Overview of recent developments in sustainable biomass certification

Jinke van Dam[a], Martin Junginger[a,*], André Faaij[a], Ingmar Jürgens[b], Gustavo Best[c], Uwe Fritsche[d]

a Copernicus Institute for Sustainable Development, Utrecht University Heidelberglaan 2, 3584 CS Utrecht, the Netherlands

b European Commission, DG Enterprise and Industry, Office BREY 07/305,1049 Brussels, Belgium

c Environment and Natural Resources Service, Food and Agriculture Organization of the United Nations, Rome, Italy, until September 2007.

d Oeko-Institut (Institute for applied Ecology), Darmstadt Office Rheinstr. 95, D-64295 Darmstadt, Germany

* Corresponding author, H.M.Junginger@uu.nl, tel +31-30-2537613

ABSTRACT

The objective of this paper is to give a comprehensive review of initiatives on biomass certification from different viewpoints of stakeholders, including national governments (such as the Netherlands, the UK, Belgium and Germany), the EC, NGOs, companies, and international bodies up until October 2007. Furthermore, opportunities and restrictions in the development of biomass certification are described, including international trade law limitations, lack of adequate methodologies, stakeholder involvement requirements and certification costs. Next, five different approaches for the implementation of a biomass certification system are compared and discussed. Main differences are the voluntary or mandatory character and the geographical extent of the proposed strategies in terms of biomass end-use. It is concluded that criteria to ensure the sustainable production of biomass are needed urgently. To some extent criteria categories can be covered using existing systems, but others (such as GHG and energy balances, changing land-use) require the development of new methodologies. A gradual development of certification systems with learning (through pilot studies and research) and expansion over time, linked to the development of advanced methodologies can provide valuable experience, and further improve the feasibility and reliability of biomass certification systems. However, better international coordination between initiatives is required to improve coherence and efficiency in the development of sustainable biomass certification systems, to avoid the proliferation of standards and to provide a clearer direction in the approach to be taken. Finally, next to certification, alternative policy tools should be considered as well to ensure sustainable biomass production.

Key words: biomass production, bioenergy trade, sustainability criteria, certification

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1. Introduction

Increases in the price of fossil fuels, growing environmental concerns regarding their use and impacts (including climate change) and considerations regarding the security and diversification of energy supply have driven the increased use of biomass worldwide. Expectations for the coming years, based on energy scenarios and various policy objectives, indicate a growing increase in the global production of biomass on a global scale and for many nations.

The global production of liquid biofuels is now estimated to be over 35 billion litres (EC 2006). Ethanol currently accounts for more than 90% of total biofuel production. Global fuel ethanol production more than doubled between 2000 and 2005, while production of biodiesel, starting from a much smaller base, expanded nearly fourfold (WWI 2006). Some examples: Brazil has exported in 2004 2.5 billion litres of ethanol (same in 2005) with main destinations India (23.1%) and USA (20.2%) (Walter et al., 2006). The rapidly changing character of worldwide biofuel production capabilities is also illustrated by recent trends in the United States. In 1995, U.S. biodiesel production was 1.9 million litres; by 2005 this was more than 280 million litres (WWI 2006).

Beside the strong increase in liquid biofuels, trade and production in pellet and solid biomass production is also rising. Total Canadian exports of wood pellets was around 625,000 tonnes in 2006 (Swaan 2006). In the Netherlands, imports for electricity production have increased by a factor of seven from 2003 to 2005, and nowadays about 80% of all electricity produced from biomass is imported. For 2004, Essent, the largest user of biomass in the Netherlands, reported that approximately 30% of the biomass originated from North America, 25% from Western Europe and 20% from Asia, with the remainder from Africa, Eastern Europe, Russia and South America (Junginger et al, 2007).

The growing use and production of biomass as a renewable energy source has created an international biomass market and leads to increasing trade in biomass resources. International trade in biofuels and related feedstock may provide win-win opportunities to all countries: for several importing countries it is a necessary precondition for meeting self-imposed targets. For exporting countries, especially small and medium developing countries, export markets are necessary to initiate their industries (Zarrilli 2006).

However, the production[1] of biomass energy crops and the removal of biomass residues from forest and agricultural systems for energy production can also result in negative ecological impacts, changing land-use patterns, socio-economic impacts and GHG emissions (e.g. for transport and vs. alternative use on-site). With considerable increase in feedstock and biofuels expected, sustainable production is becoming a key concern and is currently being considered as a possible requirement for market access, e.g. in the first draft of the EU biofuels directive (Zarrilli 2006). Setting standards and establishing certification schemes are possible strategies that can help ensure that biofuels are produced in a sustainable manner (WWI 2006).

Setting standards and establishing certification schemes are possible strategies that can help ensure that biofuels are produced in a sustainable manner (WWI 2006). Recently, policy makers, scientists and others have recognized these aspects. Certification is the process whereby an independent third party assesses the quality of management in relation to a set of predetermined requirements (standards). These are mostly formulated as criteria that have to be fulfilled for the certification of a product or a production process. To use criteria for the formulation of a certification standard they have to be operational and measurable. For this purpose, indicators and verifiers are used (see also annex 1[2]) (Lewandowski and Faaij 2005).

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[1] Note that also the end use of biomass can cause negative environmental effects, e.g. the combustion of contaminated waste wood. However, in many countries already (strict) environmental regulations ensure the sustainable end-use of biomass.

[2] More information on this topic is available in a separate report within annex which can be retrieved at www.bioenergytrade.org

Over the last years, various efforts have been undertaken as steps towards certification for imported biomass. Key documents have been published by Lewandowski and Faaij (2005), Fritsche et al. (2006), Dehue et al. (2007), WWI (2006) and Zarrilli (2006). These studies focus on specific aspects in the discussion of biomass certification and include in their discussion relevant initiatives related to their studies. A comprehensive study providing an overview of recent developments in sustainable biomass certification is considered highly relevant for all actors involved, given the rapid developments in the field.

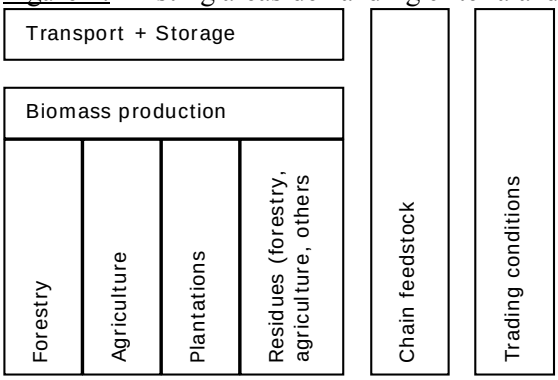
The objective of this paper is to give a comprehensive outline of initiatives on biomass certification from different viewpoints of stakeholders. The paper focuses on initiatives up until the end of 2006. The scope of this paper includes mainly new initiatives in the development of a biomass certification system, though existing certification systems are also briefly described, as experiences from these systems provide valuable inputs in the discussion. A second objective of the paper is to identify opportunities and limitations in the development of biomass certification and to give, based on this, some recommendations and conclusions. The paper is a deliverable from IEA Bioenergy Task 40.

This paper starts in section 2 with an overview of existing certification systems, which can be used as a basis for a biomass certification system. The study includes in section 3 an inventory of initiatives in the field of biomass certification from the perspective of various stakeholder groups. Stakeholders included are NGOs, companies, national government and international bodies and networks. Section 4 and 5 focus on possible strategies and limitations for the implementation of a biomass certification system, indicated by the various stakeholder groups. Section 6 and 7 conclude with an overall discussion of the developments and possibilities to move forward.

2. Overview of existing frameworks as basis for biomass certification

Precedents in the field of sustainability certification exist for a wide range of products. Criteria, basic principles and processes (see also annex 1[2]) of existing international certification schemes and indicator systems addressing sound resource management and responsible enterprise behaviour are being considered, and partly used in the development of biomass certification systems. Relevant for the development of a biomass certification system are certification systems for forestry and agricultural products and electricity.

Figure 1: Existing areas demanding criteria and indicator development for sustainable biomass trade



The introduction of forest certification was led by the Forest Stewardship Council (FSC) and a range of other schemes became operational at the end of the last decade (Zarrilli 2006). Since 1994, over 84 million hectares in more than 82 countries have been certified according to FSC standard (FSC, 2006). FSC accredited certification bodies carry out **FSC certification**. Two types of FSC certificates are available from certification bodies: the Forest Management (FM) Certificate and the Chain of custody certificate. Chain-of-custody is the path taken by raw materials from the forest to the consumer, including all successive stages of processing, transformation, manufacturing and

distribution. FSC is constantly reviewing its processes and criteria. At this moment the FSC Principles and Criteria in plantations (to further improve e.g. inclusion of social issues and issues on conversion of other land uses) and on pesticides are under review (FSC AC 2003).

Another large forest certification system is the **Programme for the Endorsement of Forest Certification schemes** (PEFC). PEFC is a global umbrella organisation for the assessment and mutual recognition of national forest certification schemes. PEFC covers both for the forest management and chain of custody verification. PEFC has in its membership 32 independent national forest certification systems. Of these, 22 schemes (in total accounting for over 191 million hectares of certified forests) have been certified through a rigorous assessment process. The PEFC provides an assurance mechanism to purchasers of forest products that they are promoting the sustainable management of forests (PEFC 2006). An example of a national forest certification scheme is the FFCS (Finnish Forest Certification System). Commercially exploited Scandinavian forests are certified to a large extent, e.g. over 95% in Finland (FFCS 2006). The PEFC system can as such be applied for the certification of forest biomass (e.g. wood chips and pellet).

Furthermore, in most Scandinavian countries, special sustainable forestry national legislation is already providing guidelines for forestry operations. Also, harvesting of energy wood is often integrated to round wood harvesting, thus forest certification is easy to use for both. In Finland e.g. pellet producer Vapo Oy is purchasing more than 99% of the raw material used in pellet production from certificated forests (Alakangas, 2007).

Another tool is the "CEN/TS 15234 - Solid biofuels, Fuel quality assurance" in which the whole fuel supply chain has to be traced back to the origin. In this technical specification the fuel supplier shall state the origin by documentation and fuel properties by quality declaration. The supplier or producer is advised to describe the fuel production process and state the critical control points where quality can change. This is a standard for fuel quality in terms of physical properties, but it could also be used for looking at other aspects in the entire production chain.

For the agricultural sector, different certification systems (e.g. **EUREPGAP**[3], **SAN**[4]) are developed to ensure that products are produced in an environmental sustainable way and are safer or healthier for the consumer. Certification systems for fair traded agricultural products (e.g. FAIRTRADE) have also been implemented to ensure 'fair' payments of agricultural products, enhance producers' quality of life and improve their market access (Zarrilli 2006).

For the energy sector, a number of **green electricity labels (EUGENE, Milieukeur, ok-power, Green Power, Austrian Ecolabel** etc.) exist and some of them include a definition for biomass. In general, two approaches in defining green electricity from biomass can be found: (1) definition of the allowed feeding material in the first place and additional criteria defining the ecological quality of the biomass and exclusion of certain technologies or types of biomass and (2) specification of the technology (plant types) and assessment of the individual plant, which applies for certification, criteria regarding the feeding material are additionally applied. Annex 2[2] gives additional information about the criteria applied by different green electricity labels (Oehme 2006).

Related to the certification systems as mentioned above, is the existence of **different indicator and criteria systems** to guarantee sustainability, e.g. ILO[5] has developed a set of criteria for sustainable

[3] EurepGAP is a private sector body that sets voluntary standards for the certification of agricultural products around the globe. It is an equal partnership of agricultural producers and retailers which want to establish certification standards and procedures for Good Agricultural Practices (GAP).It is a pre-farm-gate-standard that means the certificate covers the process of the certified product from before the seed is planted until it leaves the farm. The rules concentrate on quality management, minimization of negative environmental impacts of crop production and track-and-trace control, see also www.eurepgap.org.

[4] SAN stands for Sustainable Agriculture Network, which is a coalition of independent conservation groups that promote the social and environmental sustainability of production in several key commodity areas (WWI,2006).

[5] ILO is an abbreviation for International Labour Organization

labour conditions. (Lewandowski and Faaij 2005) and (Fritsche et al., 2006) provide further reading about existing certification systems.

3. Key actors in the development of biomass certification

Different stakeholder groups have recognized the need for biomass sustainability criteria and various groups started with the development of a biomass certification system or on principles and criteria to describe sustainable biomass trade. Stakeholder groups have different interest in biomass certification (Lewandowski and Faaij 2005). In this paper, developments in biomass certification from the viewpoint of four stakeholder groups are described: national governments and transnational organizations (in this specific case the EU), companies, non-governmental organizations (NGOs) and international organizations and initiatives, see also Table 1. The initiatives are discussed per stakeholder group and no distinction is made in the phases of development (starting with principles, to criteria and indicators to the development of the system for implementation) from the initiatives.

Table 1: Stakeholder groups and interests in certification, partly based on Lewandowski *et al.* (2005):

Stakeholders	Some interests for biomass certification
National governments and transnational organizations	Policy instrument to promote sustainable management and sustainable consumption pattern;, provides information for policy making. The EU, one of the more powerful players for establishing international standards has a special role in this.
Intergovernmental Organizations	The UN, FAO and UNEP in particular, play an important (potential) role as a neutral forum for negotiations between all kinds of stakeholders (particularly countries).
Companies (producers, trade, industry)	Instrument for environmental marketing, risk management and market access, tool for controlling origin and quality of raw materials, products or services, provides information for optimization of production processes, allows for product differentiation
NGOs	Provides information on the impacts of products, provides information whether the product meets quality or technical standards, instrument to promote sustainable management
International bodies and initiatives	Instrument to promote sustainable management and sustainable consumption pattern, information for policy consultancy and collaboration

3.1 Inventory of viewpoints of national governments

Many national governments in the world are promoting the use of biomass and the production of biofuels and renewable energy in their countries (see annex 3[2]). Few of them have taken initiatives to work on the development of a biomass certification system or on principles and criteria to describe sustainable biomass trade. As far as known, these countries are Belgium, the Netherlands, United Kingdom and some countries as Brazil, Germany, Canada, and USA to limited extent. On supra national level, the European Commission is considering the development of sustainability criteria and a European biomass certification system. Beside, most countries have indirectly included some sustainability criteria in their policies, as e.g. sustainable harvesting of crops. Although these criteria are relevant for sustainable biomass production, they fall out of the scope of this paper and are not discussed here.

Belgium, currently importing wood pellets for power production (about 700 kton in 2005), has ambitious targets for green electricity production. Sustainability energy is a regional competence in Belgium and certificate systems are implemented in three regions (Brussels, Flanders, Wallonia) for renewable energy sources and for combined heat and power. The different regions have chosen to apply different certificate systems (Verhaegen and Meeus 2005). The system in Flanders in based upon the energy balance and the use of fossil energy along the supply chain that is then subtracted 'pro rata' from the granted certificate per MWhe of green electricity. The system in Wallonia is compatible with the one in the Brussels region and is based upon avoided fossil CO_2 emissions according to a LCA with respect to the reference of the combined cycle power plant firing natural

gas with an efficiency of (for now) 55% (Marchal and Rijckmans 2006). Walloon authority imposes that each supplier undergoes an audit within six months for certification of imported biomass, which examines the sustainability of the wood sourcing as well as detail of the energy balance (through an energy audit including GHG emissions) of the whole supply chain. The sustainability of the wood sourcing can be delivered according to 1) forest certificates as FSC, 2) a traceable chain management system at the suppliers end or, in absence of such certification, 3) all public documents originating from independent bodies making a review of forest management or control in the considered country. SGS international, accepted as independent body by all Belgian authorities for granting green certificates, analyzes for each producer the global supply chain. If the product would appear in contradiction with the sustainability principle, the CwaPE (energy regulator in Wallonia) has the right to cancel the granted green certificates. So far, Flanders authorities have not requested audits or a certification procedure for imported biomass by law (Marchal and Rijckmans 2006).

Over the last years, **The Netherlands** has been importing wood pellets, agricultural residues and bio-oil for electricity production (see Junginger et al., 2007, elsewhere in this special issue). Due to the increasing imports, a project group "Sustainable Production of Biomass" was established in 2006 by the Interdepartmental Programme Management Energy Transition to develop a system for biomass sustainability criteria for the Netherlands for the production and conversion of biomass for energy, fuels and chemistry. The group was headed by prof. Jacqueline Cramer, nowadays Dutch Minister, for the aiming to develop a framework for the sustainable production of biomass. This resulted in a report describing criteria for sustainable biomass production (Cramer et al., 2006) in July 2006, and was then further elaborated into a testing framework for sustainable biomass (Cramer et al. 2007). The framework identifies 6 main sustainability themes: greenhouse gas emissions, competition with food and other applications, biodiversity, environment, prosperity and social well-being. On these six themes, nine basic principles for biomass sustainability were formulated, including criteria, indicators with minimal requirements and reporting obligations (see table 2). For example, regarding principle 1, for electricity production is that the emission reduction must now amount to at least 50-70%, for the application in transportation fuels at least 30%. The percentages are to be calculated following a methodology set up by the commission. These percentages must increase further by innovation in the future. The percentages are minimum requirements. The methodology to calculate these emission reductions is published as a separate document (Kwant el al., 2007).

The report makes a distinction in the information that production companies must submit (at the 'company level') and the information that can only be obtained at the regional and/or national level (at the 'macro level'). Dutch providers of bio-energy or biofuel, such as for instance applicants for subsidy or parties that have an obligation for a certain share of biofuel, must prove that they comply with the testing framework at the company level. The Dutch government is primarily responsible for the collecting of information at the macro level, and can cooperate with governments in the producing countries, the private sector and non-governmental organizations. At the macro level the project group attaches great importance to the monitoring of land and food prices, property relations, the availability of food, relocation of food production and cattle breeding, deforestation and change in the type of vegetation.

Also, the report recognises the various standards (either existing or under development) such as FSC, SAN/RA, RSPO, RTRS, IFOAM and others. A benchmark with the developed framework revealed that many of the existing standards (partially) cover the Dutch criteria for biodiversity, environment and social well-being (except integrity), but that greenhouse gas emissions, competition with food and other applications are not covered at all.

The report is an advice, in the first instance to the Dutch government, but also to all other parties involved. In the time to come the government will translate this testing framework into its policy for the application of biomass in the Dutch energy supply. The government can for instance incorporate sustainability criteria into instruments supporting the use of biomass.

Most recently, in September 2007 a Dutch report was released judging which obstacles can be expected when implementing the proposed framework in policy measures with regard to EU laws and WTO treaties (IPE, 2007). The main conclusions were:

- A reporting obligation for companies to delver information on the sustainability of their biomass is considered feasible under WTO/EU law. Also, putting minimum demands for GHG emission reduction (principles 1&2)is possible with minimal risk regarding WTO/EU law, but implementation is only possible within several years
- Minimum demands for biodiversity and environment will require a new national legal framework, but are given a medium-high risk profile under EU/WTO law, i.e. policy measures enforcing these demands will have to be formulated very carefully, and will largely depend on the possibility of specific biomass streams.
- Minimum demands on economic prosperity and well-being (principles 8&9) are considered impossible under WTO/EU law, except for extreme human rights violations (e.g. slavery).

The current status is that while the framework has no legal status so far, elements will be included in the new policy support mechanism for electricity from renewable energy sources. Minister Cramer announced in October 2007 that, based on the currently unsustainable production, palm oil will be excluded from the Renewable Energy Incentive (SDE) subsidy scheme (Milieudefensie, 2007).

Table 2: Summary of the Dutch framework principles and criteria. The corresponding indicators, minimum requirements and reporting obligations defined per criterion are not reported here, for details see Cramer et al (2007)

Principle	Criteria
1. The greenhouse gas balance of the production chain and application of the biomass must be positive	1.1. In the application of biomass a net emission reduction of greenhouse gases must take place along the whole chain. The reduction is calculated in relation to a reference situation with fossil fuels.
2. Biomass production must not be at the expense of important carbon sinks in the vegetation and in the soil.	2.1. Conservation of above-ground (vegetation) carbon sinks when biomass units are installed. 2.2. The conservation of underground (soil) carbon sinks when biomass units are installed.
3. The production of biomass for energy must not endanger the food supply and local biomass applications (energy supply, medicines, building materials).	3.1. Insight into the change of land use in the region of the biomass production unit 3.2. Insight into the change of prices of food and land in the area of the biomass production unit
4. Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity.	4.1. No violation of national laws and regulations that are applicable to biomass production and the production area. 4.2. In new or recent developments, no deterioration of biodiversity by biomass production in protected areas. 4.3. In new or recent developments, no deterioration of biodiversity in other areas with high biodiversity value, vulnerability or high agrarian, nature and/or cultural values. 4.4. In new or recent developments, maintenance or recovery of biodiversity within biomass production units. 4.5. Strengthening of biodiversity where this is possible, during development and by the management of existing production units.
5. In the production and processing of biomass, the soil, and soil quality must be retained or even improved.	5.1. No violation of national laws and regulations that are applicable to soil management. 5.2. In the production and processing of biomass best practices must be applied to retain or improve the soil and soil quality. 5.3. The use of residual products must not be at variance with other local functions for the conservation of the soil.
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.	6.1. No violation of national laws and regulations that are applicable to water management. 6.2. In the production and processing of biomass best practices must be applied to restrict the use of water and to retain or improve ground and surface water quality. 6.3. In the production and processing of biomass no use must be made of water from non-renewable sources.

7: In the production and processing of biomass the air quality must be maintained or improved.	7.1. No violation of national laws and regulations that are applicable to emissions and air quality. 7.2. In the production and processing of biomass best practices must be applied to reduce emissions and air pollution 7.3. No burning as part of the installation or management of biomass production units (BPUs).
8: The production of biomass must contribute towards local prosperity.	8.1. Positive contribution of private company activities towards the local economy and activities.
9: The production of biomass must contribute towards the social well-being of the employees and the local population.	9.1. No negative effects on the working conditions of employees. 9.2. No negative effects on human rights 9.3.The use of land must not lead to the violation of official property and use, and customary law without the free and prior consent of the sufficiently informed local population 9.4. Positive contribution to the well-being of local population 9.5. Insight into possible violations of the integrity of the company

The **United Kingdom** announced in November 2005 the introduction of a new policy to ensure the inclusion of biofuels and, potentially in the future, other renewable fuels in UK transport fuels. The 'Renewable Transport Fuel Obligation' (RTFO) is the UK's primary mechanism to deliver the objectives of the Biofuels Directive and will place a legal requirement on transport fuel suppliers to ensure that a specified percentage of their overall fuel sales are from a renewable source. The obligation will commence in April 2008 with targets for 2.5% (by volume) of renewable fuels to be supplied in the first year rising to 5% in 2010/11. A carbon and sustainability reporting scheme forms part of the RTFO (Archer, 2006).

The UK and Dutch Governments are cooperating on the development of sustainability requirements beginning with bilateral discussions in 2006 and leading to joint working and a common approach on many issues. The aim of this cooperation is to harmonize scheme design, reduce administration for business and demonstrate how such systems could be developed on an EU-wide basis. The European Commission and German and Belgian governments have also been involved in this process.

The sustainability assurance schemes developed in the UK and the Netherlands have complementary features, although the starting principles were different. In the UK, the focus has been on devising a practical scheme that can be operated by businesses supplying biofuels for transportation through the RTFO. Criteria categories are the same as in the Netherlands. Wider sustainability reporting is an integral part of the RTFO from the start and both environmental and social criteria and indicators have been proposed (based on an analysis of existing standards to achieve maximum consistency) (Dehue et al. 2006). Especially the environmental criteria have to a large extent been coordinated with the Dutch criteria for sustainable biomass. In addition to having defined sustainability criteria and indicators the draft methodology for the practical operation of the UK sustainability reporting has been designed. This so called “Meta-Standard” approach seeks to make maximum use of existing standards where these exists, seeks to stimulate existing initiatives such as RTRS and BSI (see section 3.4.2) and finally seeks for harmonize criteria on the long term (Dehue, 2007).

Furthermore, expected levels of reporting have been defined for the period 2008-2011 and the various permissible Chain of Custody methodologies for RTFO sustainability reporting have been described. Finally, methods for verification of company reporting have been proposed. The above is described in the Framework Report for the RTFO sustainability reporting. During the entire process there has been consultation with the Advisory group. Also a wider public consultation was held recently (both written and through sessions). The pilots have also been finished by October 2007. Based on the lessons learned from the pilot and the public consultation the technical guidance and the final version of the framework report (as a background document to the technical guidance) are currently finalized and are expected to be issues by the end of 2007, reporting will commence in April 2008 (Archer 2006, Dehue, 2007). For more information, see DfT (2007).

Brazil has since 1975 a government program to make ethanol from sugarcane and since 2002 a program for biodiesel. Starting in 2008, a 2% addition of biodiesel to petrol diesel will become mandatory (Zarrilli 2006). In Brazil, no certification systems for biomass and biofuels are currently in use. However, initial activities to include sustainability criteria into biomass production are taking place. The Social Fuel seal[6], e.g., is part of the biodiesel program and establishes conditions for industrial producers of biodiesel to obtain tax benefits and credit. In order to receive the seal, the industrial producer must purchase feedstock from family farmers and enter into a legally binding agreement with them to establish specific income levels and guarantee technical assistance and training (Governo Federal 2006).

For sugarcane production, environmental licensing includes e.g. control on land use and soil impacts. In the State of Sao Paulo (produces 60% of all sugarcane) a schedule was established to gradually reduce sugarcane[7] burning over the next twenty years. In 2000, additional steps were taken to eliminate burning and shift practices to mechanized harvesting. Controversial outcomes of these policies are immediate unemployment and creation of incentives for producers to relocate their farms to avoid regulation (Martines-Filhao and H.L. Burnquist 2006). For other agricultural products, the EurepGAP system is applied to some extent and part of the forestry plantations are FSC certified.

Canada is a major producer and exporter of wood pellets and produces ethanol from grain. The Environmental Choice^{M} Program (ECP) is a national program in Canada sponsored by Environment Canada, to recognize manufacturers and suppliers that produce products and services, which are environmentally preferable or less harmful to the environment. Companies meeting the criteria are certified as EcoLogo^{M} companies and can use the certification to market to environmentally conscious consumers. The label, belonging to the Canadian Government, is an environmental certification mark for a wide range of products. The ECP has criteria in place for the renewable green power sector (water, solar, biomass, etc) in the North American region, incl. USA (NRC 2005). The EcoLogo^{M} has a general set of criteria for renewable energy sources, accompanied by specific criteria for biomass and biogas. Criteria for biomass are (ECP 2006) (see also annex 5[2]):

- Use of only wood wastes, agricultural wastes and/or dedicated energy crops;
- Requirements for rates of harvest and environmental management systems/practices;
- Maximum levels for emissions of air pollutants.

In Germany, the Biofuel Quota Law came into force in 2007, which sets mandatory biofuel blending targets, and also mandatory sustainability requirements for biofuels under the Quota Law. The law further empowers the German Government to introduce a specific ordinance to detail the sustainability requirements for biofuels under the Quota Law. An informal working group established the key issues and requirements for biofuels sustainability to be included in the ordinance. The key requirements of the Biofuels Sustainability Ordinance (BSO) include:

- Sustainable production – requirements for Agriculture;
- Sustainable land use and protection of habitats;
- Requirements for Greenhouse Gas emissions – biofuels eligible under the Quota Law must demonstrate a certain GHG reduction potential , taking into account the full life-cycle of biofuel production, including emissions from land-use change;

The final draft of the BSO was published in late October, and a final decision of the German Government will take place on December . 5th, 2007.

Parallel to preparing the BSO, the German Government also drafted sustainability requirements for bioenergy for the 2008 amendment of the Renewable Energy Act, and is considering similar regulation for the draft Renewable Heat Law (Fritsche et al. 2006, Fritsche, 2007).

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[6] Label, Selo Combstível Social, awarded by the Ministry of Agrarian Development, www.biodiesel.gov.br
[7] One of the harmful environmental effects from sugarcane production is the burning of fields to facilitate manual harvesting. This produces GHG, ash and other airborne particulates.

In addition, research projects and governmental organizations as the German Technical Cooperation (GTZ) support the development of sustainable biomass. GTZ has carried out case studies on the potential and implications on agriculture and sustainability by liquid transport biofuels in four developing countries (Brazil, China, India and Tanzania)[8]. The study includes an analysis of the sustainability of biofuel development relating environmental, social and economic criteria to the Indian context.

A preliminary initiative has started in **California, USA**, where a roadmap is developed for the development of biomass production and use in California, commissioned by the California Energy Commission. This roadmap includes a chapter about standards and best practices for sustainable feedstock supply including aspects as land use, environmental impacts and resource monitoring (Tiangco and E. Sison-Lebrilla 2006). Furthermore, In may 2007, SUNY ESF send out a survey on sustainability criteria for bioenergy systems to international bioenergy experts. By means of a suite of criteria found in the literature, the goal was to identify areas of agreements and areas uncertainty with the long term goal to i) identify critical criteria and ii) keep their number at a feasible level. The survey was send to 137 participants; 46 experts filled the survey out and send it back while 19 experts responded that they have no time, do not feel competent, participation might compromise with their duties, or forwarded it to colleagues. Final results will be released to participants by December 2007, a publication in a peer-reviewed journal is envisaged (Buchholz, 2007).

On supra-national level, the **European Commission (EC)** is active in the development of biomass certification. The Biomass Action Plan (EC 2006) mentions that, in the context of the review of the Biofuels Directive[9], carried out by end 2006, the assessment and monitoring of the full environmental impact of biofuels will receive attention. One of the issues in the review report will be the requirement that, through a system of certificates, only biofuels whose cultivation complies with minimum sustainability standards will count towards the targets. The EC also considers how this could be applied for biomass used for other energy purposes. The system of certificates would need to apply in a non-discriminatory way to domestically produced biofuels and imports (EC 2005). In January 2007, the European Commission made proposals for a new Energy Policy for Europe, proposing:

- A binding 20% target for renewable energy in 2020
- A binding 10% target for the share of biofuels in 2020

The Commission is now drafting proposals to incorporate these targets in legislation for this so-called Climate and Energy package. As input, the commission held a public consultation, in which four main questions were to be commented on:

1. How should a biofuel sustainability system be designed?
2. How should overall effects on land use be monitored?
3. How should the use of second-generation biofuels be encouraged?
4. What further action is needed to make it possible to achieve a 10% biofuel share?

This proposal yielded a response with more than three hundred responses from NGO's, institutions, member states, the industry/ private sector, third countries and private citizens. The proposal for new legislation is now due in January 2008 (EurActiv, 2007a). However, the following information has so far been announced:

The framework will at least cover three themes:

- Minimum level of GHG savings compared with fossil fuels, from production to actual use. The exact reduction percentage is still under debate.

[8] Brazil (Kaltner *et al.* 2005), China (Gehua *et al.* 2006), India (Kashyap *et al.* 2005) and Tanzania (Janssen *et al.* 2005)

[9] Directive 2003/30/EC of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport

- No use of land types with high soil carbon for biofuel production. A more specific definition is in preparation.
- No use of high biodiversity areas for biofuel production. Again a more specific definition is in preparation.

Possibly more themes will be included. Furthermore, according to Paul Hodson (DG Env, quoted by Planetark, 2007) the legislation will seek to promote 2nd generation biofuels. Also while the EU theoretically has the capacity to meet biofuel target through domestic production, a balanced approach between domestic production and imports is preferred. As the new legislation will still have to be ratified by all member countries, actual implementation in the member states is probably earliest to be expected from 2011 onwards.

Furthermore, the 1998 Fuels Quality Directive (Dir98/70), adopted by the Commission in January 2007, is now under discussion in the Parliament (Plenary vote due in January 2008) and in the Council. This directive contains a proposal requiring fuel suppliers to measure the lifecycle greenhouse gas emissions (i.e. production, transport and use) for the fuels they supply in the EU as of 2009, and reduce these emissions by 1% per year from 2011 to 2020. It therefore has an effect also on biofuels lifecycle emissions, being a strong incentive for the best-performing biofuels in that respect. However, during the debate in September 2007 in the European Parliament, voices were raised against these proposals, arguing that it would conflict with similar rules currently being drawn up by the Commission for a separate Directive on the promotion of biofuels (EurActiv, 2007b). As of October 2007, it was undecided whether and how GHG emission reduction or sustainability criteria will be included in the revised fuels quality directive.

Summarizing, national governments worldwide are developing new biomass policies. Most of these policies relate to targets or incentives to stimulate the use of renewable energy sources. A few national governments (Netherlands, UK, Belgium, with Germany coming up in 2007) and EC on supra-national level have taken the initiative to start developing a policy framework to guarantee sustainable biomass. The systems in Belgium and UK have as main criteria reduction of GHG emissions for sustainable biomass feedstock, as Germany will include as well. The Netherlands and the UK have developed a wider set of principles including environmental, social and economic criteria. A framework for implementation is still in process. Belgium has coupled the criteria with the granting of green certificates. The UK aims to develop carbon certification schemes for environmental assurance. The EC intends to develop a system of certificates so that only biofuels whose cultivation complies with minimum sustainability standards will count towards the targets.

3.2 Inventory of the viewpoints of companies

Nowadays, different support systems (e.g. feed-in tariffs, certificates) have been initiated and implemented to accomplish national targets on the use of renewable energy sources and biofuels. Recent developments in the field of biomass certification show that this stimulated companies, involved in the supply, finance or use of electricity from biomass or biofuels, to initiate initiatives in this field. Biomass certification serves as a tool for environmental marketing, risk management and market access.

3.2.1 Parties in the biofuel / biomass supply chain

National initiatives and legislation (see 3.1) have triggered initiatives on biomass certification at companies active in the biofuel and biomass supply chain. For biomass, the supply and processing chain leads to chain interaction of various parties, depending on the economic segments in which they are active (see figure 2). Various companies are involved in the discussion of biomass certification and their initiatives tend to focus on the part of the chain in which they are responsible. A number of companies who recently included the sustainable production of biofuels are listed below[10].

[10] Given the current rapid development of new initiatives, this list of examples should not be considered exhaustive.

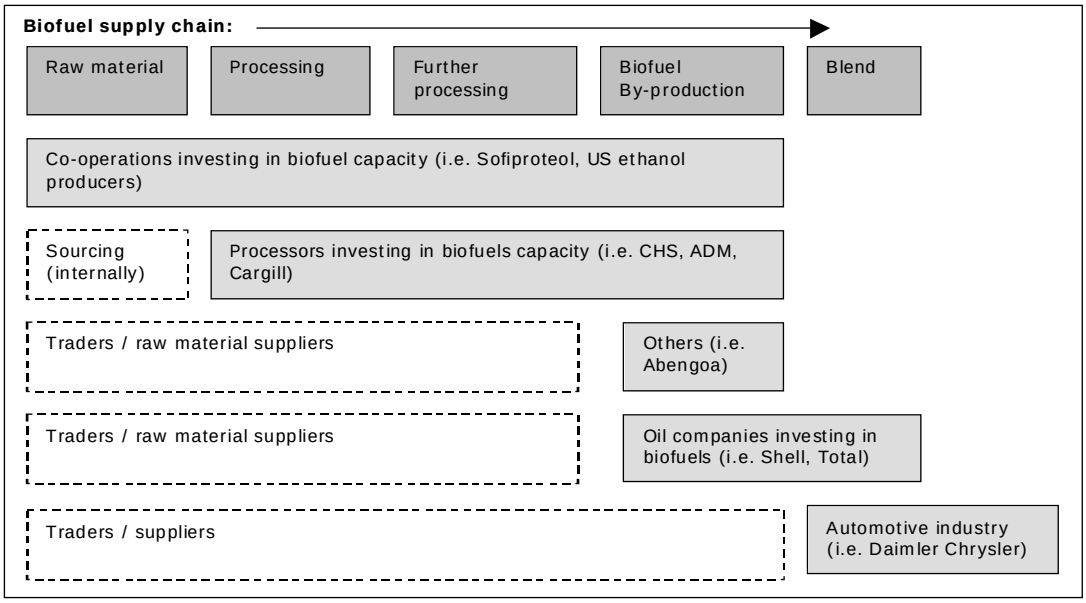


Figure 2: Companies active in different economic segments of the liquid biofuel supply chain, resulting in differences in focus and responsibilities for biomass certification (Vaals 2006)

Both the companies **CARGILL B.V.** and **CEFETRA** (*traders, raw material suppliers)* are members of the Dutch project group 'Sustainable Production of Biomass'. CEFETRA plays a coordinating and organizational role in several supply chains. It is important for the company to secure its (independent) sourcing and get as close as possible to the primary production / producer to get direct influence on factors as e.g. quality, track & tracing, the use of GMOs and sustainability. An integrated pricing system with a shortened supply system will increase the steering power of CEFETRA on these issues (Stam 2006). CARGILL is also a member of RSPO and RTRS (see section 3.4) as well as the company **UNILEVER** (*processing and supply*). Unilever has expressed its concerns about current biofuel policies (Mortished 2006), further explained in a 'Biofuels Unilever Position Statement'(Unilever 2006). Concerns relate to, among others, a decrease in availability of raw materials and sustainability aspects due to increased pressure on land and environmental, cost and energy yield aspects of low-performance biofuels (Unilever 2006).

SHELL (*oil company*) is one of the larger blenders of transport biofuels. In 2004, foundation Shell Research and Probos Foundation have invited a group of experts to take place in the 'Biomass Upstream Steering Group' (BUS), enabling Shell to identify opportunities and threats of biomass use, learn about sustainability and acceptability and make the right choices (Voss 2004).
Volkswagen (*automobile company)* has developed a fuel concept based on second-generation biofuels, which can be produced from biomass, are to a large extent CO_2 neutral and do not compete with food production. Volkswagen is calling on politicians to develop a sustainable tax model providing a secure network for investing in the development and market launch of new fuels. Apart from taking CO_2 efficiency as criteria, also other sustainability criteria should be included in fuel taxation. Volkswagen has developed a tax model catering for both CO_2 efficiency (primary criteria) and a set of additional sustainability criteria (Volkswagen 2006).

DaimlerChrysler (*automobile company*) signed in 2005 the Magdeburg Declaration with UNEP stating to promote sustainable mobility by supporting activities and further tap the potential of biofuels. This was further agreed upon in a MoU in February 2006. The two organizations call on producers for biofuels to take sustainability aspects into account throughout their lifecycle. An assurance sheme should be put into place, and to this aim UNEP and Daimler Chrysler looked at different existing schemes in different places. Daimler Chrysler intends to support the development of a 'sustainability seal' (similar to what FSC provides for wood products) for the cultivation of biomass for biofuels. Other activities of the partnership include conducting engine tests, developing

field trials in India, organizing the biennial Magdeburg Environmental Forum (platform for experts) and the development of second-generation biofuels (DaimlerChrysler 2006). See also 3.4.1.

BioX, a company for liquid biomass from palm oil imported from Malaysia, is RSPO member and has its own Code of Conduct and position paper of palm oil for energy generation. BioX, together with Control Union is currently evaluating RSPO-criteria for auditing and certification purposes. It has developed a questionnaire and pre-auditing document to audit palm oil production locations on RSPO-criteria and will audit palm oil producers to verify if they comply with the RSPO sustainability principles and criteria. BioX started a study to determine the CO_2-emissions related to the growing, production and transportation of palm oil; an issue that has not been covered by the RSPO-criteria. Since 2006, BioX is joining the GGL program (see 3.2.2) (BioX 2006).

Financing companies also play a role in the discussion of sustainable biomass production. The bank **Rabobank International** is a member of the Dutch project group 'Sustainable production of Biomass' and RTRS (Rabobank Brazil) and RSPO member. Recommendations given by the bank (Fresco and Dijk 2006) related to sustainable bio-energy are e.g. indicating that bio-energy projects should be judged on a case-by-case basis taking into account ecological, social and economic criteria.

3.2.2 Companies in the electricity supply chain

Demand on using RES is stimulated by obliging end-users to produce a share of their electricity (imposed by a quota obligation) by RES. In practice, this obligation is usually not imposed on the consumer but on electricity suppliers or distribution companies. This has introduced market mechanisms and trade in sustainable energy production and has stimulated electricity suppliers in Europe, using biomass as feedstock, to start initiatives to develop their own biomass certification systems (Verhaegen and L. Meeus 2005).

Electrabel label is a certification procedure for imported biomass and developed by Electrabel, a European energy company. For Electrabel, it is necessary to inform a potential supplier of all requirements made by Electrabel concerning the sustainability criteria for being accepted within the Belgian green certificate systems (see 3.1) and the technical specifications of the product for firing it in a thermal power plant (Marchal and Rijckmans 2006). Electrabel applies similar certification procedures in the different Belgian regions, gathering the auditing requirements for the import of biomass of Flanders and Wallonia. The requirements for biomass to be accepted according to Electrabel's standards are concentrated in a document called "Supplier Declaration" (Electrabel 2006). This document is signed by a representative of the producer and verified and stamped by a certified inspection body before being delivered to the Belgian authority. The Inspection Company SGS is in charge of checking the document and carrying out a full audit of the plant and of the supply chain within the 6 months following the first time the biomass is fired (Marchal and Rijckmans 2006).

For calculating the numbers of granted certificates Flemish authorities require the knowledge of a list of parameters related to the plant. Therefore, the supplier must fill in an informative questionnaire that consists of three functional parts (Electrabel 2006), which are: 1) sourcing and management: origin of biomass, 2) production chain, including energy consumptions and 3) transport and storage, including rail and sea transport. The questionnaire, dedicated to the suppliers of the biomass products, includes both mandatory questions as well as informative (non-mandatory) questions. The questionnaire for part 1 is included in annex 6[2] (Electrabel 2006).

The largest Dutch user of biomass, **Essent** (also RPSO member), has developed the biomass certification system **Green Gold Label** (GGL) in cooperation with Peterson Bulk Logistics and Control Union Certifications. This development started in 2002 and aims at a track and trace system for biomass from (by-) products from the power plant (and its green power it produces) back to the sustainable source. In this system mixing or contamination with non-intrinsic or environmentally harmful materials is prohibited. In every link of the chain written proof must be available that the

GGL quality system is supported, sustained and maintained. The system consists of six different standards covering the complete biomass chain from production till end-use including the bio-energy plant. Annex 7[2] shows an example for standard 1 on chain of custody and processing (GGL 2005). The standards define amongst others chain-of-custody standards, criteria for forest management and criteria for agricultural products (Control Union 2006).

GGL accepts existing certification systems (e.g. FSC standards), but has additional guidelines for pellets manufacturing and transportation. A major criterion within GGL is the requirement for tracking custody of the biomass. GGL label is continuously in development. It currently looks at possibilities to include social criteria in its certification system (Maris 2006). Beside Electrabel and Essent, also **other energy companies in Europe** (Fortum in Scandinavia, Eneco in the Netherlands, others) consider or develop at this moment their own biomass certification system (Maris 2006).

Thus, companies are actively involved in various parts of the biomass chain. Their interest in biomass certification depends on their role in the biomass chain. Energy companies have to justify the sustainability of their end product to the consumer, stimulating companies as Essent and Electrabel to develop a biomass certification system. Companies as DaimlerChrysler or Shell, also active on the end side of the chain, are involved in research and pilot projects related to new technologies and sustainability of their products. Companies on the production and transport side of biomass play a role in how to guarantee sustainable biomass production. For companies as Unilever or Cargill, trading products for food and/or energy production, the discussion on food security and change of economics for their products is highly relevant.

3.3 Inventory of the viewpoints of NGOs

Several NGOs have expressed their viewpoints on sustainable bio-energy production and started initiatives on biomass certification. In general, NGOs are positive about the possible opportunities offered by sustainable bio-energy production but also mention concerns on potential environmental and socio-economic harm due to increased bio-energy production. For example, Birdlife International "could not support further development of the Bioenergy crops industry without an appropriate certification scheme in …' (Birdlife-International 2005). In the so-called 'Bonn Declaration' from 2004 several **civil organizations from Latin America and the Caribbean** express their viewpoints on renewable energy in general. They stress the need, among other things, of energy access to civilians in the region with minimal local, national and global environmental impacts. Financial incentives should be redirected to sustainable renewable energy sources as biomass, excluding projects with negative social and environmental impacts (Several authors, 2004). **WWF Brazil** also stresses the need for a certification system in Brazil to better ensure that biofuels are produced in an environmentally and socially friendly way (Volpi 2006). These NGO viewpoints are written down in various position papers and reports.

Position papers, including sustainability principles or key concerns for sustainable biomass are developed by, as far as known, the following NGOs:

- **NGOs in South Africa**[11] (Sugrue et al., 2006), see also annex 8[2]
- **FBOMS**[12] **in Brazil** (Moret and Rodriques 2006), see also annex 9[2]
- **WWF Germany** (Fritsche et al., 2006) see annex 10[2] (coincide with criteria WWF International)
- **NGOs in the Netherlands**[13] (Verweij and Maarek 2006), (Richert et al., 2006), see annex 11[2]
- **IATP in the USA** developed sustainability principles for bioindustrial crop production, see annex 12[2], (Kleinschmidt 2006)
- **Greenpeace** and **Birdlife International** (to limited extent)

[11] Developed by South African CURES network www.cures-network.org
[12] FBOMS: Energy working group of the Brazilian Forum of NGOs and Social Movements for Environment and Development
[13] NGOs include: Milieudefensie, BothEnds, WWF, Greenpeace, Natuur en Milieu, Oxfam Novib

Table 3 provides an overview of these sustainability criteria showing that, although there is a consensus on the need to develop criteria, there is variation among them. For example, FBOMS has included 'gender equality' as a separate criterion while this criterion is not or hardly mentioned in other lists. Also, there is a difference in priority (e.g. between environmental and socio-economic criteria), strictness (e.g. use of GMOs, GHG balance) and level of detail given to these criteria.

These differences arise from the different backgrounds and aims of the NGO's described. However, it would go beyond the scope of this paper to describe these aims as well. Furthermore, it was attempted to summarize all criteria in table 3 as comprehensive as possible. However, NGO activities to promote sustainable biomass production develop fast and more principles may be developed or under way. A compiled list of concerns and issues indicated by organizations is also developed by (Bramble 2006), aiming to bring those pieces together into a coherent international governance structure for sustainable biomass production and use.

Various NGOs have started pilot projects and case studies to learn more about the use of sustainability criteria and the impact of sustainable biomass production in developing countries. A group of Dutch NGOs (BothEnds 2006; Lange and others 2006) has initiated three case studies with product/country combinations in developing countries (**Brazil, South Africa, Indonesia**) to gather information on risks and opportunities from export of biomass flows, analysed by a Sustainability Assessment Framework (see annex 13[2]). The report also gathered opinions from stakeholders in these countries to include their viewpoints in the debate in the Netherlands. The report reflects a comparison between results derived from this project and criteria proposed by the Dutch project group on sustainability criteria (section 3.1) and provides recommendations for a further dialogue.

Ahold coffee company has initiated the CSR label Utz Kapeh. The Dutch NGO **Solidaridad** is innovating the Utz concept to other commodities, including cocoa, tea, palm oil and also biofuels. To this, Utz has changed its name into Utz Certified and uses its label Good Inside. Solidaridad is focusing in its program 'renewable energy' on biomass for export from developing countries and is implementing, together with Dutch energy company Essent, a pilot biomass certification project for Utz Certified coffee husks from Brazil. The coffee husks originate from coffee plantations, certified by Utz Certified. An external monitoring of the pilot takes place according to the sustainability principles from (Cramer *et al.* 2006) (Solidaridad 2006). **German NGO representatives** from the environment and development sector (Maier *et al.* 2005), **WWF** (Fritsche *et al.* 2006), (WWF 2006b) and others also provide recommendations specifically related to approaches for the implementation of a certification system for sustainable biomass. These recommendations are further discussed in section 5.

Thus, various NGOs are actively involved in the development of a biomass certification system. Initiatives are taken to develop proposals on principles and criteria for sustainable biomass certification, including environmental, social and economic criteria. NGOs are mainly active on the production side of the biomass chain and have a strong concern about the environment and well being of the poor in rural areas. Some NGOs have provided suggestions on the implementation for a biomass certification system. NGOs play an active role in forums and have started pilot studies.

Table 3: Summary of sustainability principles from various NGOs as mentioned in reports and position papers:

	South Africa	Dutch NGOs	IATP	Greenpeace	Birdlife	WWF Germany	FBOMS
GHG, energy balance	Full LCA, Energy balance crop > 1:3	Significant GHG emission reduction & positive energy balance	Energy η and conservation		Include LCA carbon savings	Defined levels of GHG outputs and η (LCA)	Diversification of energy mix
Competition food, energy	No extension productive land, energy to the poor by own production	No violation of right to food security, concern for –indirect- land competition				Priority for food supply and food security, include regional impacts	Food security, no monocultures, crop diversity
Economic prosperity	Economic stimulus to rural communities, access to (rural) energy for poor	Promote (local) socio-economic development, no economic burden on vulnerable groups	Economic sustainability			Ensuring a share of proceeds	Rural credits, job income and generation, diversification, decentralization of activities
Working conditions		Labour conditions, human health impacts	Safe and healthy conditions			Health impacts, worker rights, share of proceeds	Organization of production, labour relations
Human rights		No violation, right of children				No violation	Gender equality
Property rights and rights of use	Indigenous land ownership, land redistribution	Equitable land ownership, land-tenure conflicts to be avoided				Rights to land use clearly defined	
Social conditions		Revenues invested in social well-being	Respect social, cultural heritage				Social inclusion Participation in decision making
Integrity							Social accountability
Environment	*See for details below*	*Revenues invested in environment*		*See for details below*	*Environmental impacts general*	*See for details below*	*See for details below*
Origin of biomass	Crop types, no annual crops						Crop diversity, no monocultures
Biodiversity	Maintained	Maintained, production energy crops increases ecological quality, risk conversion land use	Promote biological diversity, nature	Concern: burning wood from ancient forests	Include criteria on biodiversity	No additional negative biodiversity impacts, no negative land use changes	Defined limits for occupation of biomes; comply with economic, ecological zoning;
Waste	EIA on potential waste						
Use of agro-chemicals			Sound nutrient management	No / limit use of fertilizer, pesticide		Avoiding negative impacts	Minimization or elimination of pesticide use;
Farming practices	Conservation farming techniques, intercropping	Associated farming practices to protect environment				Production practices	Use of best available practices; diversity of crops;
Soil quality	Maintained	Sustainable use of soil resources	Strengthening the soil	Concern: loss of topsoil		No additional soil erosion and degradation	Reduction of soil loss
Water quality and quantity	No extension irrigated land, measures	Sustainable use of water resources	Protecting water	Concern: risk for increase in salinity		Protection of water bodies	
Emissions to air	EIA to determine potential pollution		Protecting air	Concern: toxic emissions			
No GMOs	Prohibited	Currently not allowed	Prohibit GMO	No Use of GMOs		Exclusion GMO	No priority
Training	Included						Training, technology transfer
Institutional, governance	Included	Good governance, government context included, land use planning	Stakeholder participation, transparency			Land use planning, EIA of biomass production	Regulatory compliance, region classified by EIA

3.4 Inventory from viewpoints of international bodies, organizations and initiatives

On international level, activities to develop a biomass certification system are initiated by international bodies and organizations, international networks and roundtables in which various stakeholders (NGOs, companies, government) participate also promote initiatives.

Different international bodies have recognized the need for biomass sustainability criteria. Within the UN, **UN-Energy,** created in 2004 as a follow-up to the World Summit on Sustainable Development (WSSD), is the principal interagency mechanism in the field of energy. Its aim is to promote coherence in the UN system's response to the WSSD and to collectively engage non-UN stakeholders. An overview of activities from UN-Energy and its members (e.g. World Bank, various UN organizations) can be found in (UN-Energy 2006).

Biofuels is an issue addressed within the UN as it is considered as a possible instrument to stimulate development. At the same time, sound policies and some pre-conditions are required to realize this (Zarrilli, 2006). The **UN Biofuels Initiative** (UNBI) is established within the UN as mechanism to coordinate initiatives within different UN bodies related to biofuels. The UNCTAD Biofuels Initiative aims to support developing countries which are considering the option to engage in biofuels production. The Initiative is supported by the UN Foundation and is being undertaken in partnership with UNCTAD, FAO, UNDP, UNEP and UNIDO. To promote a sustainable production, trade and use of biofuels in developing countries, under conditions that can attract foreign and domestic investment, UNCTAD aims to assess, in cooperation with the UNBI, biofuels potentials within developing countries and work with national decision-makers and private-sector groups to develop country-specific strategies (National Biofuels Action Programs) for the production and use of biofuels (UNF 2006) (Zarrilli, 2006).

The **International Bioenergy Platform IBEP** (established by the FAO) is focused on knowledge management and transfer. IBEP provides expertise and advice for governments and private operators to formulate bioenergy policies and strategies. It also assists in developing tools to quantify bioenergy resources and implications for sustainable development in general and food security in particular, on a country-by-country basis. IBEP has developed a proposed plan of action. One of the activities mentioned is to assist in the development of an international scheme to develop workable assurances and certification bases principles, methodologies, criteria and verifiable indicators (FAO 2006). One of the activities by IBEP, started in December 2006, is the development of an analytical framework to assess the implications of different types of bioenergy systems on for a set of different food security contexts., resulting in the formulation of national strategies, based on recommendations on how to undertake bioenergy development.

The **FAO Forestry Department** is working on biomass certification, in cooperation with **IEA Task 31**[14], by evaluating principles, criteria and indicators for both biomass from forest used for energy as well as for wood fuel and charcoal production systems. The study includes a review of existing forest certification schemes. Based on this, criteria are developed to cover forest biomass for energy. These are tested in the field using case studies. For the production systems (including transport from the forest site), key factors influencing the production chain are assessed as well as an evaluation of the impact of the various steps of that chain in ecological, social and economic terms. The project is also analyzing the legal and institutional framework under which wood fuel production systems fall. Using the results of the assessment a set of criteria covering ecological and socio-economic aspects of the production cycle will be developed and eventually be tested in the field (Rose 2006).

Furthermore, amongst other projects, FAO recently started the BioEnergy and Food Security (**BEFS**) project This three-year project will provide guidance to policy-makers and other stakeholders to assess the potential effects of bioenergy production on food security in developing

[14] IEA Tasks are heading under the bioenergy agreement of the International Energy Agency. Task 31: Conventional forestry systems for sustainable production of biomass

countries. It will develop national strategies, strengthen national (and local) capacities and formulate suitable downstream projects with national counterparts. The proposed activities will help ensure that linkages between food security and bioenergy are mainstreamed into development and poverty reduction strategies, that the linkages to the right to food are established and that the food needs of vulnerable people, particularly in rural areas, remain paramount. Project activities will focus on the elaboration of a quantitative and qualitative framework to analyse land use, bioenergy production potential and the relationship(s) to food security and poverty alleviation concerns in participating countries in Latin America, Asia and sub-Saharan Africa. First an analytical framework will be developed. In a second phase, the project will formulate bioenergy strategies that have mainstreamed food security considerations, and identify a preliminary set of sustainable bioenergy projects that will be suitable for investment, support rural development and readily adaptable to other countries and communities. The results of this project will provide the technical guidance, analytical and knowledge management tools necessary to ensure that food security remain central to the development of sustainable bioenergy policies. Planned training workshops ensure that project outreach extends beyond the participating countries (FAO, 2007).

UNEP started the Certification of Biomass Project, as outcome on the 4th Environmental Forum in Magdeburg (in cooperation with DaimlerChrysler, see section 3.2). One of the activities in this partnership is the development of sustainability criteria for biomass cultivation used for biofuels production. A core-working group (also with UNEP, WWF, others) was formed to pursue this initiative on investigating criteria and indicators for ensuring sustainability pathways for biomass production. For this initiative, preparatory activities (as in September 2006) include (Ernest 2006):

- Review of existing certification systems linked to biomass certification;
- Compilation of certification labels (forestry, bioenergy and palm oil, agricultural and trade labels)
- Compilation of ongoing initiatives by international communities and country policies on biofuels.
- A crop assessment for biofuels understanding different requirement of crops

UNEP was asked to lead the development of a collective programme of work on bioenergy sustainability under the G8's Global Bioenergy Partnership. UNEP has proposed a way forward which is currently under review by the GBEP members. Part of the suggestion is an initial set of recommendations for decision makers in governments and industry as well as a set of sustainability criteria covering the sustainability of the entire life-cycle, i.e. production, conversion and use of bioenergy. Both are open for discussion, amendment and review by the GBEP members (Otto, 2007).

Furthermore, UNEP joined forces with DaimlerChrysler, WWF Germany, BP, and the Ministry of Agriculture of Baden Wuertemberg to develop sustainability criteria for production of biomass for liquid biofuels with the aim of designing an assurance system (certification or other). UNEP, Daimler Chrysler and the Ministry of Agriculture of Baden Wurtemburg issued a working paper that includes (Otto 2007):

- Review of existing certification systems linked to biomass certification.
- Compilation of certification labels (forestry, bioenergy and palm oil, agricultural and trade labels) - understanding the technical processes, structure, etc.
- Compilation of ongoing initiatives by the international communities and country policies on biofuels.
- Assessment of the requirement of different crops.

UNEP joined the Roundtable on Sustainable Biofuels Initiative and is actively involved in its four working groups. Under this cooperation, UNEP and EFPL are organizing regional outreach events to ensure wide stakeholder involvement. Results of this work will be reported back to the GBEP process (Otto, 2007).

Bioenergy has a large number of registered projects (32.5% of total) in the pipeline for the Clean Development Mechanism, administered by the **United Nations Framework Convention on**

Climate Change (UNFCCC). UNFCC has as one of its objectives the development of monitoring and baseline methodologies for CDM projects. Until now only few methodologies for biofuels are approved because of uncertainties in determining 'leakage' (Fritsche et al., 2006), lack of capacity in CDM project development in many developing countries, and a limited availability of CDM baseline methodology specifically developed for biofuels projects (UNCTAD 2006).

The **IEA Bioenergy Task 40** (www.bioenergtrade.org) on International Sustainable Bioenergy Trade aims to investigate what is needed to create a commodity market for bioenergy. Parties as industry, NGOs, governmental bodies and FAO participate in this task. Key priorities of the task are (amongst others) sustainability criteria, standardization and terminology for biomass trade (A. Faaij 2006). Main recommendations from a workshop, organized in 2005 in Brazil in cooperation with IEA Bio-energy Tasks 30 and 31, related to biomass certification were:

- The aim should be an internationally accepted framework based on existing experiences;
- Great diversity of competing systems should be avoided. A certification system could be created by initiating a gradual process for certification procedures, starting at regional level;
- A certification system should include a wide variety of stakeholders to ensure credibility.
- It could be based on current best practices and supported with high quality scientific knowledge.
- A gradual development is needed as such a certification system should not create new barriers, i.e. negative experiences as gained with the CDM (e.g. in terms of complexity, required time and formulation costs) should be avoided.
- Crucial in a system is the build-up of credibility by verification and accreditation of the data.

Studies from Task 40 members on biomass certification relate to e.g. certification system development for sustainable bio-energy trade (Lewandowski and Faaij 2005) and to case studies on impacts of sustainability criteria on costs and potentials of bioenergy production in Brazil and Ukraine (Smeets and I. Lewandowski 2005).

The **Global Bioenergy Partnership, (GBEP),** launched in May 2006, consists of private sector associations, countries and international agencies (Canada, China, France, Germany, Italy (Chair), Japan, Mexico (Co-Chair), Russia, UK, USA, FAO, IEA, UNCTAD, UNDESA, UNDP, UNEP, UNIDO, UN Foundation, WCRE and EUBIA). GBEP's overall objective is to coordinate and implement targeted research, development, demonstration and commercial activities related to bioenergy supply and use, with a particular focus on developing countries. GBEP also provides a forum for implementing effective policy frameworks, identifying ways and means to support investments, and removing barriers to collaborative project development and implementation.

EUGENE, an independent network of environmental and consumer organizations and research institutes, promotes green electricity labelling as a market-tool to facilitate and stimulate additional production of renewable and energy efficient services. The EUGENE label applies to geothermal, wind, solar, electric, hydropower and biomass energy and is given to defined 'eligible sources'. Eligible sources for biomass are, e.g., dedicated energy crops, residual straw from agriculture etc. More specific criteria for eligible biomass resources, like e.g. production methods, are not provided (Lewandowski and Faaij 2005). A study from EUGENE, meant as support for possible certification of biomass, includes a proposal of biomass criteria for application by EUGENE standard. The criteria are subdivided in two groups (Oehme 2006), see table 4.

Issues surrounding the production of large commodities as palm oil, soybeans or sugarcane (which can all be used as biofuel feedstock) in Asia and South America have triggered initiatives as the establishment of Roundtables where all stakeholders in the chain are represented. **The Roundtable on Sustainable Palm Oil (RSPO)** is created by organizations carrying out their activities in and around the entire supply chain for palm oil. RSPO has developed a set of 8 principles and 39 criteria for sustainable palm oil production, which were adopted end 2005 (RSPO 2005), see also table 5 and annex 14. The principles relate to social, economic, ecological and general criteria. RSPO

criteria are now in a 2-year trial phase. Third party verification arrangements are being put in place for evaluation of compliance with RSPO principles and criteria, and in supply chain audits to verify compliance with requirements for sustainable palm oil traceability. First certifications of oil mills, estates and growers are expected early 2008. Arrangements for trade in certified oil will be published at the next RSPO conference, November 2007 (RSPO 2006, Vis, 2007).

Table 4: Summary of proposal biomass criteria for application by EUGENE (Oehme 2006):

Criteria, which can easily become operational and monitored / verified:
Eligibility of sources (including e.g. woody, herbaceous and fruit biomass)
Requirements on the origin of wood fuel (sustainable forest management, certification for plantations)
Use of Genetically Modified Organisms (GMO) is not permitted
Energy crops and SRC crops shall not be produced on converted land
Emissions of CH_4, N_2O and NH_3 by usage of manure have to be reduced
In the annual average, the plant need to met an overall efficiency of at least 60%
Co-firing of solid biomass is permitted under conditions (e.g. required efficiency of 70%)
Criteria for which further elaboration is needed to become operational:
Wood fuel from non-certified forest has to meet a set of criteria
Maintenance of soil fertility
Biomass from dedicated cultivation on arable land needs to comply with guidelines for integrated crop protection, livestock waste should comply with principles of integrated farming
The non-renewable proportion of the energy that is used for extraction, transportation and processing, and also balancing, is not permitted to be greater than 10% of the electricity supplied with the label.

Table 5: Summary RSPO principles to promote sustainable oil palm production (RSPO 2005):

Principles RSPO
Commitment to transparency
Compliance with applicable laws and regulations
Commitment to long-term economic and financial viability
Use of appropriate best practices by growers and millers
Environmental responsibility and conservation of natural resources and biodiversity
Responsible consideration of employees and of individuals and communities affected by growers and mills
Responsible development of new plantings
Commitment to continuous improvement in key areas of activity

The **Roundtable on Sustainable Soy** (RTRS) has as one of its objectives to develop and promote criteria for the production of soy on an economically viable, socially equitable and environmentally sustainable basis. The 2nd Conference of the RTRS in 2006 includes several presentations with examples of responsible production models and an overview of certification options (RTRS 2006). In September 2007, a technical working group has started to develop the RTRS principles, criteria and its verification system (RTRS, 2007). The developed 'Basel Criteria for responsible Soy production[15]' forms a relevant background document in the light of these developments, see also (ProForest 2004). A similar initiative has started for sugarcane by the establishment of the **Better Sugarcane Initiative** (BSI). One of the aims of the BSI is to determine principles and to define globally applicable performance-based standards for 'better sugarcane' with respect to its environmental and social impacts (WWF 2006a).

Finally, in November 2006, the **Ecole Polytechnique Federale de Lausanne** (EPFL) initiated a multi-stakeholder workshop to investigate the potential for developing internationally accepted and implementable standards for sustainable biofuels (Opal, 2006). This resulted in the establishment of the **Round table on Sustainable Biofuels (RSB)** in 2007. RSB aims to achieve global, multistakeholder consensus around the principles and criteria of sustainable biofuels production and builds on existing national and commodity based initiatives. As latest document, they published a

[15] The purpose of the Basel Criteria for Responsible Soy Production was to provide a working definition of acceptable soy production to be used by individual retailers or producers. Criteria were developed by Proforest (also involved in RSPO).

second version of global principles for sustainable biofuels production on October 23, 2007 for comments (Haye, 2007).

Summarizing, initiatives initiated by international bodies focus on a wide range of activities as coherence, support of developing countries and exchange and transfer of information. Some of these international bodies have formulated specific projects, often in collaboration with more partners, to gain better insight in the development of a biomass certification system. International networks and roundtables are based on a voluntary basis. They have started their own activities for the development of a certification system for their specific target product.

Table 6 provides a summarized overview of initiatives from stakeholder groups in the field of biomass certification. Table 7 shows that various biomass certification systems exist or are under development to guarantee the eligibility of the biomass source and its transport or to guarantee the sustainability of its production (woody biomass, palm oil or soy). These systems show some coherence but differ in the inclusion of the type of biomass, time frame, system (mandatory / voluntary) and demands of their criteria.

Table 6: Summarized overview of involvement of stakeholders in process of biomass certification

Initiatives	Principles	I & C[16]	Status	Organization	Platform function
National Governments					
Netherlands	Yes (environment, socio-economic)	Yes	Pilot studies	Working group set up by government	Stakeholder consultation
Belgium	Yes (GHG, sourcing)	Yes	Criteria coupled to green certificate	Independent body in coop. with authorities	
UK	Yes (environment, socio-economic)	Yes	Certification expected in 2008	Legislation development (RTFO)	Stakeholder consultation
Canada	ECOLOGO (general), also for biomass	Yes	Since 2005	Government owned label	
Brazil	Social Seal for biodiesel	Yes	In implementation	Government regulation	
Germany	Yes (GHG and others)	No	In development	National regulation	
Others[17]	No	No	Not applicable	Not applicable	Partner in debate
E.C.	Yes, in development	No	Draft proposals	Policy development within EU	Partner in debate
Companies					
Essent	Yes (Environmental criteria, social criteria in development)	Yes	Green Gold Label	Independent body: Control Union	IEA Task 40 member
Electrabel	Yes (Sourcing, energy / GHG balance)	Yes	Electrabel label	Independent body: SGS	Member IEA Task 40
BioX	Based on RSPO criteria	n.a.	Auditing palm oil locations	In cooperation with Control Union	RSPO member
Daimler-Chrysler	Background studies	No	Studies, discussion, forum	Initiative in coop. with UNEP	Forum for environment
Volkswagen	Tax model incl. criteria	Yes	Model development		Partner in debate
Shell	Studies on sustainability biomass	No	Studies, small projects	Under framework of BUS initiative	BUS Forum of experts
Rabobank				Financing partner	Partner in debate
Others[18]	No	No	Position papers	Not applicable	Partner in debate
NGOs					
WWF	Yes	Yes	Road map	Approaches, see study WWF Germany	RSPO member
Solidaridad	Yes (Utz Certified label)	Yes	Project with case studies	Project in coop. with GGL (Essent)	Involvement stakeholders
NGOs Netherlands	Yes	Yes	Proposals for policy tools, pilot studies	Study assigned by Dutch NGOs	Participation in debate (RSPO)

[16] I & C: Indicators and Criteria
[17] Various governments have started policy developments on biomass and biofuels, mainly focusing on stimulating the use of it by defining targets or policy incentives, see section 3.1
[18] Companies as Unilever, Cargill and CEFETRA are actively involved in the discussion on biomass certification issues.

NGOs South Africa	Standpoints on concerns biofuel production	No	Position paper	Working group representing NGOs	
NGOs Germany	Yes	No	Policy Paper	Study through stakeholder process	
NGOs Brazil	Sustainability criteria	Yes	Report	Developed by various NGOs	
IATP	Sustainability criteria	No	Criteria combined with good practice	Through stakeholder process	
Others	Limited	No	Position papers[19]	Not applicable	Partner in debate
International organizations, initiatives					
UN-Energy	No	No	Not applicable	Platform (non-) UN organizations	Coordination, exchange info
UNBI	Background studies in trade & potential	No	In planning	UNCTAD chairs initiative	Coordination, support
FAO	Yes, for forest biomass	Yes	Pilot studies	Partner is IEA Task 31	Partner in debate
UNEP	In development	No	Preparatory studies	In coop. with others (e.g. G8 GBEP, DaimlerChrysler	Partner in debate
IBEP	Background studies	No		FAO chairs initiative	Knowledge exchange
G8 GBEP	White Paper; mandated UNEP to develop I&C	(Yes)	in planning	Initiative within G8 countries + UNEP	Coordination
EUGENE	Yes (sourcing), additional P in process	Plan	Existing label, additional C&I	Network for green labels	Networking function
RSPO	Yes, for palm oil production	Yes	Pilot studies and working group	Roundtable on voluntary basis	Stakeholder process, platform
RTRS	Yes, for responsible soy production	Planned	Working group and consultation	Roundtable on voluntary basis	Stakeholder process, platform
RSB	Yes, for sustainable biofuels production	Planned	Working group and consultation		
BSI	Planned for sugarcane production	Planned	No	Roundtable on voluntary basis	Stakeholder process, platform

4. Limitations for the implementation of a biomass certification system and possible strategies to overcome them

Section 4.1 discusses the role of the World Trade Organization (WTO) in relation to international biomass certification. Section 4.2 discusses limitations and counter arguments for implementing a biomass certification system and possible strategies to overcome them.

4.1 Biomass certification and international trade law

Certification schemes and labelling programmes fall within a grey area of the WTO. The *Technical Barriers to Trade* (TBT) Agreement requires that regulations (mandatory) and standards (voluntary) should not create unnecessary trade obstacles and prohibits discrimination between domestic products and foreign products (the national treatment principle) and between products from different WTO members, called the 'most favoured-nation principle' (MFN) (Bauen *et al.* 2005). The MFN and National Treatment obligations apply only if two products are "like", which is determined on a case-by-case basis by four criteria (WTO 2006b): a) properties, nature and quality of the product; b) tariff classification; c) consumers' tastes and habits and d) product end use.

Environmental trade measures that distinct between products based on their production *process and production methods* (PPMs) that do not influence the physical characteristics of a product may violate the TBT obligations (Wessels *et al.* 2001), see annex 15[2] for some PPM examples (WTO 2006b), (Wessels *et al.* 2001). This is important to consider, as criteria related to sustainable biomass certification are likely to be based on non-product related criteria

[19] Various NGOs (Greenpeace, Birdlife) have published a position paper to express their views on biomass and biofuels in the EU and worldwide. A lists of concerns is expressed in these papers, see section 3.3

At present, the applicability of the TBT Agreement that is based on non-product related PPMs is unclear. Jurisprudence is not conclusive, and authoritative authors are divided on the subject (Zarrilli 2006). The Appellate Body in Asbestos (annex 15[2]) has interpreted jurisprudence on the setting of PPM-based regulatory requirements, emphasizing that regulatory distinctions may be drawn between products found to be 'like', provided that the distinctions in question do not systemically disadvantage imports over domestic products (Zarrilli 2006)[20].

Though countries do not hold a univocal position on it, several WTO members hold the position that standards and labels that refer to PPMs are not among the measures covered by the TBT agreement. On the other hand, labelling programs increasingly rely on Life Cycle Analysis and indeed refer to PPMs. Several current certification proposals for biofuels are currently the result of individual initiatives and may escape from WTO rules. However, they can (or are meant to) have impacts on the accessibility of products in the markets of destination and on consumer's choice (S. Zarilli, 2007)

[20] How this jurisprudence applies to biofuels and related feedstock is still an open debate as the jurisprudence is looked at on a case by case basis (Wijkstrom 2006). One specific characteristic of the Asbestos case, which may not be applicable to a biofuels or related feedstock case, is that it showed a physical difference between products: The presence of Asbestos can or cannot cause cancer (health aspect), see also GATT

Table 7: Started initiatives for a biomass certification system (+ criteria are included, - criteria are not included[21])

Check list:	**Green Gold Label**	**Electrabel Label**	**Government (BE)**	**UK-RTFO**	**Project group (NL)**	**EUGENE (EU)**	**RSPO**
Type of biomass	Biomass (all), complete chain	Biomass (all), complete chain	Biomass certificate, energy generation	Biomass source for biofuels	Biomass (all)	Focus on end part of chain	Palm oil production, production side
Status	Certification in implementation, also in development	Certification in implementation, also in development	Green certificates linked to GHG / energy criteria	Establishment certification in development	Principles developed, testing phase C&I (pilot studies)	Actual label, adds extra principles for biomass in specific	Principles developed, testing phase C&I (pilot studies)
Principles included:							
GHG and Energy balance	-	+	+	+	+	+	+
Biodiversity	+	-	-	+	+	-	+
Competition of food supply, local sources	-	-	-	-	+	-	-
Leakage	-	-	-	-	- [22]	-	-
Economic well-being	- [23]	-	-	+	+	-	+
Welfare / social criteria	- [16]	-	-	-	+	-	+
Environmental criteria	+	+	-	+	+	+	+
Procedure and organization:							
Type of system[24]	Track-and-trace Sourcing	Track-and-trace Sourcing	Cooperation with e.g. Electrabel, SGS	Track-and-trace Sourcing or book-and- claim, currently under consideration.	Track-and-trace Sourcing or book-and- claim, currently under consideration.	Track-and-trace sourcing of biomass types eligible under EUGENE	Track-and-trace Sourcing
Organization	Established by company Essent, now open for 3rd parties	Label is developed by company Electrabel	Government provides green certificate based on criteria compliance	Initiated by government, organizational structure in process	Initiated by government, organizational structure in process	European Network of green energy labelling bodies	Roundtable with stakeholders in palm oil production
Verifier	Control Union	SGS	Independent 3rd party verification	Requirements not yet determined	Requirements not yet determined	Independent 3rd party verification	Verifier working group (in progress)
Relation to national policies	Stimulated by policy	Required by law	In regional policy (in development)	Plans to embed in national policy	Plans to embed in national policy	On voluntary basis	On voluntary basis
(Plans to) make use of existing systems	FSC, 'Organic' certification	Yes (e.g. FSC)	See Electrabel	Yes (e.g. FSC)	Will apply e.g. FSC, and GGL	Yes (e.g. FSC)	Makes use of existing systems

[21] This is a general overview. When a criterion is included (+), the level of detail in methodology, indicators etc. may still vary per certification system.
[22] Currently investigated how to take this into account
[23] The inclusion of socio-economic principles are taken into consideration
[24] Track-and trace implies the physical traceability of the traded biomass. Under book-and-claim, production and redemption of a certificate is separated (and the certificates can be traded separately from the physical biomass). Similar systems exist for example for renewable electricity, where Certificates of Origin are traded. For some of the initiatives described here, this choice has not yet been made, but the requirement of calculating GHG and energy balances makes a track-and-trace requirement likely.

Also, the complainant would have to establish that the 'like' imported product has been afforded less favourable treatment than the domestic product (Howse and van Bork 2006). The jurisprudence is e.g. applicable to measures relating to post-import environmental impacts. Measures to minimize overall impacts of a fuel throughout its lifecycle on global carbon emissions do not seem to interfere with local or domestic policies either as it relates to a global environmental problem (Howse and van Bork 2006).

In this respect, the prime requirement in almost all current initiatives is to meet GHG and/or energy targets (see table 7), and it is the expectation that biofuels from developing countries in general will be able to meet these criteria. For example, case studies on the sustainability of ethanol production from sugarcane in São Paulo, Brazil show that GHG emission reduction potentials of 80% can be achieved (Smeets et al., 2006). Under current practices in São Paulo state, GHG reduction levels of, for example, 30 to 50% (the reduction level used by Dutch government for criteria on GHG reduction) can easily be met, and a disadvantage of import products from Brazilian ethanol in European countries is therefore not likely. The feasibility of other criteria, e.g. labour circumstances, can differ largely on local scale and can only be assessed on case-by-case basis.

The latter example also relates to the GATT (General Agreement on Tariffs and Trade) stating few exceptions, which may justify *environment-related measures* on products and the use of necessary measures to assure these standards are met, even though they violate the general principles of GATT. These exceptions are justified when a) necessary to protect human, animal or plant life or health or b) relating to conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption (Bauen et al., 2005). Air is considered as an exhaustible resource and the argument of adequate supply of (sustainable) biofuels within this context has plausibility as well (Howse and van Bork 2006). Another exception, stated in GATT, is the 'National Security Exception' allowing taking necessary measures for the protection of a country's national interest. It is acknowledged that energy security is a vital dimension of national security in general (Howse and van Bork 2006).

No provisions exist within WTO agreements to link trade with social issues and labour standards, and any attempt to make such linkages has so far been met with opposition. However, the International Organization for Standardization (ISO) has recently launched the 'Working Group on Social Responsibility' with the task of publishing a ISO26000 standard on guidelines for social responsibility in 2008 (Bauen et al., 2005).

The Code of Good Practice (annex 3 of TBT[2]) provides disciplines to standardising bodies, including those related to transparency, for preparing, adopting and applying standards (Wessels *et al.* 2001). Members should use international standards where appropriate but the TBT Agreement does not require members to change their levels of protection as a result (Fritsche, *et al.* 2006a). The value added of the Code is that it extends the TBT discipline to standards developed by non-governmental bodies, which have accepted it (S. Zarrilli, 2007). Based on previous concerns and debates in the 1990s regarding the use of the Code, especially with reference to voluntary eco-labelling schemes, it was agreed that there should be a) an open market for all certification schemes b) no political action to diminish the trade of uncertified products and b) no inclusion of the origin of the timber on the label to avoid discriminatory action against specific regions (FASE-ES 2003).

Sustainability standards can be linked to *subsidies and tariffs*. These may affect international trade and are therefore included in WTO rules. The *classification of a product* is important to define which tariff levels and which set of disciplines and domestic subsidies are applicable. Product classifications for biofuels are not consistently aligned with the actual consumer market in question, which leads to a number of problems with respect to consistency, certainty and non-discrimination of existing WTO obligations. An approach would be to

define 'new' products for biomass-derived energy carriers. However, this is a complex process which can take many years (Howse and van Bork 2006). Subsidies are arranged in the Agreement of Agriculture (AoA) and the Subsidies and Countervailing Measures Agreement (SCM), the latter prohibiting export subsidies and subsidies contingent upon the use of domestic products over imported products. Based on the SCM Agreement, subsidies should not have certain kind of adverse trade affects or cause adverse effects (injury) to a group and be non-specific, not directed at limited group of particular products (Howse and van Bork 2006). Within AoA, countries have agreed to pursue the harmonization of subsidies. A number of approaches allow countries to subsidize products. 'Green boxes'[25] are permitted. In order to qualify for the "green box", a subsidy must not distort trade, or at most cause minimal distortion; they have to be government-funded and must not involve price support. They tend to be programmes that are not directed at particular products, and include direct income supports for farmers that are decoupled from current production levels or prices (WTO 2006). At this moment "green box" subsidies are allowed within WTO but may be difficult to maintain if liberalization of the agricultural sector proceeds (Fritsche et al., 2006).

Finally, it should be noted that WTO is an international forum where agreements are negotiated and signed by governments. In case policy measures do affect international trade, WTO provides a platform for other governments to complain and request for adjustments, and it is recognized that governments should not hold environmental policies in the way they consider legitimate (Wijkstrom 2006). Currently, as part of the Doha Round of negotiations, members are discussing the relationship between WTO rules and multilateral environmental agreements that may contain trade-related measures. At this stage of negotiation, it is not clear what the outcome will be (Pellan 2006). WTO agreements, also related to biomass certification, are a result of negotiations and in advance the outcome is thus unsure. In general it can be said that international consensus of criteria and broad consultation among states, taking into account the variety of conditions in diverse countries promotes the acceptance between WTO members. (Howse and van Bork 2006)

Thus, based on above, the WTO context for biomass certification is:

- There are possibilities to design environmental measures and sustainability criteria for biomass (in line with WTO principles) that distinguish 'like products', see table 8.
- Subsidies should not have certain kind of adverse trade affects or cause adverse effects (injury) to a group and be non-specific, not directed at limited group of particular products.
- There is an open market for certification system with a risk for proliferation of systems.
- International consensus promotes acceptance of criteria and the Code of Good Practice can serve as a tool to promote transparency and stakeholder participation.
- WTO agreements are a result of negotiations between members, and in advance the outcome of these agreements is unsure.

[25] In WTO terminology, "boxes" identify subsidies

Table 8: Relation biomass sustainability criteria in WTO context

Criteria in line with WTO when:	Remarks
Related to post-import impacts	Visible in end use of product
Referring to a global scale with no to limited interference with local policies	E.g. GHG levels
Based on consumer preference, unspecified to a specific product and translated to voluntary standards.	These can include environmental or socio-economic criteria
Needed to protect human, animal or plant life or health or relating to conservation exhaustible natural resources	Criteria applicable are e.g. air emissions or GHG balance
Internationally agreed upon with broad consensus.	More complicated for criteria with impacts on local / regional level
No international provisions exist within WTO for linking trade with social issues and labour standards.	Socio-economic criteria through voluntary standards (e.g. as FSC) possible at this stage

4.2 Limitations on the implementation of biomass certification and possible approaches to overcome them

Limitations mentioned on the development of a biomass certification system provide lessons learnt for future implementation. Not everyone sees certification as a means to guarantee sustainable biomass production and counter arguments are also heard in this section.

4.2.1 Lack of adequate criteria and indicators

There is a need for guidance on risk minimisation. To ensure the effectiveness of such guidelines[26], certification with monitoring and verification could be used (Otto, 2007). Although there is consensus about topics that are at stake, there is no consensus yet which criteria should be included to guarantee sustainable biomass trade and how less quantifiable targets should be measured (WWI 2006). An implication mentioned for the development of a biomass certification system is how to make some of the concerns and sustainability principles operational into effective indicators and verifiers. There is experience in applying some and little to no experience of applying others. Better insight is e.g. required on the design of criteria and indicators according to the requirements of a region and how to include avoidance of leakage effects and the influence of land use dynamics (Faaij *et al.* 2006), with a first step for a "priority rule" being suggested by Fritsche *et al.* (2006a). Other issues mentioned by various organizations on how sustainability criteria can be translated into operational indicators and verifiers are included in annex 16[2] (BothEnds 2006, WWI 2006). Pilot studies are needed to build up experience of how sustainability criteria can be met under diverse conditions (Cramer *et al.* 2006). The development of new methodologies, to measure impacts, and valuation approaches on how to assess overall damage and benefits is recommended (Smeets *et al.* 2006).

4.2.2. Requirement of effective control and monitoring system

Procedures and solid (documentation) systems are needed to implement a reliable certification system, see also (ProForest May 2006). Besides, establishing an effective, reliable international biomass certification system is further complicated due to large differences between regions in production and scale (monocultures, small scale, different crops), national context (legislation, stakeholders, their view on sustainability) and environmental vulnerability (drought, fire, soil) as also indicated in pilot studies from (BothEnds 2006). Also, NGOs have indicated in several cases that the frequency of field visits is often too low. If stricter monitoring is required, this will also have an impact on the costs and feasibility of a system. How, in this light, a certification system would have to be given shape must be worked out further (Cramer et al., 2006).

[26] UNEP has done due diligence guidelines www.unep.fr/energy/act/bio/doc/edd_biomass_crops.pdf (Otto, 2007)

It is advised to design and adopt specific, quantifiable criteria for sustainability indicators. Despite their specificity, they should be flexible enough to be adapted to the particular requirements of a region. Criteria have to be enforceable in practice, easily comprehended and controlled without generating high additional costs (WWI 2006). More insight is needed in the monitoring compliance and limitations of sustainability criteria developed for biomass (BothEnds 2006). (Cramer et al., 2006) recommend that a biomass certification system must be based on a track-and-trace system, in which the traceability of biomass is guaranteed. The guarantee of complete traceability in the short term is still difficult, making a transition period necessary.

4.2.3 Open market limits effectiveness certification system

(FASE-ES 2003) mentions that the open market for (in this case) FSC certification has transferred the responsibility for 'combatting environmental and social crime from governments to consumers faced with hundreds of eco-labels, the vast majority of which are a result of opportunistic product marketing'. This competition has led some certifiers to lax application of FSC-standards, e.g. by including vague formulations that criteria have to be fulfilled 'within a certain timeframe' after the certificate had been issued. This resulted in abuse of the possibilities of the system. (WWI 2006) indicates that open competition in certification schemes and –therefore- confusion for consumers has hampered efforts to develop meaningful certification systems in eco-tourism and organic foods. (FASE-ES 2003) also mentions that certifiers often have a commercial relationship through direct contracts with the certification client, which results in an interest of the certifiers in a positive assessment that weakens the objectivity of the problem.

(WWI 2006) recommends that a proliferation of standards, differing from one country or region to another, have to be avoided. Further coherence in biomass certification systems, possibly through promotion of international agreements and standardization of criteria, is needed.

4.2.4 Small stakeholders' limitations to implement requirements

Smallholders, often operating with limited resources and technical skills, may lack the capacity (knowledge, financial resources) to implement necessary changes required for transition to a new certification system (ProForest 2006). This may be, without transition period, too complicated for smaller companies. There is a risk that only larger producers can fulfil these new demands in short time which involves a risk for marked disturbance as only few producers can offer certified feedstock resulting in artificial high prices (Maris 2006). While a certification scheme should be thorough, and reliable, it should not create a hurdle for nascent industries (WWI 2006).

It is recommended to pair a certification scheme with assistance and incentives (WWI 2006) and to look for possibilities for group certification to guarantee that small producers are not excluded (Cramer et al., 2006). Using existing certification systems in the development of a biomass certification system, at least for the short term, may promote the involvement of smaller stakeholders. Existing systems may not cover all required criteria but it limits the risk for market disturbance. Including extra criteria in a certification system can then be achieved over time by mutual consultation (Maris 2006). Because of the difficulties for smallholders, a scheme would have to be accompanied by capacity building (Otto, 2007).

4.2.5 Stakeholder involvement required for a legitimate and reliable system

While expert judgment can flag the issues, alert the stakeholders to major concerns and provide methodologies for measuring, valuating and monitoring the different aspects, experts should not unilaterally decide which sustainability criteria to include and how to prioritize them. To a large extent, the judgement of local stakeholder is also crucial to take into account the circumstances and needs in specific situations.

Furthermore, (ProForest May 2006) and (Ortiz 2006) mention that an adequate understanding and involvement of primary processors and workers in the field, often the ones controlling and monitoring the criteria, is required for successful implementation of a biomass certification system. Their involvement in the strategic development of the criteria, as e.g. currently developed in Europe, is however limited and often starts (too) late in the process (Ortiz 2006). Main arguments for participation failures in certification systems from (FASE-ES 2003) are that the selection of consulted groups is often arbitrary, tending to include most influential actors while local groups are often neglected. Also, people without access to modern communication channels (e.g. rural people) are often not informed. Other limitations mentioned are the gap of 'technical expertise' between certifiers or specialists and the local population and, in case questions or problems are raised, the lack of budget in the certification assessment to include more detailed studies.

It is important that all concerned and affected in a participatory process (multi-stakeholder approach) set the certification criteria (Maier et al., 2005) and broad consensus about basic underlying principles in the certification process is achieved. Where strict, specific criteria and indicators are difficult to establish due to differing opinions of stakeholders, the use of "process indicators" that show continuous improvement may help facilitate progress in moving forward. Relying on existing certification systems should be approached with caution, as they may (be perceived to) represent only some of the stakeholders' interests (WWI 2006).

4.2.6 Limitations related to national legislation and governance

A biomass certification system needs to comply with international (see 4.1) and national legislation. The latter is a minimum requirement in most existing certification systems. (Smeets et al., 2006) mention in a study on the sustainability of Brazilian bio-ethanol, that a weak government and law enforcement system is an implication related to national legislation. This is also acknowledged in case studies from (Lange et al., 2006) mentioning that a lack of governmental land-use planning can increase risks for local food security and leakage effects. Lack of land certification is another concern, limiting the position of local communities. Although legislation might be in place, a weak governmental law enforcement system in developing countries to ensure compliance of these laws may remain a problem (see also 4.2.2).

Additional control mechanisms might be required in countries with weak governmental and law enforcement system. Support is needed to national governments to improve their law and enforcement systems.

4.2.7 Cost levels of biomass certification

Compliance with criteria has to be controllable in practice, without incurring high additional costs (Faaij et al., 2006). Within the frame of extra costs for the sustainable production of biomass and certification, two different cost aspects are identified (see also annex 17):

- Extra costs to meet sustainability criteria for the production and transport of biomass (e.g. measures against soil erosion or an additional wastewater treatment facility).
- Costs for monitoring the compliance with the sustainability criteria and the physical traceability of the product; Components of these costs are e.g. the costs of field study by a certifier or sampling the palm oil during loading and unloading.

A brief attempt to quantify possible cost ranges for these cost items, based on existing sustainability schemes and certification systems, is included in annex 17[2]. Based on this, it can be concluded that costs for complying with (strict) sustainability criteria can be substantial: a range of 8-65% additional costs was found in literature, though incidentally also a slight cost reduction was reported. Costs for the certification process itself and chain-of-custody are (in case of large-scale operations) much lower, a range of 0.1 - 1.2% was found.

However, for small-scale farmers, again this number may be much higher. Costs are strongly related to the scale of operation, the strictness of sustainability criteria, the number of sustainability criteria and the expertise required to check them adequately. In addition, many biomass types (especially not pre-treated, bulky biomass) have already a relative low economic value. For example, in Finland one lorry of forest chips (40 tonnes) residues costs about € 800 at the power plant gate (Alakangas, 2007). For such streams and small-scale production, extra costs for sustainability certification could potentially become prohibitive.

(Zarrilli 2006) mentions that developing countries have traditionally encountered difficulties getting certificates (see 4.2.4) issued by their domestic certification bodies and recognized by the importing countries. They often need to rely on (expensive) services provided by international certification companies. Issues of cost and who pays are therefore critical to the success of a certification program, particularly when seeking participation of smaller-scale producers with fewer resources (WWI 2006). It is recommended to make as much as possible a link with existing certification systems to limit administrative burdens and costs (Cramer et al., 2006), see also 4.2.4.

4.2.8 Issues related to inequalities in development and international trade

There is concern that biomass certification can become an obstacle for international trade and develop trade restrictions due to proposed sustainability criteria. Measures to ensure conformity may act as powerful non-tariff barriers (especially for developing countries) if they impose costly, time-consuming tests (Zarrilli 2006). Also, some sustainability indicators under development go beyond indicators developed in many other sectors and it should be avoided that this backfires on biotrade if too many restrictions are put in place (Cramer et al., 2006). (WTO 2006) also mentions a number of arguments why not to distinguish between products on the basis of how they are made, i.e. on the basis of sustainability criteria:

- If one country sets rules (such as requiring eco-labels), which deals with the way products are made in another country, then it is intervening in the producing country's rules;
- When products are identified only by what they are, not how they are made; countries can set their own standards as appropriate for their level of development and can then make their own trade-offs between their own needs (and values) for development and environmental protection;
- If countries do not impose their standards on each other, standards can be tailored to conditions, priorities and problems in different parts of the world.

Sustainability criteria should be developed through a transparent and fair process, taking into account local conditions, where all countries involved are effectively presented. A multi-stakeholder approach is needed to get as much input and buy in from the different players in the area (Otto, 2007). Support is needed to improve developing country's capacity to play an active role in the development of biomass certification (Zarrilli 2006). It must be considered that there is a large diversity in the technical efficiency level in biomass production in the world ranging from large-scale, high-tech production to smaller-scale, low-tech biofuel production focused primarily on poverty alleviation. The appropriate technologies and policy orientations required to promote these two objectives are different. Policymakers need to clearly define their outcomes and design policies accordingly. The larger and more developed biofuel industries become, the greater the policy effort required to fulfil social and environmental aims (WWI 2006).

5 Proposed strategies for implementation of a biomass certification system

Certification is one of the policy tools available to pursue the sustainability of biomass. Policy tools which can be used to promote the sustainability of biomass are mentioned by (Richert et al. (2006):

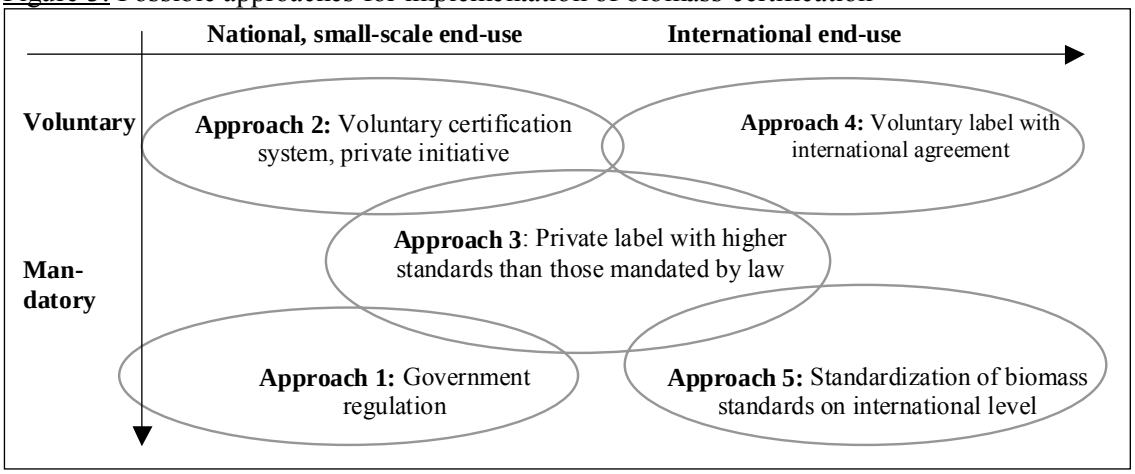
- *Certification*: Only biomass that is certified according to criteria derived from sustainability principles is allowed to be imported as a result of government support for bio-energy production.
- *Product Land Combinations*: Only biomass from regions that comply with sustainability principles are allowed to be imported as a result of government support for bio-energy production. Government decides which products from which regions are eligible for government sponsored bio-energy production.
- *Regionalization:* In this strategy, Europe utilizes its own biomass resources before importing biomass from developing countries.

Table 9: SWOT analysis for certification to pursue sustainable biomass (Richert et al., 2006).

Strengths	Weaknesses
• Flexible in land choice; • Clear translation 'do no harm' possible; Connects to approach NGOs to stimulate forerunners (promotes continuity)	• Controllability system is low (control by private parties) • Political discussion on approach & considerations lacking • Translation "do more good" is limited; • Expensive (administration is expensive for companies and therefore difficult to apply for small holders); • The system is inflexible once a standard is developed (in practice it turns out to be difficult to adapt a standard);
Opportunities	**Threats**
• Certification is not dependent of a national political context so that local initiatives can be rewarded	• Because of decentralized implementation, there is a risk that the quality of certificates is variable; • Due to low technical feasibility of high quality certification, there is pressure to weaken quality of standard; • Is applied without consideration, automatism

The three tools were analyzed by scoring the effectiveness, the technical, juridical and political feasibility and the time needed to implement the tool. Advantages and disadvantages for certification as a policy tool in specific are included in table 9 (Richert et al., 2006). In this section, we discuss proposed strategies and pathways for the implementation of a biomass certification system as can be found in several studies and in literature. Five main strategies can be distinguished (see figure 3), which will be discussed one by one.

Figure 3: Possible approaches for implementation of biomass certification



Approach 1: Government regulation for biomass (minimum) standards

This approach is based on a government regulation for biomass minimum standards, possibly combined with incentives (Cramer et al., 2006). It coincides with e.g. the viewpoint described in the study by (WWF 2006) that 'promotes the adoption of a mandatory GHG certification scheme for all biofuels, whether produced in the EU or imported, combined with reporting obligation for environmental and social sustainability issues with a view to improve performance over time. (Maier et al., 2005) also favour this approach mentioning that the EU must insist upon the development of an eco-fair certification scheme for sustainable bioenergy sources, which guarantees privileged market access to the EU. Initiatives to embed biomass certification into national policy can be found in countries as UK, Belgium and the Netherlands (see section 3.1).

Approach 2: Voluntary certification system, bottom-up approach

In this approach, also called the *bottom-up approach* (Fritsche et al., 2006), a group of governments, companies, and other interested parties voluntarily adopts standards and certification schemes, as e.g. several Roundtables are developing. Collaborative certification schemes could be a starting point, setting minimum standards for cultivation and harvesting practices for producers. As trade increases in volume and complexity, a more advanced and innovative certification scheme may build off of earlier efforts. While not all biomass types may fulfil the entire set of sustainability criteria initially, the emphasis should be on the continuous improvement of sustainability benchmarks (WWI 2006).

Relevant in this approach is to see which player can take the lead in the process. Also, time and interest is needed to introduce and implement standards. Existing instruments or organizations can be used to push the process, e.g. bi- and multinational financing institutions are relevant players in this process to start implementing sustainability standards for their project (co-financing) operations (Fritsche et al., 2006). Currently, two voluntary certification systems (GGL and Electrabel) that cover the complete biomass chain are in implementation. Other certification systems are under development (see section 3.2 and table 9).

Approach 3: Private label with higher standards than those mandated by law

As part of a voluntary certification scheme, it would be possible to develop an eco-label for those biomass related products that meet higher than those mandated by law (WWI 2006). Object of certification is a governmental regulation for biomass minimum standards combined with a set of private standards. Higher standards or special cases are based upon voluntary agreements of biomass producers. The latter would include companies in the chain of custody whose statutes or internal regulations contain several biomass standards and being based upon goodwill (Fritsche et al., 2006). In this approach, there are several institutions that can take care for the certification of biomass: governmental institutions (certification with regard to governmental guidelines) or private certification institutions (governmental guidelines combined with stricter private guidelines) (Fritsche et al., 2006). An example for this approach can be found in the UK (see section 3.1) considering to link of GHG certification to RTFO and to cover other environmental and social criteria by a separate voluntary scheme (Bauen and R. Tipper 2005).

Approach 4: Voluntary bio-energy label combined with international agreement

Promoting international general agreements on 'well functioning global markets for bio-energy is suggested by (Hektor 2006). These agreements could be established through written general guidelines or 'codex of behaviour' for direct actors involved. A similar kind of approach is suggested by (Verdonk 2006) giving proposals for governance systems for bio-energy, based on a comparative case study research on the governance of comparable commodities as e.g. coffee and wood. The proposal results in a system consisting of two pillars: a bio-energy labelling organization (BLO) and an International Agreement on Bio-Energy (IAB) (see also table 10).

Table 10: Characteristics of the proposal (Verdonk 2006):

Instrument	Description	Purpose
Pillar BLO:		
Progressive certification	Multiple levels of compliance on sustainability criteria	Certification of production; Enables participation of many producers
Progressive price premium	Linked to the level of compliance and product quality	Incentive for producers to participate and to increase the level of compliance
Impact assessments	On local economy, food & energy supplies, complementary GHG using LCA studies	Prevents leakage effects and food & energy shortages; ensures GHG complementary
Marketing assistance	Advice programs on certification and organizing trade relations; certification subsidies for small & Southern producers	Enhances involvement of and benefits for small & Southern producers
Buyers groups	Actors from industry and civil society	Stimulate demand of BLO certified bio-energy
Monitoring	Chain-of-custody certification	Certification of trade
Pillar IAB:		
Covenants	Agreement between industries and governments	Increases use of BLO certified bio-energy
National import & production rules	Based on BLO certification	Limits import and production of non-BLO certified bio-energy
Regulation of market prices	Internalize environmental costs in prices energy	Lowers the price difference with unsustainable sources of energy

The BLO, for example a FSC-based certification system, might be able to penetrate the market within short time and offers stakeholder participation and standards that secure most sustainability concerns. The BLO seems acceptable to industry and the WTO (Verdonk 2006). The attractiveness for small and southern producers is enhanced in this system using Fair Trade based instruments, but remains in balance with downstream interests at the same time.

The framework of universal sustainability principles enables geographical differentiation of standards and accommodation of numerous bio-energy feedstocks. In order for the BLO to be manageable in the starting phase, it is proposed to limit the number of bio-energy feedstock and/or the number of sustainability concerns in its starting phase. Within time, the scope can be further widened (Verdonk 2006).

As the BLO suffers from dependency on conscious consumers, governmental intervention was originally proposed by Verdonk (2006) through a UN Agreement on Bio-Energy in order to realize significant market penetration (the 2nd pillar). However, as the establishment of an UNAB was considered a bridge too far (based on interviews), the development of an IAB by front running (Western) countries was chosen as alternative option. Western countries are assumed to have less divergent views on sustainability and foreign politics and have already markets for sustainable production.

Approach 5: Standardization of biomass minimum standards on international level

An option to regulate sustainable biomass standards internationally in a legally binding form would be through adopting a multilateral environmental agreement (MEA) or by integrating the standards into existing international agreements or standards (Fritsche et al., 2006). An agreement on the objectives about standards for bioenergy is recommendable on international level. The framework conditions for bioenergy should be regulated from which criteria for different sectors can be further established. Further step of refinement of these standards can take place to regional level with regard to objectives and conformation to the regional legal framework. This regulation can go beyond the minimum criteria of the international agreement and concrete instruments can be applied (Fritsche et al., 2006). No international agreements (voluntary or legally binding) exist yet for sustainable biomass standards. However, on a regional supra-national level, the EC is currently proposing the development of standards and a policy framework to secure sustainable biomass for the European region (see section 3.1).

6. Discussion

In this section, the strategies described in section 5 for the implementation of a biomass certification system are discussed (section 6.1), followed by a discussion on possible roles of stakeholder groups in the development of such a biomass certification system (section 6.2).

6.1 Recommendations in development of a certification system

The approaches as mentioned in chapter 5 are discussed based on the indicators used in the study from (Verdonk 2006) and concerns indicated in section 4.3.

6.1.1 Stakeholder involvement

The success of a biomass certification system depends on the involvement and support of the wide range of parties involved in the biomass production, trade and processing chain. Full involvement of all stakeholders, including small stakeholders, is advisable. A bottom-up approach (approach 2) includes the interest and involvement of all relevant players. Roundtables as RSPO serve well as forums to discuss topics relevant for biomass certification between stakeholders and reach common agreement on it. This approach requires a strong commitment of the stakeholders involved as it lacks an obligation for the market to fulfil the sustainability criteria. This diminishes a guarantee for international sustainable biomass trade. To secure sustainability concerns (see 6.1.2) some governmental intervention (approach 1, 3, 5) might therefore be required. Top-down approaches (approach 1, 5) might, on the other hand, involve the risk to exclude smaller stakeholders in the consultation process.

6.1.2 Securing sustainability concerns

Most stakeholders agree that a set of environmental, social and economic criteria should be included in a biomass certification system. Currently, various organizations are preparing principles or criteria (see section 3) but only few have started to bring them into practice. Lack of consensus and limited experience in translating some concerns for sustainable biomass production into indicators and verifiers hampers operationalization (see 4.2.1) and leads to the tendency to simplify sustainability criteria for the short term, taking into consideration extra criteria for the future. Weakening criteria may create a risk for securing biomass sustainability. On the other hand, a gradual development of a certification system with gradual learning (to gain insight and experience in criteria, see 6.1.4) and expansion over time might to be desirable (approach 2, 3, 4) for the short term to guarantee some level of sustainability for biomass production and trade.

Sustainability concerns are more secured in a certification system where standards of a certification system are (partly) translated into policy instruments (approach 1, 3, 5). A consideration in the development of a biomass certification system is therefore whether a certification should be legally binding or with restricted or no binding force. See also 6.1.4.

6.1.3 Level of flexibility (regional refinement)

Environment, policies (see 6.1.5) and possible implications vary from place to place (see 4.2.2) and a possibility for regional refinement of standards is therefore relevant. A developed voluntary or government regulated certification system (approach 1, 2, 3) may turn out to be, once standards are developed, inflexible (see table 11). A framework with minimum standards may enhance the flexibility of a system, as national or local relevant standards can be set (approach 5).

6.1.4 Feasibility in costs

Criteria need to be controllable in practice, without incurring high additional costs. At this moment, existing biomass certification systems (table 7) have included environmental criteria to limited extent and socio-economic criteria are not included yet or only to a certain limit and a compliance with the complete list of criteria (as proposed by various NGOs or governments) means therefore in reality a further expansion of criteria and principles for these systems. The feasibility of biomass certification systems (based on a more extended list of criteria) with respect to controllability and costs is therefore at this point still largely unknown.

Figure 4: Making use of existing certification system

Acceptance of existing certification systems (figure 4), although not covering 100% of the proposed criteria to secure sustainable biomass, may facilitate in the development of an international biomass certification system, at least in the short term. This practice, already used by voluntary certification systems (approach 2, 3) as GGL and Electrabel, requires a certain level of flexibility in a transition period of a certification system. Currently, knowledge is built up through the development of certification systems, policies and pilot

projects. This may provide (new) initiators in this field with insights in the development of a certification system.

6.1.5 Scope of possible regulation (legitimacy)

A biomass certification system has to comply with international trade regulations. This in itself requires coherence and coordination of the development of standards and policies from national to international level (approach 4, 5, see figure 3). Regulation for a limited number of criteria (energy use, GHG balance) seems to be possible according to WTO requirements but is more complicated for other criteria to secure sustainable biomass (see 4.1). Although it is possible to try to reach international consensus on these criteria, this is considered to be complicated for criteria with an impact on local scale. In this case, a possible solution is to translate criteria to voluntary standards. With this respect, a private label with higher standards than those mandated by law (approach 3) can be a solution. In general it is desirable for a sustainable biomass standard to be internationally regulated, because this requires acceptance of such standards under international law.

Using international environmental agreements, however, also has its limitations. Standards agreed upon are unlikely to be ambitious and international agreements and full implementation by contracting parties can take a long time. Also, MEAs are often inadequately implemented due to a combination of factors and problems (limited jurisprudence, soft commitments). An international agreement (approach 4, 5) will therefore have to be pursued over a longer period. With the need to secure the sustainability of biomass in a fast growing market, the initial development of a biomass certification system on national / regional level (approach 1, 2, 3, 4), possibly expanded into an agreement on international standards (approach 5) on a longer term, seems to be more feasible.

In addition to the establishment of a biomass certification system, there is the possibility for governments to use financial incentives to stimulate the use of certified biomass (approach 1, 3, 4) In this case, it is important that the incentives (e.g. subsidies) provided do comply with WTO rules (see 4.1). For the longer term, harmonization of subsidies is pursued, which might be a reason for governments to select alternative policy measures on the longer term to stimulate compliance of sustainable biomass criteria.

6.1.6 Compliance with national legislation

It is expected that progress to develop national policies and standards to secure sustainable biomass will vary strongly from country to country. Certification systems often need to comply with national legislation, which is not always in place or enforcement is weak (see 4.2.6). Thus, priorities, problems, government structures and processes vary in different parts of the world, as well as national legislation.

On one hand, these differences require to look at existing governance structures and to refine standards with respect to a regional scope (approach 1, 2, 3, 4). On the other hand, it might be desired to develop a set of minimum international standards to pursue countries to reach a certain level of sustainability for biomass production (approach 5). In all cases, additional support may be needed to improve a country's governance system in general, a task reaching beyond the scope of biomass certification.

6.1.7 Level of comprehensiveness and international coherence

There is a risk for proliferation of criteria, standards and systems that differ from one country or region to another (see 4.2.3). This trend is already visible today. Table 3 shows e.g. differences in the extent and strictness of sustainability criteria between various NGOs. Table 7 shows differences in the inclusion of socio-economic and environmental criteria between existing biomass certification systems or the ones in development.

Proliferation of certification systems in the market involves various risks (see also 4.2.3). To prevent this, international coherence between certification systems is desired. From a policy perspective, the preferred situation is one in which countries agree on common standards. This can be reached by an international framework of standards facilitated by a voluntary agreement by front running countries (approach 4) or by a binding international agreement (approach 5). For both approaches, The Code of Good Practice may serve as a useful instrument to encourage coherence and further international standardization of a biomass certification system.

6.1.9 Limited time horizon for implementation

A comprehensive, reliable and controllable biomass certification system is most efficient to secure the sustainability of biomass. This can be best achieved through a certain form of regulation (approach 1, 5) and international coherence (approach 5). However, achieving this requires a long process of negotiating towards an international treaty (approach 5), which can take a very long time. The question is whether other options are available in the interim. It is expected that the establishment of a voluntary biomass certification system, with its limitations to secure the sustainability of biomass, can be established in only a couple of years (approach 2, 4)

6.1.10 Avoiding the creation of additional trade barriers

A voluntary certification system (approach 2, 3) diminishes the risk for possible additional trade barriers as standards have fewer implications for trade compared to regulations. A (combination of) limited number of mandatory regulations (approach 3), or (extended with) a set of standards established by government or a private institution (approach 2, 4) is a possibility for a biomass certification system. Concerns related to the impacts of a biomass certification system in developing countries (especially for small stakeholders) relate to stakeholder involvement (6.1.1), regional flexibility (6.1.3 and 6.1.6) and additional support. The last is further discussed in section 6.2.

6.2 Role stakeholders in development of international biomass certification system

Current initiatives on biomass certification from various stakeholder groups range from building up experience through research and pilot studies, further developing sustainability criteria and certification systems and providing assistance. When discussing assistance, the role of developing countries in the development of a biomass certification system requires specific attention. Stakeholders recognize the opportunities of bioenergy for developing countries, but express at the same time their concerns. In various cases certification may not be achievable without outside assistance. Based on previous sections, table 11 provides an overview of possible roles of stakeholder groups in the development of biomass certification.

The implementation of an international biomass certification system involves a wide range of parties and requires therefore good coordination and coherence within and between stakeholders. Recommendations for further cooperation within and between various groups of stakeholders are:

- Companies, especially larger ones, active within the entire bioenergy chain may play a leading role in knowledge exchange and coordination of initiatives.
- Cooperation between companies and NGOs in specific elements of the chain, especially on the biomass production side, might be supplementing.
- Coordination in the wide range of initiatives is desired to prevent overlap of activities and to promote coordination and participation of all stakeholder groups, including the less powerful, in the discussion on biomass certification.
- There are a range of international initiatives with, partly overlapping, activities and objectives. A strong focus per initiative, based on own strengths, is recommended. The

most appropriate international body or initiative could take the lead in facilitating and promoting an international standardization or agreement for sustainable biomass standards.

Table 11: Overview of possible roles stakeholder groups in development of biomass certification:

Stakeholders	Possible roles
International bodies	• Assist in development international framework conditions or agreement for bioenergy • Initiator debate about role WTO in biomass certification • Coordinating role in stakeholder debate from various stakeholder groups • Support to promote sustainable biomass (financially, expertise, sharing knowledge) • Provide specific assistance to developing countries[27]
Regional bodies	• Policy or legal framework on biomass certification on regional level, integrating standards certification system into regional policy • Promoting coherence national policies on regional level • Refinement standards to local and regional conditions, further specification of set biomass standards • Support to build up expertise in implementing biomass certification system • Provide specific assistance to developing countries[36]
Government bodies	• Policy framework for biomass certification, set of biomass minimum standards possibly with more extended set of private standards • Policy measures (subsidies, regulations) to promote sustainable biomass • Support to build up expertise in implementing biomass certification system • Provide specific assistance to developing countries[36]
Companies	Key activities with the focus of initiatives depending on interests of the company: • Build experience in certification through (pilot) studies over the complete biomass chain, gradual learning and expansion of system over time • Promoting coordination and cooperation between companies on development certification system, e.g. energy companies in Europe may stimulate coherence in the development of biomass certification systems, at least on regional level, and form a strong incentive to other producers in the world. • Technical improvements of biomass related products • Financial assistance (especially for banking sector)
NGOs	• Keep watch over the reliability of the system in development • Representing and involving the less powerful in discussion on biomass certification • Building up experience through pilot studies and work in the field, mainly on the biomass production side • Trigger the discussion proposals by the development of principles and pathways for implementation of a biomass certification system.
Roundtables	• Facilitate discussions on biomass certification among stakeholder groups, at this time mainly on biomass production side • Promote initiatives on biomass certification (via biomass production side) in coordination with other initiators on biomass certification systems • Implementation of pilot studies

[27] Assistance from international and national governments can be provided in various forms. Based on own expertise, assistance can be provided in e.g. integrating sustainability standards for biomass into national policy or strengthening national legislation. It is desired to embed specific assistance on sustainable biomass to developing countries in broader development programs in which wider development issues (e.g. poverty alleviation, energy security) are addressed.

7. Summary and conclusions

The need to secure the sustainability of biomass production and trade in a fast growing market is widely acknowledged by various stakeholder groups and setting standards and establishing certification schemes are recognized as possible strategies that help ensure sustainable biomass production and trade.

Recently, various stakeholder groups have undertaken a wide range of initiatives as steps towards the development of sustainability standards and biomass certification systems. Sustainability standards and criteria are developed by various organizations. Between them, there seems to be a general agreement that it is important to include economic, social and environmental criteria in the development of a biomass certification system. However, mutual differences are also visible in the strictness, extent and level of detail of these criteria, due to various interests and priorities.

Concrete initiatives to translate these standards into operational criteria and indicators and to monitor and verify them through an established biomass certification system are more limited. At this moment, there are two certification systems for biomass in operation, initiated by energy companies, and some pilot studies are in implementation or under development.

The development of a (biomass) certification system is impeded by a number of issues. Many uncertainties on the feasibility, implementation, costs and compliance with international trade law of international biomass certification systems remain. Also, the possible risk of proliferation of individual standards and systems causes loss of efficiency and credibility. Therefore, it is worthwhile to consider in this preliminary phase which ways can be followed if the strategy to be taken is the development of a reliable, efficient biomass certification system. In section 5, five possible approaches for a way forward, all with its own strengths and limitations. However, for all apply that some urgent actions can be identified, needed for further development:

1. **Better international coordination between initiatives is required to improve coherence and efficiency in the development of biomass certification systems**. Various international organizations can take the lead in this as EC (for European region), UNEP/FAO/UNCTAD or others. This does not only prevent proliferation of biomass certification systems, but also provides a clearer direction in the approach to be taken (e.g. national or international oriented, mandatory or voluntary) for national and local initiatives.

2. Existing WTO agreements already provide some support about the role of WTO within the development of a biomass certification system. However, no precedent within WTO exists for biomass certification. **A process to assess the WTO-compatibility of a biomass certification scheme and to provide countries with the opportunities to exchange views on it is needed.**

3. Certification is not a goal on itself, but means to an end. It can be one of the policy tools that can be used to secure the sustainability of biomass. Setting up good practice codes and integrating sustainability safeguards in global business models may be also effective ways to ensure this. Thus, **an open vision for (a combination with) alternative policy tools should be maintained to look for the best suitable options to secure sustainable biomass production and trade**.

4. At this moment, experience is limited to make some criteria operational and more experience and time is required. Issues such as the design of specific criteria and indicators according to the requirements of a region, how to include avoidance of leakage effects and the influence of land use dynamics require the development of

new methodologies and integrated approaches. On the other hand, there is a need to secure the sustainability of biomass in a fast growing market on the short term. **A gradual development of certification systems with learning (through pilot studies and research) and expansion over time, linked to the development of advanced methodologies can provide valuable experience, and further improve the feasibility and reliability of biomass certification systems**. This stepwise approach gives the possibility for coherence of activities, monitoring and adjustment if needed.

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