local prosperity of the large-scale production of biomass”.³² Some other initiatives require the undertaking of a social impact assessment³³. For instance ISCC requires that “a participatory social impact assessment has been conducted, and the report is publicly available in appropriate language to surrounding communities. On the basis of that SIA report a continued dialogue with surrounding communities is in place. Documents of regular meetings with communities (with two-way communication) and local government with listed risks and/or impacts and evidence of documented negotiations or resolution processes are compiled.”³⁴

Securing of food supply is explicitly mentioned in the criteria of ISCC, RSB and Cramer Commission. Local communities are regarded by RSPO, RTRS, Cramer Commission, FSC and ISCC. A social impact assessment is required by BSI, ISCC, RSPO and RTRS.

The Swan requirements for biofuels are very vague stipulating “that the raw material does not originate in areas in which biodiversity or values worthy of protection for social reasons are under threat”.

3.6 Economic issues

The production of biomass should make an active contribution to the local economy.³⁵ It should secure and expand employment opportunities in rural areas and the local population should be included into the value chain and into the decision making processes.³⁶ In addition to generation of employment and (fair) income, it can enable an increased access to “basic needs”, such as potable water, sanitary facilities, adequate housing, education and training, infrastructure and health services. However, there are examples that the benefits of energy crops production may not come to the people in general, but rather to a few, mainly already wealthy foreigners.³⁷

³¹ Simonetta Zarrilli, *Making Certification Work for Sustainable Development: The Case of Biofuels* (2008), http://www.unctad.org/en/docs/ditcted20081_en.pdf (accessed August 16, 2010), p. 21.

³² Cramer et al., *Testing framework for sustainable biomass.*, p. III.

³³ “Social impact assessment (SIA) is a methodology to review the social effects of infrastructure projects and other development interventions.” Source: Wikipedia, http://en.wikipedia.org/wiki/Social_impact_assessment

³⁴ International Sustainability and Carbon Certification, *Sustainability Requirements for the Production of Biomass: ISCC Draft 10-01-19 V 1.13* (2010b), http://www.iscc-system.org/e865/e890/e1491/e1496/ISCC202SustainabilityRequirements-RequirementsfortheProductionofBiomass_eng.pdf, p.24

³⁵ Cramer et al., *Testing framework for sustainable biomass.*, p.50.

³⁶ Horst Fehrenbach et al., *Criteria for a Sustainable Use of Bioenergy on a Global Scale*, UBA-FB 206 41 112, p.66

³⁷ M. Verdonk, *Governance of the emerging bio-energy markets*, p. 40.

Principle:

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.

Criteria:

- i. Activities shall have generally positive effects on social welfare and accessibility to rural areas
- ii. Development of local energy systems that enable combinations of different renewable energy sources shall be encouraged
- iii. Bioenergy systems should preferably give positive effects on local economy

Initiative	Economic Issues
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.
BSI	5.9 To promote economic sustainability
FSC	Principle 5: Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits
ISCC	4.4.8 All impacts for surrounding communities, users and land owners taken into account and sufficiently compensated for.
Swan pellets	Not covered
Swan fuels	Not covered
Cramer Commission	Principle 8: The production of biomass shall contribute towards local prosperity Principle 9: The production of biomass shall contribute towards the social well-being of the employees and the local population
RSPO	Principle 3: Commitment to long-term economic and financial viability
RSB	Principle 5: In regions of poverty, biofuel operations shall contribute to the social and economic development of local, rural and indigenous people and communities
RTRS	3.4 Fair opportunities for employment and provision of goods and services are given to the local population
SEKAB	Not covered
RES Directive	Not covered

Economic issues are covered by all initiatives except the Swan-criteria, SEKAB and the RES Directive. For this criterion it is very difficult to develop testable indicators. BSI measures the criterion with "value added / tonne cane", whereby the agricultural operation should make a profit of at least 2 \$, and the mill at least 4 \$ for a tonne produced/ processed cane. Such a stringent monetary indicator is difficult for certification systems, which certify various energy crops in global scale, because the conditions of

a single value chain can vary largely. Furthermore it is questionable, how much of the value added remains in the local economy.

The European Union with its mandatory sustainability approach has to respect the rules of the World Trade Organisation for international trade. One of the principles of the WTO is the principle of non-discrimination. Environmental and health considerations have been accepted by the WTO as reasons for product differentiation, but further social and economic issues (e.g. labour rights, rural development or food security) are seen as “nontariff trade barriers” which restrict free trade.³⁸

The Cramer Commission has decided to require reporting on the direct economic value that is created; policy, practice and the proportion of the budget spent on local supply companies and the procedure for appointment of local staff and the share of local senior management.

The economic issues can also be a topic of a social impact assessment, which is required in some certification systems.

4 Conclusions

Today there are several organisations and initiatives which have developed guidelines and criteria for sustainable bioenergy production. The scope, geographical range and supply chain coverage of the criteria differ and a comparison of the various initiatives is not easy. Through the Renewable Energy Directive of the European Union, which sets targets for the share of renewable energy in the energy consumption and requires compliance with sustainability criteria for biofuels and bioliquids, the development of sustainability criteria particularly for biofuels has been fast in the last two years.

In the Baltic Sea Region wood is the most important bioenergy source in most of the countries and forest certification systems have been used for many years with good results. Nevertheless, as seen in the analysis, some sustainability issues, particularly energy efficiency and climate mitigation efficiency, which are very important in the context of bioenergy, are not fully covered.

In this report the criteria of the Bioenergy Promotion project are compared to sustainability criteria initiatives which are used in the Baltic Sea Region. The results of the comparison are shown in a table on the next page.

The analysed initiatives contain also some criteria, which are not covered by the project. One of them is legality, which is included in all of the initiatives. Also human rights are part of all other sustainability criteria. Besides soil and water quality, also air quality is an issue in the criteria of Swan for fuels, RSB, Cramer Commission, BSI, ISCC and RSPO. Continuous improvement is an important principle in several systems.

³⁸ Zarrilli, Simonetta. *Making Certification Work for Sustainable Development: The Case of Biofuels*. 2008, p.vi.

Biodiversity is the only criterion, which is considered in all of the analysed initiatives and certification systems. Biomass production shouldn't take place on land with high biodiversity value. Bioenergy Promotion criteria haven't set a cut-off date for conversion of HCVAs. The reference dates of the other certification systems differ; FSC, Swan and SEKAB don't have any cut-off date, the others have their reference dates between November 2005 and January 2009.

The requirement of energy efficiency can be found only in five of the initiatives, RSB, ISCC, RSPO, Swan biofuels and BSI. The availability of biomass for energy production isn't unlimited, and the more efficient the bioenergy production and use, the more fossil fuels can be replaced with the saved bioenergy and the more GHG emissions can be reduced. GHG emissions are, after all, an issue in all initiatives except Swan pellets and FSC. Since wood is the most important bioenergy source in the Baltic Sea Region, it would be appreciated if these sustainability certification systems, whose scope is wood energy and are used in our region, would consider the reduction of GHG emissions in their criteria.

Besides FSC and Swan pellets, which don't consider GHG emissions at all, only RSPO allows the land use change for biomass cultivation on land with high carbon stock. SEKAB follows the RTFO³⁹-principles which actually include the impact of land use change, but currently it is possible to report that the land use change impacts are unknown (=0 g CO₂).

SEKAB is the only certification system, which complies fully with the GHG-saving requirement of Bioenergy Promotion regarding heating, cooling and electricity production. SEKAB requires a minimum reduction of 85 % in fossil carbon dioxide, from a well-to-wheel perspective.

Cramer Commission comes also very near to the BP-criterion; it has set the threshold value for biofuels to at least 30 % and for electricity to at least 50-70% reduction.

The Directive on renewable energy of the European Union requires a reduction of 35 % of GHG emissions (the threshold value will increase to 60% in 2018) for all kind of bioenergy and complies with the BP-requirement only partly. ISCC and BSI have set their reduction requirements pursuant to the RES Directive. RSB hasn't set any threshold value for GHG emission reduction in its actual standard, but it has published an additional EU Access-standard to get the recognition as a voluntary standard according to the RES Directive and has adapted the RES Directive-requirement for the purpose.

Social aspects and economic issues are not covered by Swan certifications, SEKAB and the RES Directive. Other certification systems include the criteria of the Bioenergy Promotion Project in their sustainability requirements.

The certification systems and initiatives should pay particular attention to the criteria on energy efficiency and GHG reduction. These two issues were the ones, which were the most weakly

³⁹ The Renewable Transport Fuels Obligation, UK, requirement on transport fuel suppliers to ensure that five percent of all road vehicle fuel is supplied from sustainable renewable sources by 2010, and it is implemented through a certification scheme.

presented in the analysed criteria. Especially the certification systems for woody biomass should take into consideration, if they shouldn't include these issues into their criteria.

Bioenergy Promotion	Cramer Criteria	RSB	ISCC	RSPO	Swan pellets	Swan fuels	SEKAB	BSI	FSC	RTRS	RES Directive
Biodiversity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Resource Efficiency:	Yes	Yes	Yes	Yes	Not covered	Not covered	Yes	Yes	Yes	Yes	Not covered ⁴⁰
Energy Efficiency:	Not covered	Yes	Yes	Yes	Not covered ⁴¹	Yes	Not covered	Yes	Not covered	Not covered	Not covered
Climate mitigation efficiency: GHG emissions from bioenergy production and use	Yes	Yes	Yes	Yes	Not covered ⁴²	Yes	Yes	Yes	Not covered	Yes	Yes
Climate mitigation efficiency: land-use change	Yes	Yes	Yes	Not covered	Not covered	Yes	Not covered ⁴³	Yes	Not covered	Yes	Yes

⁴⁰ The European Directive refers to the minimum requirements for good agricultural and environmental condition from the Council Regulation (EC) No. 73/2009. These requirements apply only for raw materials cultivated in the area of the European Union.

⁴¹ The requirements of the Swan-criteria for pellets apply only for the manufacture, not for the whole production chain.

⁴² The greenhouse gas requirement of Swan for pellets covers only boiling and drying (Fuels that are used during pellets production must produce a maximum greenhouse gas contribution of 100 kg CO₂ per ton of pellets).

⁴³ Calculation of CO₂ according to RTFO-principles, which include the impact of land use change. BUT before the RES Directive is implemented into UK law, where information is not provided (i.e. 'unknown' is reported) the calculation does not require the use of a default value for land use change impacts.

Bioenergy Promotion	Cramer Criteria	RSB	ISCC	RSPO	Swan pellets	Swan fuels	SEKAB	BSI	FSC	RTRS	RES Directive
CO₂ threshold value	Partly ⁴⁴	Not covered ⁴⁵ / EU-Standard for biofuels: Yes	Partly ⁴⁶	Not covered	Not covered ⁴⁷	Not covered ⁴⁸	Yes	Partly ⁴⁹	Not covered	Not covered	Partly ⁵⁰
Social aspects: food security, local production of biomass for other applications	Yes	Yes	Yes	Yes	Not covered	Not covered	Not covered	Yes	Yes	Yes	Not covered ⁵¹
Social aspects: conservation of cultural remains and heritages, prosperity of local communities	Yes	Yes	Yes	Yes	Not covered	Yes	Not covered	Yes	Yes	Yes	Not covered ⁵²
Economic Issues	Yes	Yes	Yes	Yes	Not covered	Not covered	Not covered	Yes	Yes	Yes	Not covered

⁴⁴ The emission reduction of GHG amounts to at least 50-70% for electricity production and at least 30% for biofuels.

⁴⁵ The RSB-standard is still going through a pilot testing phase and in the standard it is stated that "during the pilot test period, not to exceed 9 months, testing will be done against minimum GHG emission reduction thresholds set at 10%, 40% and 70%. At the conclusion of the pilot test period, the initial minimum GHG emission reduction shall be set such that it is significant and ambitious.

⁴⁶ The minimum reduction of 35 % applies also for heating, cooling and electricity, which is too low compared to the Bioenergy Promotion threshold.

^{47, 48} Swan uses absolute limits instead of relative. For pellets the emission maximum is 100 kg CO₂ equivalent for boiling and drying of one ton pellets. The greenhouse gas emissions of fuels must not exceed 50 g of CO₂ equivalents/MJ of fuel over the course of the whole life cycle. Land use change is not included in the calculation. Both do not cover the whole production chain and are not in accordance with the BP criteria.

⁴⁹ BSI uses absolute threshold values and requires that the GHG emissions must stay under 50 g CO₂ eq per MJ. This fulfils the requirement of the BP criteria for biofuels (reduction of 35%), but not the requirement of reduction of 80% for heating, cooling and electricity.

⁵⁰ The minimum reduction of 35 % applies also for heating, cooling and electricity with bioliquids, which is too low compared to the Bioenergy Promotion threshold.

⁵¹ Only reporting.

⁵² Only reporting.

5 List of acronyms and abbreviations:

BioSt-NachV	Biomassestrom-Nachhaltigkeitsverordnung, German Biomass-electricity-sustainability ordinance
BSI	Better Sugarcane Initiative
Cramer	Criteria from the publication <i>Testing framework for sustainable biomass: Final report from the project group "Sustainable production of biomass"</i>
EPFL	École polytechnique fédérale de Lausanne
EU	European Union
FSC	Forest Stewardship Council
GBEP	Global Bioenergy Partnership
GHG	Greenhouse gases
HCV	High Conservation Value
ISCC	International Sustainability Carbon Certification
ISO	International Organization for Standardization
ITTO	International Tropical Timber Organisation
NEN	Nederlands Normalisatie-instituut (the Dutch Standardization Institute)
NTA	Netherlands Technical Agreement
PEFC	Programme for the Endorsement of Forest Certification
RES Directive	Directive 2009/28/EC on the promotion of the use of energy from renewable sources
RSB	Roundtable on Sustainable Biofuels
RSPO	Roundtable on Sustainable Palmoil
RTFO	Renewable Transport Fuel Obligation (UK)
RTRS	Round Table on Responsible Soy
SEKAB	Svenska Etanolkemi AB
WTO	World Trade Organisation

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