BIOMASS FUTURES

Biomass role in achieving the Climate Change & Renewables EU policy targets. Demand and Supply dynamics under the perspective of stakeholders . **IEE 08 653 SI2. 529 241**

Biomass Futures Sustainability Indicators: Summary of the WP4 work

(Policy briefing under D6.4)

Uwe Fritsche (IINAS)

Compilation of summary for policy makers: Bettina Kretschmer (IEEP), Calliope Panoutsou (Imperial College)

Öko-Institut e.V. Institut für angewandte Ökologie Institute for Applied Ecology

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Content

Preface

This publication is part of the BIOMASS FUTURES project (Biomass role in achieving the Climate Change & Renewables EU policy targets. Demand and Supply dynamics under the perspective of stakeholders - IEE 08 653 SI2. 529 241, www.biomassfutures.eu) funded by the European Union's Intelligent Energy Programme. It forms part of a series of policy briefings prepared under Work Package 6 of the Biomass Futures project ('Support Policy Makers'), deliverable D6.4. The policy briefings are intended to translate the results generated within Biomass Futures to a wider group of stakeholders, most notably policy makers at EU and Member State level. This briefing summarises the work that was undertaken in WP4 led by Uwe Fritsche (Oeko-Institut, as of April 2012: IINAS). **All the underlying work and therefore all views expressed are those of Uwe Fritsche. Policy makers and other interested stakeholders are invited to contact Uwe Fritsche at IINAS: uf@iinas.org.**

1 Introduction

The Biomass Futures project assesses the role of bioenergy in meeting Europe's renewable energy targets as spelled out in the Renewable Energy Directive (RED)[1]. It does so by conducting sectoral market analyses, estimating the availability of biomass for energy and by modelling the demand and supply of bioenergy within the energy system. These insights will play an important role given the large anticipated contribution of bioenergy in meeting the EU's renewable energy targets. According to analyses of the Member States' National Renewable Energy Action Plans (NREAPs), biomass will make up 19 per cent of total renewable electricity in the year 2020, 78 per cent of total renewable heating and cooling in 2020 and 89 per cent of total renewable energy in transport. All together, bioenergy is expected to make up over 50 per cent of total renewable energy use[2]. Underpinning the analysis of bioenergy supply in the context of renewable energy demand is the identification of sustainability criteria for all forms of bioenergy. Where feasible, sustainability constraints are included in the quantitative analyses. As learned from interactions with stakeholders including national policy makers, the results of such model runs showing the impact of extended binding sustainability criteria to solid and gaseous biomass on bioenergy markets and the associated implications for meeting the RED targets are of great interest.

This briefing summarises the work on sustainability indicators under work package 4 of the project and is based on Deliverable 4.1 'Sustainable Bioenergy: Key Criteria and Indicators'[3]. The aim of this work package was to identify, define and quantify (where possible) the main sustainability standards and criteria regarding indirect land use change, air, water, soil requirements and social impacts and provide input to the Commission on future sustainability criteria ('RED-plus').

2 Policy context

While mandatory sustainability have been introduced for biofuels and bioliquids, these do not include mandatory requirements for soil, water and air issues and also do not cover solid and gaseous biomass. On the former, the Commission is expected to report in the course of 2012 whether to introduce binding criteria on soil, water and air issues. On the latter, the Commission has published an initial report in 2010, deciding not to propose mandatory criteria on the EU level for solid and gaseous biomass[4,5]. On the national level, the Commission recommended introducing sustainability criteria along the lines of the biofuel and bioliquids criteria already introduced by the EU's renewable energy Directive. The main reasons for not proposing mandatory criteria were:

- the existing framework of legislation and voluntary standards were deemed sufficient to safeguard sustainable production in the agriculture and forestry sectors;

[1] Directive 2009/28/EC of the European Parliament and of the Council of 5 June 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

[2] These figures are taken from http://www.ecn.nl/docs/library/report/2010/e10069_summary.pdf.

[3] Fritsche, U R (2012) Sustainable Bioenergy: Key Criteria and Indicators. Final Deliverable 4.1 for the Biomass Futures project. Available at: http://www.biomassfutures.eu/work_packages/work_packages.html.

[4] Report from the Commission to the Council and the European Parliament (2010) on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling, COM(2010)11, 25.2.2010, Brussels. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0011:FIN:EN:PDF.

[5] See also an earlier briefing produced by IEEP, ' Delivering Sustainable Bioenergy in Europe – Commission Adopts Report on Sustainability Criteria for Biomass', available at: http://www.biomassfutures.eu/work_packages/WP4%20Sustainability/D%204.4%20Biomass_criteria.pdf.

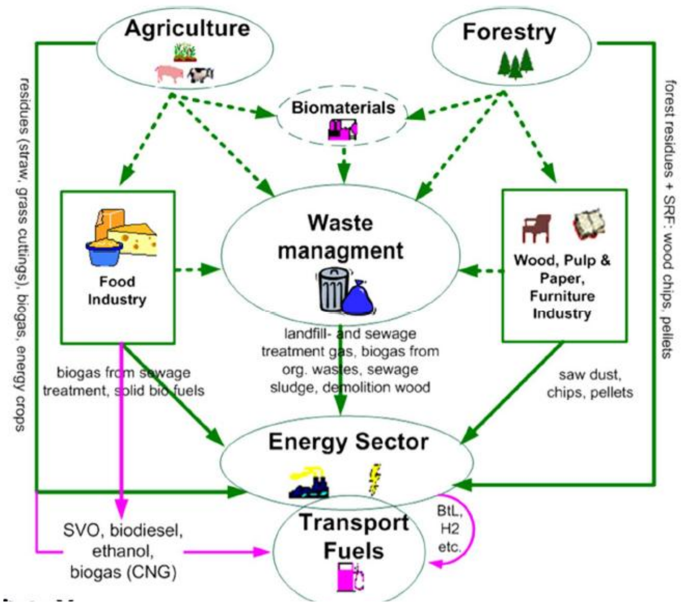
- greenhouse gas savings compared to fossil fuel use associated with solid and gaseous biomass in heating and electricity tend to be high;
- the import share for these types of bioenergy sources in 2007-2008 was low; and
- the bio-heat and bio-electricity markets are dominated by small-scale producers for whom binding criteria would represent a significant burden.

Sustainability initiatives are being out forward in other contexts as well, including on an international level and feedstock-specific initiatives. These include:

- ISO: Project Committee is created, but the work will take at least until 2013[6];
- GBEP: national indicators from Sustainability Task Force were published in November 2011; currently the initiative is in the phase of piloting and capacity building[7];
- Global Environment Facility (GEF): a study on biofuels has been completed, to be published soon[8];
- The certification schemes ISCC and RSB recognised by the Commission for the mandatory biofuels criteria are planned to be extended to cover all bioenergy;
- A range of feedstock-specific initiatives has been and/or is continuously developed, eg on sugarcane, forest biomass, palm oil, soy (BSI, FSC, PEFC, RSPO, RTRS…).

3 Biomass Futures sustainability criteria and indicators – main principles and key challenges

The work on sustainability criteria and indicators within the Biomass Futures project is set within that context. A 'RED-plus' sustainability indicator framework was developed with the aim to ***encompass all biomass flows***, see the figure below[9].



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[6] http://www.iso.org/iso/iso_technical_committee?commid=598379

[7] http://www.globalbioenergy.org

[8] http://www.thegef.org/gef/node/445

[9] Taken from: http://www.biomassfutures.eu/public_docs/workshops_2012/20_march_2012/lunch_seminar/Supplying%20sustainable%20bioenergy%20Fritsche.pdf

Furthermore, the aim was to develop a ***coherent set for all bioenergy***, i.e. electricity, heat and transport; at the same time, it should offer a perspective to extend the criteria to apply to ***bio-materials*** as well in order to ensure the sustainable development of the bioeconomy.

A number of ***key challenges*** have been identified. These include global food security as the overarching social dimension. Critical environmental issues include:

- Impacts of indirect land use change on the greenhouse gas (GHG) balance of bioenergy sources as well as on biodiversity. These are not confined to food crops; displacement effects take place also whenever non-food crops are grown on arable land;
- Resource use efficiency, i.e. maximising yields from land as well as residues use;
- Impacts on agro- and forest biodiversity, which can be positive or negative depending on location, practice, scale to mention the most important factors;
- Longer-term considerations: use of transgenic plants (GMO) in the bioenergy sector.

4 The indicators

Oeko-Institut / IINAS propose a list of nine criteria. These are listed and briefly described below, together with the subordinated indicators, the latter being 'quantitative or qualitative factors or variables providing means to measure achievement, to reflect changes, or to help assess performance or compliance, and - when observed periodically - demonstrate trends'. For a complete account of all underlying considerations including the calculations of the quantified indicators we invite interested stakeholders to download the complete D 4.1 report from the Biomass Futures website.

Criterion 1: Sustainable Resource Use

Resource use efficiency requirements for bioenergy crops cover both land use efficiency and the conversion efficiency in relation to using residues and wastes.

Indicator: Land Use Efficiency

The productivity of converting cultivated bioenergy feedstocks into useful energy products such as gaseous, liquid or solid bioenergy carriers, expressed in terms of available bioenergy carriers per hectare of cultivated area, should be set to a **minimum net energy yield** that evolves over time, as shown in the table below.

Setting	2020	2030	unit
smallholder, marginal/degraded land	>25	>35	GJ_{bio}/ha
plantation, marginal/degraded land	>50	>75	GJ_{bio}/ha
plantation, arable land*	>100	>150	GJ_{bio}/ha

*Source: compilation by Oeko-Institut; * = mainly for intercropping, agro-forestry systems, etc.*

In calculating the net bioenergy yield (or bioenergy productivity), by- and co-products along the bioenergy life cycles need to be taken into account.

Indicator: Secondary Resource Use Efficiency

For bioenergy carriers stemming from the conversion of secondary biomass resources such as residues and wastes, a minimum efficiency, expressed in terms of the heating value of the bioenergy output divided by the heating value of the secondary resource input, should be set to increase the resource-efficient use of those resources. The minimum conversion efficiencies should be set to:

- 55 % by 2020 for biofuels,
- 60% by 2030 for biodiesel,

- 50 % by 2020 and 55 % by 2030 for ethanol,
- 65 % for biomethane (2020 and 2030), again taking into account by- and co-products along the product life cycles.

For conversion to solid bioenergy carriers (chips, pellets etc.), no minimum requirement is necessary, as their conversion efficiency is typically > 85%.

Criterion 2: Biodiversity

Impacts on biodiversity can arise from land use change related impacts as well as from the extraction and use of biogenic residues.

Indicator: Conservation of land with significant biodiversity values

The substantiation of the EU RED criterion needs continuous improvement with regard to scope and qualifying maps. The target should be that by 2020, all land with a potential for biomass cultivation should be fully recognized in a global GIS database sufficiently in resolution to unanimously identify high-biodiverse areas

Indicator: Land management without negative effects on biodiversity

Specific activities to cultivate and harvest bioenergy crops and to manage agricultural and wood residue extraction have to be addressed in terms of their compatibility with biodiversity in general, and agro-biodiversity in particular. Impacts and management practices are scale- and landscape-dependent, therefore the only overall rule proposed is to maintain ecosystem services. The indicator needs spatially disaggregation into agro-environmental zones or similar metrics, and substantiation with regard to different cultivation systems and management practices (especially for forests) within those zones. As a target for 2020, the overall metrics of maintaining ecosystem services should be established and be implemented as indicators.

Criterion 3: Climate Protection

Proofing that the use of bioenergy contributes towards reducing greenhouse gas (GHG) emissions throughout the entire life cycle, including emissions from indirect land use change (ILUC) is a crucial criterion.

Indicator: Life cycle GHG emissions and direct land use changes

For bioenergy-based transport fuels, the minimum GHG reduction requirements against the oil-based comparator should be set to 67% by 2020 (75% by 2030), taking into account the full life cycles of the bioenergy production, and emissions from direct land use changes.

For bioenergy carriers being used for electricity and heat, the minimum reduction requirements should be based on natural gas as comparator, and be set to 55% by 2015, 60% by 2020, and increased to 75% by 2030, taking into account direct LUC.

Furthermore, it should be demonstrated from 2020 onwards that the minimum GHG requirements are met when soil carbon changes are taken into account, given the extraction of residues from agriculture and forests can significantly impact on the GHG balance due to changes in soil carbon.

Indicator: Inclusion of GHG effects from indirect land use changes

The minimum GHG reduction requirement presented above should be achieved taken into account an ILUC factor which develops over time. For an initial phase of 2015-2020, the ILUC factor should be in the order of 3.5 t CO_2/ha/year (according to OEKO 2011), and be applied for any bioenergy feedstock cultivation established on previously used agricultural land (including grassland and pasture land). Similar to the direct LUC effects, the cut-off date Jan 1, 2008 should be used, i.e. bioenergy feedstock cultivation on land being already used for this purpose before that date should be considered as ILUC-free.

Criterion 4: Soil Quality

Indicator: Avoid Erosion

There are bioenergy feedstock cultivation systems and practices which avoid erosion, though, and their application should become mandatory not later than by 2020. For this, a list of cultivation systems and practices must be developed which are acknowledged as “zero erosion”.

Indicator: Soil Organic Carbon

The soil organic carbon content of land being used for bioenergy feedstock cultivation or for extracting surplus biomass growth (e.g. grass cuttings from permanent grassland) must be at least maintained. This requirement should become effective for all bioenergy systems by 2015.

Indicator: Nutrient Balance of Forested Soils

The elaboration of this indicator continues. As a target for 2020, a generic traffic light system for soil maps should be established and be implemented as an indicator.

Criterion 5: Water Use and Quality

Indicator: Water Availability and Use Efficiency

Water for irrigation of bioenergy feedstock cultivation and for process water used in bioenergy conversion facilities must, together with existing agricultural, industrial and human (residential) water uses, not exceed the average replenishment from natural flow in a watershed, expressed in total actual renewable water resources (TARWR). Furthermore, the establishment of new bioenergy cropping systems and bioenergy conversion facilities must be placed outside of areas with severe water stress.

For both water indicators, GIS-based mapping is needed with adequate spatial resolution, and the seasonal variations of water flows must be considered. Thus, these indicators need significant data development before being subject to use in operational requirements for bioenergy so that the water requirements should be introduced by 2020.

Indicator: Water Quality

The monitoring and limiting of pollutant loadings (including nitrate, phosphorous and pesticides) to waterways and water bodies attributable to bioenergy feedstock cultivation and effluents from bioenergy processing should be required for all bioenergy by 2015.

Criterion 6: Limit Airborne Emissions

Airborne life-cycle emissions of non-GHG pollutants from bioenergy should be limited to a maximum of those of competing fossil energy.

- For the EU and OECD countries in general, emissions from modern gas-fired systems (electricity, heating, transport) should be the benchmark.
- In developing countries, the generic benchmark should be oil-based.
- In developing countries and emerging economies with a share of more than 50 percent of coal in the energy matrix for heat and electricity, the benchmark should be coal.

Indicator: Emissions of SO_2 equivalents

Lifecycle emissions must be lower than the respective benchmark. The EC JRC will develop default data for SO_2 equivalent emissions from key bioenergy life cycles, and the respective benchmarks.

Indicator: Emissions of PM_{10}

The methodology to quantify and limit emissions of particulates in the micro scale should be the same than for SO_2 equivalents.

Criterion 7: Food Security

Land used to cultivate biomass feedstocks for bioenergy in general, and for biofuels in particular, is a limited resource that may already be in use, so that increased competition for this land might affect food security both directly in crowding out food and feed production, and indirectly through food and feed price feedbacks.

Indicator: Price and supply of national food basket

The indicator aims to measure the impact of bioenergy use and domestic production on the price and supply of a food basket in the context of all relevant factors. The measurement of this indicator consists of five steps, plus additional methodologies for the assessment of the welfare impacts at national and household levels (see the full report[10]). It should be further considered to test the new approach developed by FAO BECSI which translates the GBEP food security indicators to the economic operator level[11].

Criterion 8: Social Use of Land

The social use of land is primarily related to the theme of access to land, water and other natural resources. Land access is a consequence of land tenure. From a social sustainability perspective, this might be one of the major concerns associated with bioenergy development in some areas.

Indicator: Allocation and tenure of land

This indicator aims to measure the percentage of land which has been leased by the state or a domestic authority and/or sold through one-to-one negotiations to individual or corporate investors for new bioenergy production. This indicator would serve as a proxy to assess how new bioenergy production and use influence land tenure as well as local communities livelihood conditions and land customary rights.

Criterion 9: Healthy Livelihoods and Labour Conditions

Therefore, the key labor standards and principles of the ILO Declaration on Fundamental Principles and Rights of Work must be met to reduce possible negative impacts on the overall livelihoods of people living in bioenergy feedstock cultivation areas.

Indicator: Adherence to ILO Principles for Labour Rights

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[10] This follows the work by GBEP (Global Bio-Energy Partnership) 'The GBEP Sustainability Indicators for Bioenergy' (2011), http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/Indicators/Report_21_December.pdf.

[11] See FAO 'Impacts of Bioenergy on Food Security - Guidance for Assessment and Response at National and Project Levels' (2012), http://www.fao.org/docrep/015/i2599e/i2599e00.pdf.

Jobs in the bioenergy sector should adhere to nationally recognized labour standards consistent with the ILO Declaration on Fundamental Principles and Rights at Work. This includes the ILO standards on: freedom of association and collective bargaining; elimination of forced and compulsory labour; elimination of discrimination in respect of employment and occupation; abolition of child labour, health and safety; and working conditions and wages.

5 Next steps

IINAS continues to be in constant dialogue with policy makers. The definition of sustainability indicators under the Biomass Futures project is developed further by IINAS as part of the project "Criteria and Indicators for Sustainable Solid Bioenergy" in collaboration with the Dutch Ministry of Economic Affairs, Agriculture and Innovation, the European Commission's Joint Research Centre and the Swedish University of Agricultural Sciences (SLU).