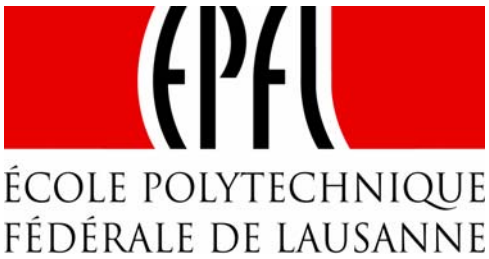

Sustainable Liquid Biofuels Development for Transport

Frequently Asked Questions and Review of Initiatives

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Table of Acronyms

ACCS	Assured Combinable Crops Scheme	LCFS	Low-Carbon Fuel Standard
BLO	Bio-energy labeling organization	LEAF	Linking Environment and Farming
BSI	Better Sugar Cane Initiatives	LowCVP	Low Carbon Vehicle Partnership
C&S	Carbon and sustainability	LUC	Land use change
CARB	California Air Resources Board	MEA	Multilateral environmental agreement
CDM	Clean Development Mechanism	NGOs	Non-Governmental Organizations
CENBIO	The Brazilian Reference Center on Biomass	NRI	Natural Recourses Institute
DME	Di-methyl eter	PPMs	Process and production methods
EC	European Commission	PPO	Pure Plant Oil
ECCM	The Edinburgh Centre for Carbon Management	RFS	Renewable Fuels Standard Program
EPFL	École Polytechnique Fédérale de Lausanne	RSB	Roundtable on Sustainable Biofuels Production
ETBE	Ethyl tert-butyl ether	RSPO	Roundtable on Sustainable Palm Oil
EU	European Union	RTFO	Renewable Transport Fuels Obligation
EUBIA	European Biomass Industry Association	RTRS	Round Table on Responsible Soy
EUGENE	European Green Electricity network	SAN/RA	Sustainable Agriculture Network / Rainforest Alliance
EUREPGAP	Protocol for Fresh Fruit and Vegetables	SASA	Social Accountability in Sustainable Agriculture
FAO	United Nations Food and Agriculture Organization	SBMS	Sustainable Biofuel Meta-Standard
FLO	Fair Trade label Organizations International	SFIS	Sustainable Forestry Initiative Standard
FLP	Flower Label Program	SIA	Sustainability impact analysis
FSC	Forest Stewardship Council	TBT	Agreement on Technical Barriers to Trade
G8	Group of Eight (Canada, France, Germany, Italy, Japan, Russia, the UK and the USA)	UN/DESA	United Nations Department of Economic and Social Affairs
GBEP	Global Bioenergy Partnership	UNCTAD	United Nations Conference on Trade and Development
GHG	Greenhouse gases	UNDP	United Nations Development Programme
GMOs	Genetically modified organisms	UNEP	United Nations Environment Programme
IAB	International Agreement on Bio-energy	UNIDO	United Nations Industrial Development Organization
IBEP	International Bioenergy Platform	UNNGOCSD	United Nations NGO Committee on Sustainable Development
IEA	International Bioenergy Trade	VROM	Department of Housing, Spatial Planning and the Environment
IFA	Integrated farm assurance	WCRE	World Council for Renewable Energy
IFOAM	International Federation of Organic Agriculture Movements	WTO	World Trade Organization
ISA 3000	International Standard on Assurance Engagements	WTT	Well-to-Tank
ISO	International Organization for Standardization	WTW	Well-to-Wheel
JRC/EUCAR/ CONCAWE	Joint Research Center/ European Council for Automotive R&D/ Oil Companies European Assosiation forenvironment, healt and safety in refining and distribution	WWF	World Wildlife Foundation
LCA	Life Cycle Assessment		

Preface

Increased worldwide concern about the sustainability of large-scale production of liquid biofuels for transport has led certain governments and institutions to start developing

sustainability standards in order to assess the environmental and social performances of this production. Several initiatives are being developed worldwide and some controversial issues and questions arise when trying to tackle sustainability assessment in this context.

The goal of the present document is to describe and compare different initiatives on biofuels sustainability standards, in the intention of offering a useful tool for policy makers and different stakeholders already involved or wishing to be involved in liquid biofuels consumption and production. The Part I of the document is dedicated to an overview of frequently asked questions about the sustainability of biofuels production. This part is designed as a short introduction to the main document. These questions start from the definition of the term "sustainability" itself, as considered in the context of this document, and cover aspects such as the implications of implementation and verification of a sustainability certification scheme, the issues that such a scheme must or must not cover, the possible impacts of large-scale biofuel production on food security, or the possibly undesired proliferation of biofuels sustainability initiatives. In the Part II of this document these questions are deepened by describing an extensive list of initiatives, varying in scope and application framework, for the development of sustainability standards for liquid biofuels production. For each initiative a general context was depicted, sustainability issues are treated along with implementation and verification schemes. Some of the initiatives, especially those of UK, the Netherlands and the State of California in the U.S. are the most developed. However, various initiatives have emerged from supranational and regional organizations, as well as initiatives coming from NGOs and private sector organizations. Even if they do not always show a very high degree of sophistication, these initiatives illustrate the point of view of the stakeholders involved and highlight the necessity of a serious process of harmonization of existing and future initiatives.

This document comes to enrich a sometimes harsh discussion. Biofuels, as an alternative to a full reliance on fossil fuel and a strategy to reduce greenhouse gases (GHG) emissions, are increasingly attacked from a point of view of sustainability. The question is raised whether the cure could be worst than the disease. As an example of the kind of reactions this subject can produce, the United Nations Special Rapporteur on the Right to Food is demanding an international five-year postpone on producing biofuels to combat soaring food prices[1]. Multiple and contradictory interests play a role here, and we claim that more constructive questions should be asked as follows: is there any *ways to produce biofuels in a sustainable manner and how to promote them internationally* ? We must have in mind that the energy transition is going on and the challenge is to make it as progressive as possible in order to avoid high price volatility and economic shocks that will be more destructive for weak economies countries and will give less incentive for investment in energy innovation. First generation biofuels are transitional technologies and second generation will open the door to a new energy era. Therefore, a global approach of anticipation is much needed and achieving a rational consensus is highly demanding.

The research activities of the Laboratory of Energy Systems (LASEN) aim at integrating clean technologies into the energy systems, the environment and the society.

The LASEN has developed specific skills in assessment of high penetration of renewable and clean technologies into existing energy systems, impacts of energy systems on the environment, integration

[1] http://www.swissinfo.org UN rapporteur calls for biofuel moratorium. October 11, 2007

of energy facilities and infrastructures in the environment, and development of intelligent decision-making support systems for planning and operating energy systems compatible with market-oriented and decentralized decision processes.

Extensive research activities have been conducted in biomass energy systems, focusing in methodology design for estimating the biomass potential, logistics and supply chain modeling, economic optimization models, life cycle assessments and integration of biomass into the energy systems. Past experiences in biofuels lead to several papers, in reviewed journals, Conference Proceedings with reviewed board and scientific reports.

At present, research activities in biofuels are focused on economic and environmental assessments of biofuels production in developing countries and in sustainable biofuels international standards development. Two PhD theses are on-going in these subjects. Case studies are being analyzed in India, Madagascar, Southern Africa Development Community and Brazil. PhD theses focus on sustainable biofuels production in developing countries.

The LASEN has collaboration with University of Tsinghua (China),University College Tniruvananthapuram (India), Southern Africa Economic Community, Brazilian national reference Center on biomass (CENBIO) and the University of Sao Paulo (Brazil). Moreover, the LASEN is part of the Energy Center of the EPFL (http://cgse.epfl.ch/page65660.html) which is working on a multi-stakeholder initiative to develop international standards for sustainable biofuels.

The LASEN's team on sustainable biofuels mainly includes:

1. Dr. Edgard Gnansounou (Head of the LASEN, PhD, Civil Engineer, Specialist in energy planning and in techno-economics and environmental assessment of bioenergies)
2. Luis Panichelli (Environmental Engineer, PhD Student at LASEN, Argentina)
3. Juan David Villegas (Chemical Engineer, PhD Student at LASEN, Colombia)
4. Arnaud Dauriat (Environmental Engineer, Postgraduate in Energy and specialist of life cycle assessment)
5. Several master students

PART I

Rationale for Sustainable Liquid Biofuels' production

1. How to define "sustainability"?

The most common definition of Sustainability or Sustainable Development was given by the World Commission on Environment and Development (the Brundtland Commission) in 1987. It means to satisfy our present needs without compromising the future generations' ability to meet their own needs. The definition implies the balance of three components, stated in the Declaration of Rio on Environment and Development in 1992: 1) Environmental protection, 2) Economic growth and, 3) Social development.
Sustainable development demands joint reliance on the three criteria: preserving the environment, satisfying the human needs in a social fairness way and stimulating progress (UNNGOCSD, online).

Consequently, the sustainable production of bioenergy is defined as "*the production of biomass-based fuels for transportation, heat and electricity generation that allows an economic growth preserving the natural environmental and promoting a a well balanced social development*".

In this booklet, biofuels stand for liquid fuels derived from biomass and used for transport purposes. Gaseous fuels and other utilizations such as heat and electricity generation are not included in the next sections.

2. Why do we need a sustainability assessment of biofuels?

Due to the exponential growth in biofuels production to diversify the fuel mix, significant concerns have been raised about the sustainability of the production strategy. Certain risks to the economic growth, the preservation of the natural environment and the social development have been identified. The economic performance of the biofuel production strategy depends on oil prices. Due to the instability and fluctuation of the oil markets, the sustainable economic growth of the biofuel production system is not always guaranteed. Moreover, the scale economy plays an important role in achieving the economic viability. The life cycle emission of GHGs, the deforestation for feedstock production, the degradation of soils, the

consumption of water and the loss of biodiversity may impact more or less severely the natural environment. Finally, the food availability, the working conditions, and the distribution of benefits introduce risks of imbalances in the social development. Hence, a consistent framework and a robust methodology are needed to verify that the biofuels are produced in a sustainable way.

3. How to assess sustainability in biofuels production?

The sustainability of biofuels' production is assessed by the implementation of a hierarchical assessment tool. A set of sustainability principles is defined and is verified by the fulfillment of a set of criteria that are measured by indicators (Fig. 1).

A principle is a premise of reasoning or action that is formulated based on social values, tradition and scientific knowledge (see also FAO, 2002). A set of principles define the contextual framework for developing a sustainability assessment system. It provides the basis of indicators, criteria, compliance checkers and verifiers. In order to assess the fulfillment of sustainability principles it is necessary to determine what the conditions that verify them are. A criterion is a set of conditions by which an object is assessed for given dimensions. It defines the rules to be satisfied in order to accomplish the sustainability principle and operationally translates the meaning of the principle.

To satisfy one principle a set of criteria has to be verified. The measurements for verifying the criteria are called indicators. An indicator provides a consistent and clear measure of an attribute of the system under study that when satisfying the sustainability rules (criteria) it contributes to the accomplishment of a sustainability principle. An indicator is a quantitative or qualitative variable that can be measured. When testing the indicators' fulfillment of the criteria over time, the sustainability trend of the system can be determined.
Finally, in order to add specificity to an indicator a verifier is introduced. A verifier is a set of data that provides meaning, precision and site-specificity to the indicator.

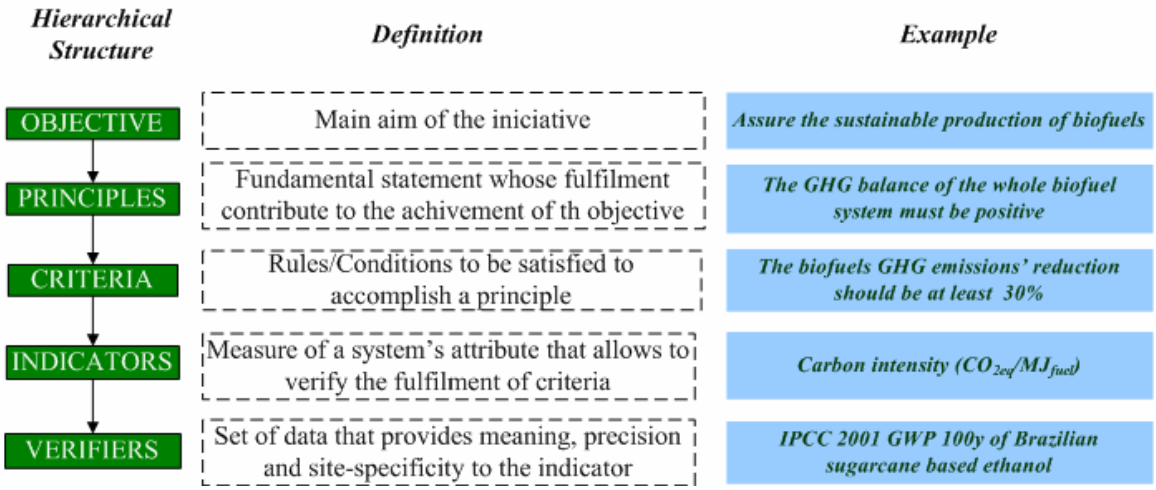


Figure. 1. Overview of hierarchical assessment tool. Adapted from NRI, 2002.

4. Why do we need to consider regional specificities?

Even though the general objective and the principles are universal and common to all locations, the criteria, the indicators and the verifiers are specific for each region. Moreover, principles may have different degree of importance depending on the local context and social values. In some regions the economic growth can be primordial, while in others the development of social fairness and the protection of the environment can be more highlighted. This is typically the case of the North-South differences, where industrialized countries are more concerned about the social and environmental constraints of biofuels production while developing and emerging economies, on the other hand, focus on the economic growth opportunity. For example, the European Union promotes the development of biofuels in order to reduce the vulnerability of the energy supply and to be able to achieve its GHG emissions reduction targets. This policy focuses more on environmental and social issues than on economic growth. On the other hand, the main driving force for biofuels production in developing and emerging countries (i.e. Malaysia, Brazil, India and Indonesia) is the promotion of the economic development.
Moreover, even in the same country, different perceptions of the sustainability issues can be confronted depending on the actors' interests and preferences. The limiting factors of sustainable production can vary geographically from one place to another. Water use is a critical factor in few regions (e.g. India), land-use and water quality can be the most constrained factor in intensive agricultural regions (European Union), social conditions may be important in labor intensive feedstock production (i.e. Sugarcane in Brazil). Consequently, while sustainability has one clear meaning, the relevant rules to achieve it (the criteria) are locality-specific, so are the indicators and checkers used to verify the compliance with the sustainability conditions.

5. Why a multi-stakeholders approach?

Similarly to the regional specificity, the perception of environmental, social and economic risks vary from one individual to another as their function in society may rely on different objectives. Local governments, NGOs and academia may be more concerned about the social, technical and environmental aspects, whereas, private producers such as car manufacturers, oil industry, agriculture and biofuels associations may favor the economic aspects.
A balance of stakeholder's opinions is essential to achieve a consensual definition of the conditions to assure sustainable production of biofuels in a specific region.

6. Socio-environmental criteria. Should economic criteria also apply?

Some controversies have arisen in the development of sustainability principles. Current initiatives focus on environmental and social issues, while the economic aspects are less treated. As the principles are to be applied to the private sector, consequently the rationale is that the economic profitability is assured, while the socio-environmental issues should be monitored as they are an uncontrolled factor of private stakeholders.
However, our perspective is that the sustainability principles should tackle the three dimension of sustainable development: 1) Environmental protection, 2) Economic growth and, 3) Social development. For instance, a government in a developing or emerging country

may decide not supporting a biofuel project if its economic global impact is not significant compared to other aspects.

7. Could biofuels development hamper the food procurement and endanger food security?

The issue of "food or fuel" came on the spotlight since the protest in Mexico City about the surge of the tortilla maize prices in January 2007. The strong support of the U.S. administration to corn-bioethanol production was accused. This situation was backed up by the rise of agricultural commodities prices during the year 2006 and the earliest 2007.

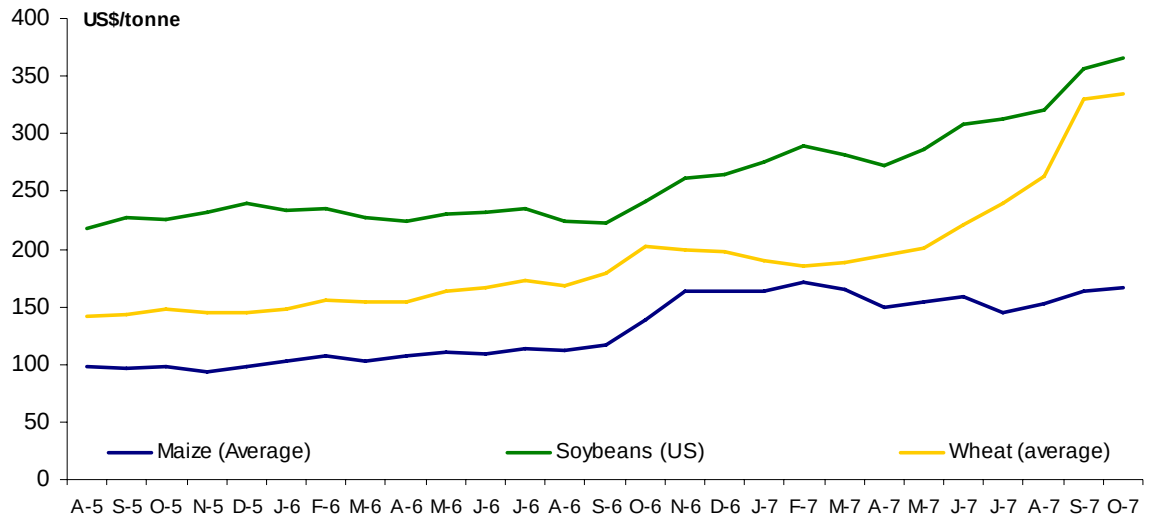
Does biofuels production in the world endanger presently and in short term food security?

Pros: There is a correlation between the increasing use of agricultural feedstock for biofuels production and the increase of the prices of the corresponding commodities. The general consensus from past analysis and future projections is that biofuels production will raise food prices and consequently will threaten food security, especially in biofuels producing countries and in poor countries where food imbalances prevail (Tokgoz *et al*., 2007; Kojima *et al.*, 2007; OECD, 2007; OECD/FAO 2007; FAPRI, 2007). Agricultural commodities used for biofuels production will increase their price and, due to the correlation between agricultural commodities market prices, the price of other agricultural commodities will also increase.

Cons: The prices of agricultural products on the international market result from the confrontation between the demand and the supply. While biofuels production contributes to reduce in short term the agricultural products available for food, other factors may also contribute similarly such as the weather conditions and the short term yield of agricultural production. The analysis must be deepened in order to identify the role of biofuels among all other factors. Presently, the share of arable lands used in the world for biofuels production is about 1% (IEA, 2006). However this proportion is higher in some producing countries such as the U.S. and that is liable for raising the price of some agricultural products such as maize, the international market of which the U.S. is the main supplier.

Factual case of corn: The bioethanol production in the U.S. will maintain the international maize price at a high level in short term however …
According to the *World Bank Maize Commodity Brief* (April 27, 2007), there was a surge on the maize price in 2006 mainly due to the increased use for ethanol production in the U.S. that accounted for 20% of the maize produced in the country. However, the increase of the maize demand in the U.S. due to bioethanol did not cause a decrease of the U.S. export of maize. That export in 2006/2007 reached a record compared to the last three years. However, the U.S. stock of maize decreased sharply from 49'968 metric ktons (2005/2006) to 7'557 ktons (2006/2007). That is the main explanation of the price surge of the maize on the international market. Even if the maize producers in the U.S. are intended to plant more maize and reduce cotton and soybean areas, about half of the increase of their production will be devoted to the increase of ethanol that will use 25% of the U.S. maize crop in 2007/2008. Therefore the *World Bank* predicted that the maize price will average $ 170/ton compared to an average of $122/ton in 2006.

However, the prediction of the *World Bank* for 2007 does not occur thank to the adaptation of the production in the U.S. and in Latin American countries. The FAO is expecting a record cereal harvest in 2007. The problem rather comes from the impact of poor weather conditions on the wheat production in Europe that has provoked a hike of the international wheat price with a spillover effect on the price of the maize (Fig. 2).



Maize (Average): US No.2, Yellow, U.S. Gulf ; Argentina, Up River, f.o.b.
Wheat (Average): US No.2, Hard Red Winter ord. Prot, US Fob Gulf ; US No.2, Soft Red Winter Wheat , US Gulf ; Argentina, Up River, f.o.b.
Soybeans (US) : US No.1, Yellow, U.S. Gulf.

Figure 2. Evolution of the international prices of maize, wheat and soybean. Source: FAO, International Commodity Prices.

Notwithstanding the high price of the U.S. maize in 2007, that price is still lower than in many developing countries. Table 1 compares the case of U.S. and South Africa.

Table 1. Comparison of U.S. with South Africa's Cereals prices for selected dates.

Commodity	One year ago	One week ago	**11 October 2007**
	U.S. $ / ton		
U.S. Yellow maize	108.4	134.7	**136.7**
RSA Yellow maize	166	265	**277**
RSA White maize	167	250	**270**
Exchange rate (Rand/$)	7.75	6.89	**6.72**
Oil price ($/barrel)	57.75	78.97	**80.11**

The raise of the maize price in South Africa results jointly from poor yield in 2007, increase of the fertilizers prices as a consequence of the oil price increase and the hike of the international wheat price mainly due to the weather conditions in Europe.

What would be the case in long term?

Access to food depends on the possibility to obtain a certain amount of food at an affordable price. Consequently, food procurement and security depend mainly on food availability and prices. Biofuels development can indirectly influence these factors (Fig. 3).
Food procurement relies on the availability of land to produce a specific product. Land is a limited resources and its allocation to produce one or another crop will depend on ecological (soil type, climate) and economic factors (mainly, crop market price). Consequently, fuel and food crops compete for the same land unless the land availability is significantly higher than the needs. Otherwise, this competition can lead to displace food crops production when energy crops market value are higher than for food crops. Moreover, energy crops can displace livestock production reducing the availability of livestock derived products. This effect is due to the land use change for the production of biofuels feedstock.

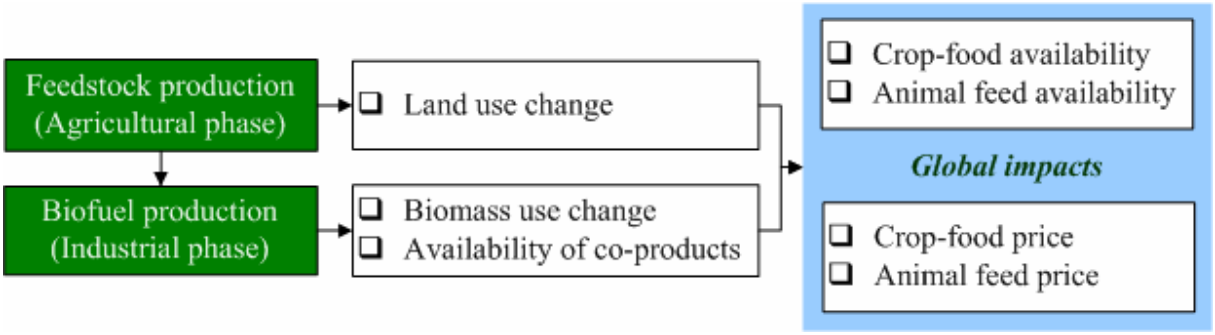


Figure 3. Impact of biofuels production on food security

When using edible crops (such as sugar-cane, corn or soybean) for biofuels production even if the land use remains the same, the feedstock is used for another purpose. This change in the use of the biomass can also lead to reduce the availability of food crop products (sugar, corn grain, soybean oil). Furthermore, biofuels demand can expand the agricultural frontier, displacing feedstock production.
On the other hand, biofuels production co-products such as soybean meal and DDGS are used as animal feedstock. A higher availability of these co-products can reduce the livestock production costs, increasing the accessibility to livestock derived products.
It seems clear that when introducing a new demand for the same feedstock or land, its availability will decrease and its price will increase unless the productivity of the agriculture increased enough.

Would the increase of productivity compensate the diversion of agricultural areas from food to fuels? That will depend on the market share of biofuels in long term and on the precautions taken at international level for prioritizing sustainable biofuels in international markets.

Furthermore it is expected that the raise of international price of agricultural commodities jointly with the improvement of agriculture performance in developing countries will contribute to the reduction of poverty and to the increase of their food security. When the second generation biofuels will become available in the long term and crop productivity will increase, the impact of biofuels production on food security will be significantly reduced (Msangi *et al.*, 2007). While food exporting countries (specially developing and emerging economies) may benefit from higher food prices, particular concern raised for net food importing developing countries and poor urban populations, especially in the case of emergency due to civil wars, natural hazards or climate change. These cases come under the food aid and should be treated in a convenient way.

The case of the food aid

The increase of the agricultural commodities prices due to large scale production of biofuels will endanger in short term the affordability to food of the populations in poor regions. Meanwhile, it could create the opportunity of the competitiveness enhancement of agriculture in most of the developing and emerging countries. There was a complaint that the present dominated in-kind food aid hampered the development of agriculture in poor countries and was an indirect way that the donors could use to continue subsidizing their agriculture and dominate the international market. Negotiations are going on within the WTO in order to promote grant and purchase food on the local markets of the beneficiary countries instead of systematic in-kind food aids, this latter kind of aid being reserved to physical shortage in the aided countries. By favoring the increase of the agricultural commodities prices, the diversion of part of the lands to biofuels in industrialized countries will support development of agriculture both for food and biofuels in developing countries. The sustainability of this scheme depends however on the international regulation of the process. Intelligent solutions must be implemented, including orienting grant to the populations in poor, prevent diversion from food to fuels in countries where food imbalances prevail and give limited in-kind food aid if necessary particularly in the transitional period when agriculture of the poor countries is being adapted and in the

cases of physical collapses. The main risk of that scheme, from the viewpoint of the food aid agencies, is the possibly decrease in food aid from industrialized countries such as the U.S. and Europe as a consequence of a high reduction of their cereals stocks and the reluctance of their administration to replace previous in-kind food aids by the required grant.

8. What national initiatives for sustainable biomass are already in course?

Among the most influential national initiatives for sustainable bioenergy we can count the following:

- Carbon and Sustainability reporting within the Renewable Transport Fuels Obligation (RTFO) –United Kingdom.
- Testing Framework for Sustainable Biomass- The Netherlands
- Low-Carbon Fuel Standard for California-USA

9. What international initiatives for sustainable biomass are already in course?

Several international initiatives for sustainable bioenergy exist at different maturity states, including the following:

- Roundtable on Sustainable Biofuels Production- RSB, Switzerland
- Biofuels Initiative of UN Conference on Trade and Development-UNCTAD
- International Bioenergy Platform (IBEP)-FAO
- Global Bioenergy Partnership (GBEP)- G8 +5
- The European Commission Initiative
- Sustainable International Bioenergy Trade – IEA Task 40

10. Why we need to certify the sustainable production?

Even though an individual can claim for the sustainability of its commercialized biofuel, this has to be valued in some way. To this end, a certification approach is used. Some initiatives proposed a mandatory compliance with the sustainability principles while others prefer a voluntary approach. However, independently of the adopted strategy, the principles should be verifiable and enforceable to be implemented as a policy instrument (Cramer, 2007).

11. How to certify the compliance with the sustainability principles?

Most of the initiatives proposed the implementation and certification scheme based on a Meta-Standard on Sustainable Biofuels Production. As defined by the International Organization for Standardization (ISO, 1993) a Meta-Standard is a standard of a higher or second-order kind, that is, a generic standard, definition language or other tool or technique used to specify and express standards, guidance material, tests and implementations. Compliance with the Meta-Standard is achieved through the certification to existing standards which have proved to give a sufficient guarantee that the principles and criteria of the Meta-Standard are fulfilled (EcoFys, 2007). However, the existing standards normally do not cover

all the sustainability principles; therefore, additional checks are proposed to verify the sustainability of the production system. The meta-standard approach is suitable due to its ability of rapid implementation in a cost-effective way, avoiding the proliferation of standards and accounting for the acceptance of individual producers. Other initiatives propose a specific standard for low carbon biofuels and other are still not clear about the way to implement the sustainable principles.

12. What kind of verification approach could be applied for the certification of bioenergy?

Several methods are proposed to verify the implementation of the certification system and deal with the chain of custody of the sustainable produced biofuel. The soundest include *the track and trace system, the mass balance system, the book and claim system and the bulk commodity system*. Description of each system is shown in the respective initiative. With some advantages and disadvantages it seems that all the suggested systems are foreseen as suitable. May be, different systems will co-exist or a single approach will be implemented.

13. Which are the benefits of a certification system?

The benefits of the certification will depend on the objective of the governmental policy. The certification is proposed to those companies willing to commercialize biofuels in a given territory. If the certification is mandatory the single benefit is the right to continue commercializing biofuels. On the contrary, the certification is voluntary and the company will benefit from a tax reduction or exemption if its biofuels are certified. In some cases, the tax reduction is proportional to the amount of impact reduced (i.e. proportional to the reduction in GHGs). This may give the company a competitive advantage for commercialization. Some uncertainties exist about the possibly use of certification scheme as a commercial barrier. The main solution to this is to follow the WTO rules for avoiding barriers to trade. However, the voluntary approach is seen as an intermediate step for obligation. In the long term the assurance of the sustainability production is expected to be mandatory. From the societal point of view, the benefits of the certification go towards the benefits of sustainable development. A certification scheme will allow satisfying the sustainability principles aiming to protect the environment, promote the economic growth and the social development.

14. How to partly transfer the benefits of the certification to the feedstock producers?

Feedstock production will take place mainly in developing and emerging countries. However, the main biofuels consumption is expected to take place in industrialized countries. Consequently, significant trade is foreseen between biofuels' producers and consumers. As the private benefit from certification will apply to the companies commercializing biofuels mainly in developed countries a north-south controversy arise. A suitable mechanism has to be developed to transfer part of the private benefit of certification to the feedstock and biofuel producers. This issue is not clear in the reviewed initiatives. Differential market prices for certified and non-certified production can be a solution. Nonetheless, this has to respect international trade agreements. Feedstock producing countries, on the other hand, will benefit

from socio-environmental issues such as better working conditions, higher land productivity, better management practice that in the end will result in a sustainable economic-growth.

15. Will certification systems create additional trade barriers? What is the WTO context regarding this issue?

From the producer's point of view, the implementation of technical regulations and sustainability standards for the production of biofuels could be seen as the establishment of discriminatory non-tariffary restrictions to trade. From this perspective, it is important to clearly situate the development of these standards and obligations in the framework of the World Trade Organization (WTO) agreements. The Agreement on Technical Barriers to Trade (TBT) (WTO, 1994), establishes that "products imported from the territory of any Member shall be accorded treatment no less favorable than that accorded to *like* products of national origin and to *like* products originating in any other country". This rule must apply for all WTO members when establishing technical regulations, defined as documents stressing the *mandatory compliance* of product characteristics or their process and production methods (PPMs); and for the development of standards, defined as guidelines of *voluntary compliance* for product characteristics or their related PPMs. The TBT also establishes that technical regulations "shall not be more trade restrictive than necessary to fulfill a legitimate objective, taking account of the risks non-fulfillment would create". As legitimate objectives the TBT counts national security requirements; the protection of human health or safety, animal or plant life health, or the environment. In that sense, national obligations regarding a net carbon dioxide emissions reduction, or aiming at protecting biodiversity could be justified and fit into the WTO normative. According with TBT agreement, the process of development of sustainability standards must agree with the *Code of Good practice for the Preparation, Adoption and Application of standards* that establishes a framework for this kind of initiatives. However, given that WTO relies on agreement and discussion that are currently ongoing, there are some issues that need to be further clarified. One of these issues has to do with the question whether the definition of "like products" would include or not process and production methods (PPM's). In other words, the question is whether certification schemes must deal with the production phase and not only with product characteristics, and whether this inclusion could introduce discriminatory and arbitrary trade barriers (Fritsche *et al*, 2006; Van Dam *et al*, 2006). This question still needs a definite answer. The future of sustainable biomass initiatives depends strongly on it.

Finally, the agreement recommends taking into account special development, financial, and trade needs of a developing country member regarding the implementation of technical regulations and sustainability standards. Therefore, sufficient adaptation time must be allowed to all members, with a special mention to developing countries.

16. When is a voluntary or a mandatory certification system appropriate?

The answer to this question has already been partially developed when answering the precedent question about the WTO framework. Some uncertainties exist about the misuse of certification as a commercial barrier. In general, voluntary certification system is seen as a friendliest approach regarding international trade than technical regulations are, even if financial incentives are used to stimulate the use of certified biomass (Fritsche *et al,* 2006; Van Dam *et al*, 2006). However, long-term sustainability of biofuels production could be better served by the implementation of technical regulations and obligations. The Renewable

Transport Fuels Obligation (RTFO) –United Kingdom, combines the two approaches, linking the obligation with GHG certification and covering environmental and social criteria by a separate voluntary scheme. In the long term the assurance of the sustainability production is expected to be mandatory.

17. Are there issues that cannot be addressed through a certification system?

According to Cramer (2006), there are elements which fall out of the company level and are only visible at a macro level, being the government's responsibility to monitor them. Most of these macro effects are related to indirect land use change: land prices, food prices, property rights, and the availability of food, relocation of food production and cattle feeding, deforestation, and change in type of vegetation. The European commission expressed doubts about the link of indirect effects of land use change and commitments at firm level. In general, initiatives on biofuel certification, recommend monitoring these effects without directly including them into the certification scheme.

18. How to deal with a proliferation of criteria and isolated initiatives?

A harmonization effort must be undertaken in order to avoid the hampering of sustainable biomass-to-fuels initiatives. International consensus must be reached regarding scope and enforceability of sustainability standards and regulations. International panels and multi-stakeholder initiatives as the Round Table on Sustainable Biofuels, based at the Swiss EPFL (École Polytechnique Fédérale de Lausanne) Energy Center, have a crucial role in this process. Experience must be taken from advanced initiatives, as the UK or the Netherlands ones. At the implementation level, a meta-standard strategy is suitable due to its ability of rapid implementation in a cost-effective way, avoiding the proliferation of standards and accounting for the acceptance of individual producers.

PART II

Review of initiatives on biofuels' sustainability

1. Renewable Transport Fuels Obligation (RTFO)- The UK approach

The context of the UK Biofuels Sustainability Standards setting

The Energy Act 2004 allowed the UK's government to decide introducing a Renewable Transport Fuel Obligation (RTFO) the details of which were to be defined through a complementary legislation. The government intends to implement the RTFO from 2008, requiring fossil fuels companies to blend a certain percentage of biofuels to transport fuels, i.e. 2.5% in 2008/2009, 3.75% in 2009/10 and 5% in 2010/2011. The fulfillment of the RTFO is compulsory for any big company supplying fuels to the UK market; obligated parties are those companies that supply more than 450'000 litres of fossil fuels per year. The verification of the obligation requires that the obligated suppliers provide a monthly and annual carbon and sustainability reporting to the RTFO administrator.

The proposed "carbon and sustainability"[2] certification scheme is the result of drafts by two Consultants E4Tech and ECOFYS. The description of the principles and the methodology to evaluate their compliance are stated in the draft documents: E4Tech (2007) for the Greenhouse gas and ECOFYS (2007) for other Sustainability dimensions. Another reference is ECCM (2006).

The whole process of the UK's initiative on Biofuels sustainability includes several steps starting from the Energy Act of 2004 to the implementation of the RTFO that is due to begin on 15 April 2008 (Fig. 4).

[2] In the proposed UK's Biofuels Standard, "Carbon" information and "Sustainability" information (environmental and social information) are considered separately. That conception is somewhat artificial as the life cycle Greenhouse gas balance also pertains to the sustainability assessment.

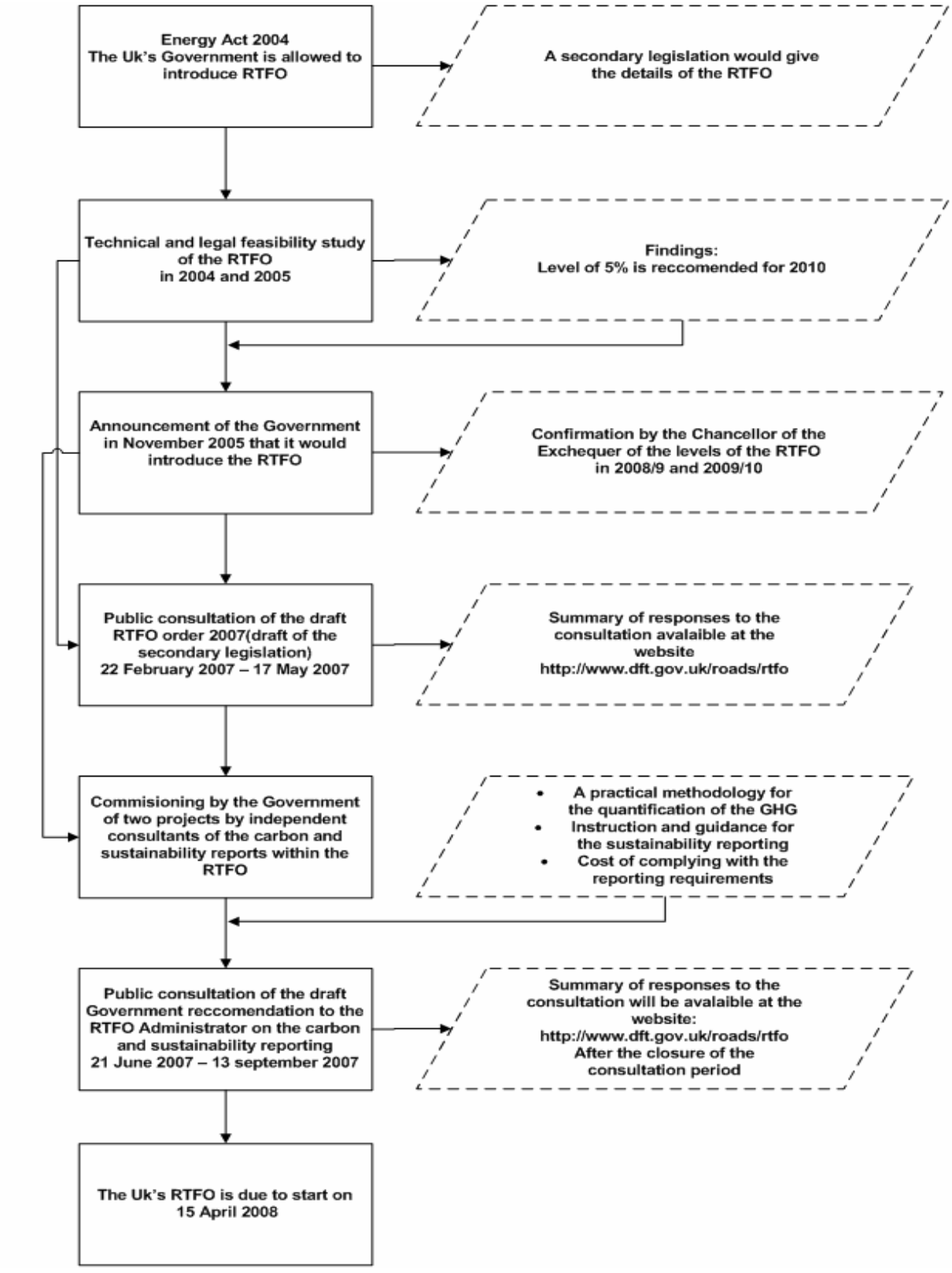


Figure 4. The process of the UK's initiative on Biofuels sustainability.

The involvement of the stakeholders in the process was organized through the *Low Carbon Vehicle Partnership (LowCVP)* that gathers over 250 organizations including automotive and

fuel industry, the environmental sector, government, academia, road user groups and other organizations.

The LowCVP was founded in 2003 by the UK's Government with the aim to develop collaborative initiatives for promoting the markets of low carbon vehicles and fuels and to build understanding and consensus concerning the best options towards low carbon transport. The tasks of the LowCVP were conducted through Working Groups. The principal role of the working groups is to develop strategies and provide advice to the UK's Government in various areas such as biofuels and hydrogen. The strategies are based on studies ordered to independent consultants and on international studies. Concerning the biofuels' sustainability standards, the LowCVP was a shared instrument of the UK's Government and the stakeholders to achieve consensual propositions for the RTFO and avoid possible bottlenecks related to misunderstanding and to lack of information. The government has funded through the LowCVP the studies on which the *Carbon and sustainability (C&S) Reporting within the RTFO* was based. The intermediary reports of these studies were validated within the LowCVP before delivering to the Government. The details of the mission, aims and objectives of the LowCVP is presented on the website of the organization (http://www.lowcvp.org.uk).

In the rest of the section 1, the reporting of the Greenhouse gas emissions reduction, the other sustainability dimensions and the verification approach within the draft of standards are presented.

The Greenhouse gas reporting

The "carbon" reporting is based on the calculation of the "carbon intensity" of a biofuel in order to estimate the total GHG saving from a Well-to-Wheel (WTW) approach based on a Life Cycle Assessment. The carbon intensity is « *a measure of the amount of GHG emissions produced, expressed in units of CO_2 equivalence (converted on the basis of global warming potential), per unit of fuel* » (E4Tech, 2007). Contrary to the "Sustainability" reporting that is restrained to the production of the feedstocks, the "Carbon" reporting covers the whole production chain of the biofuel. However, the reporting methodology is the same.

The GHG savings of a biofuel are determined as the difference between the carbon intensity of the reference fossil fuel (e.g. petroleum diesel) with the biofuel (e.g. soybean-based biodiesel). The approach models specific biofuels pathways including wheat to ethanol, sugar beet to ethanol, sugarcane to ethanol, corn to ethanol, ethyl-tertiary butyl ether, oilseed rape to biodiesel, soy to biodiesel, palm oil to biodiesel, used cooking oil and tallow to biodiesel and bio-methane. A specific tool based on Excel® Spreadsheet was designed to calculate their GHG emissions. The tool includes default values of the modeled pathways i.e. value that can be used for a given pathway in case of lack of information. Methodological assumptions vary from one pathway to the other.

Other sustainability dimensions

Under "Sustainability", the Department for Transport of UK (Department of Transport, 2007) includes environmental and social dimensions. The proposal of Sustainability reporting within RTFO was made by Ecofys, a Consultant office, based on the Meta-Standard concept. That

concept includes the possibility to consider compliance with existing *qualifying standard*s, i.e. those standards (e.g. standards on Sustainable agricultural practices) that are compatible with selected principles of the *RTFO Sustainable Biofuel Meta-Standard (SBMS)*. To get certified, those biofuels that are not already certified for any *qualifying standards* must comply with all the "Sustainability principles" of the RTFO-SBMS and with the required GHG emission reduction.

Few existing standards on agriculture are listed in Table 2 with the mention whether they are accepted or not as *qualifying standards* for 2008/2011.

Table 2. Qualifying standards

Standard	Qualification
Assured Combinable Crops Scheme (ACCS)	Not accepted
EurepGAP, integrated farm assurance (IFA), Combinable Crops	Not accepted
LEAF	Qualifying Standard
Sustainable Agriculture Network / Rainforest Alliance (SAN/RA), farm assurance scheme.	Qualifying Standard
Round Table on Responsible Soy (RTRS)-Basel criteria	Qualifying Standard
Roundtable on Sustainable Palm Oil (RSPO)	Qualifying Standard
International Federation of Organic Agriculture Movements (IFOAM)	Not accepted

Concerning the particular case of sugarcane, no standard exists till now. However, sustainable production of this crop can be certified based on auditing by the RTFO-administrator and being producers member of initiatives for standard development such as the Better Sugar Cane Initiatives (BSI).

The "sustainability" criteria are inspired on existing standards for sustainable agriculture and are limited to the agricultural phase, excluding processing, conversion and transportation. The rationale of this decision is risk-based (feedstock production account for most of the environmental impact) and due to implementation of the Meta-Standard (most of the existing standards are farm-gate standards). The "sustainability" criteria also exclude by-products and waste-products as it is not expected that their certification will change the behavior of the farmer due to their low economic value. However, this assumption may be reassessed in the specific biofuel pathways where co- products play a significant role. "Sustainability" criteria are divided in environmental and social principles (Annex 1).

Environmental criteria

Environmental criteria are based on ECCM report (ECCM, 2006) modified to include carbon storage reporting and recommendations from the WWF sustainability standards for Biofuels (Fritsche UR, et al., 2006). The criteria are divided in five main areas, namely: carbon storage, biodiversity conservation, soil conservation, sustainable water use and air pollution. Reporting on *Carbon stock changes due to direct land use* is not compulsory. However in absence of that reporting, the RTFO Administrator will *conduct an ex post facto analysis to assess the potential impact of land use change*. A carbon stock change indicator (Carbon pay back time) and a reference date for *land use change (LUC)* are included to the reporting of the LUC. The impacts of *indirect land use changes* are excluded from this methodology but biofuels production on idle land is recommended.

Social criteria

Social criteria were based on principles from the *Social Accountability in Sustainable Agriculture (SASA)*[3] modified to include land rights and biomass locally-oriented production (Annex 2). *Competition with food* is not included due to the difficulty in assessing the link between *food security* and *biofuels production*.

Reporting levels and targets

The government admits that availability of information and efforts by the suppliers to collect the reporting data will increase in time. Hence, "don't know" response is permitted in the reporting for part of required data. However the level of completed data fields within the monthly reporting by each obligated supplier is expected to increase along with the implementation of the RTFO according to the targets in Table 3.

Table 3. Targets expected by the Government for completed data fields within the monthly reporting

Reporting	2008/2009	2009/2010	2010/2011
Percentage of feedstock meeting a Qualifying Standard	-	50%	80%
Annual GHG saving of fuel supplied	40%	50%	60%
Data reporting of sustainability characteristics	35%	65%	80%

Source: Department of Transport, 2007.

Verification of the C&S report

A chain of custody from the feedstock producer to the fuel supplier must be set up to validate the carbon and sustainability reports. Three methods are proposed and considered as suitable to the objectives of the RTFO to track this issue.

1. Bulk commodity: Based on a physical separation of certified and non-certified plantations. It allows the supplier to certify that the feedstock used for the biofuel production was produced according to sustainability standards. To this end, this method is the most credible and transparent to the civil society. However, the cost of the logistical structure to keep two feedstock's types separated may be significantly high.

2. Book and claim: As no link exists between the physical product and the certificates market the supplier can only claim that the product was added to the market but it can not certify the sustainability of the production system. If the supplier buys the certificate directly from the farmer there will be a guaranty that most of the benefit of the sustainability production stays in the farm. Otherwise, biofuels industry and down stream companies in the supply chain may retain the added value of the sustainable production system.

3. Mass balance: This approach is a mix of the two others. The mass balance allows linking the physical product with the sustainability certificate but there is no physical segregation of

[3] http://www.isealalliance.org/index.cfm?fuseaction=Page.viewPage&pageId=504&parentID=500&nodeID=1.

the feedstock types. The method is credible, transparent and do not need extra investment in the logistic structure.

The mass balance is the default approach adopted for reporting in the RTFO C&S. The obligated suppliers must hire independent auditors for carrying out audits against the International Standard on Assurance Engagements (ISA 3000).

2. Testing Framework for Sustainable Biomass- The Netherlands approach

The Context of the Dutch Biofuels Sustainability Standards setting

The regulation on biofuels development in the Netherlands considers two phases (Wismeijer, 2007) that differ from policy point of view. The first phase focuses on obligation instrument and the second phase introduces tradable certificates.

In the first phase, the minimum EU target of biofuels market share is implemented throughout obligation that a certain percentage of the sales must be biofuels. The translation of the EU targets into obligations in the Netherlands is presented in Table 4. The obligations must be met separately by biodiesel and bioethanol in order to promote the development of both of these biofuels.

Table 4. Translation of the European Biofuel Directive into Dutch obligations

	Obligation in the Netherlands		EU target
	Biodiesel	Bioethanol	
2007	2.0%	2.0%	2.0%
2008	≥2.5%	≥2.5%	3.5%
2009	≥3.0%	≥3.0%	4.5%
2010	≥3.5%	≥3.5%	5.75%

Source: Wismeijer, 2007

During this phase, the Excise exemption that was previously valid till 2006 for voluntary development of biofuels is no more applicable.

In the second phase, the certification scheme that will be applied includes sustainability criteria based on principles and indicators developed in the *Testing framework for sustainable biomass* (Cramer *et al*., 2007). That framework is devoted to sustainability criteria for biomass production and processing, with emphasis on biomass for electricity and heat generation as well as for transport fuel with a possible extension to the biomass use as raw material for chemical production. It was developed at the request of the Dutch government by the project group "Sustainable production of biomass", which started activities in January 2006 under the chairmanship of Prof. Dr Jacqueline Cramer who has been later nominated as Minister of VROM (Department of Housing, Spatial Planning and the Environment). An initial report was presented in July 2006, followed by a process of consultations and further

elaboration, with the support by six working groups (Greenhouse gas emissions; competition with food, local energy supply, medicines and construction materials; biodiversity, other environmental issues; economic prosperity; well-being). Finally, two reports were presented, one in January 2007 from the working group on the greenhouse gas emissions calculation methodology, (Kwant *et al.*, 2007); the other one, the framework itself, was presented in February 2007. Figure 5 illustrates chronologically the process leading to the development of Dutch approach for Sustainability criteria.

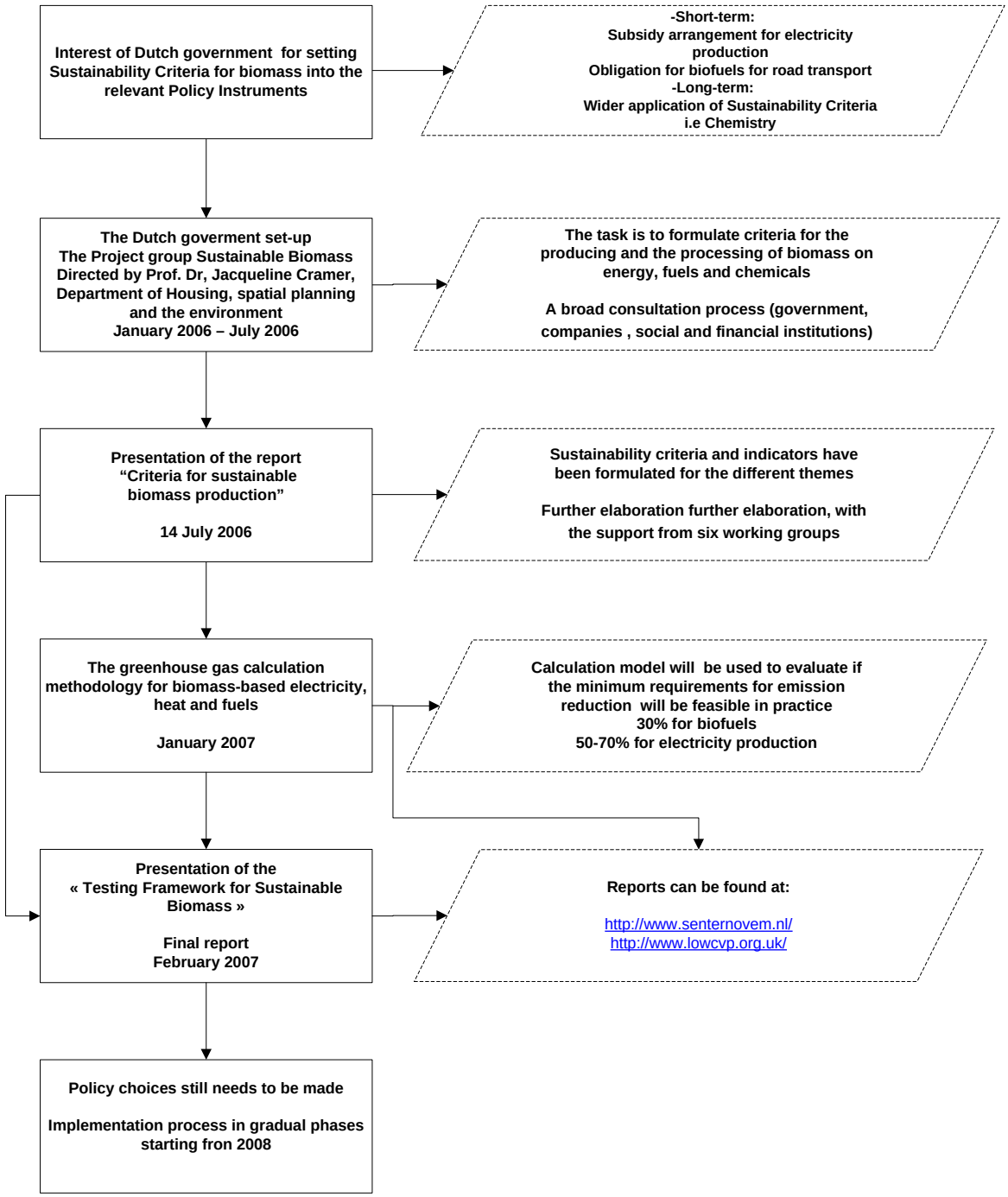


Figure 5. Development of Dutch approach for Sustainability criteria.

The testing framework does not differentiate between biomass of Dutch, EU or not EU origin. The framework is intended to be included in the Dutch government relevant policy instruments. In the short term this regards the Dutch subsidy arrangement for electricity production and the obligation for biofuels for road transport. In the longer term the Dutch government wishes to promote a wider application of these sustainability criteria, i.e. for bio-based chemical production. The aim is to increase social support in the eventuality of large-scale use of biomass for the Dutch energy supply. The implementation step needs a careful coordination with national and international legislation and regulations, as recommended by the Cramer's commission. In the rest of the section 2, the sustainability standards and the GHG calculation methodology as defined by the project group is presented along with the verification approach within the framework.

Sustainability dimensions

The Dutch testing framework is organized into nine different principles, each one referring to a more specific set of criteria and indicators. The nine principles are arranged according to six different themes related to global sustainability as illustrated in Table 5. According to the testing framework, principles are taken as general starting points, formulated as objectives which serve as a basis for quality requirements.
Criteria are the translation of these principles into concrete requirements that have to be complied with. Indicators are qualitative or quantitative parameters by which a criterion becomes testable. Themes, principles, criteria and indicators are comprehensively summarized in Annexes 3 to 8.

Table 5. Testing Framework for sustainable biomass. Principles of sustainability.

Themes	Principles
Greenhouse gas emissions	The greenhouse gas balance of the production chain and application of the biomass must be positive
	Biomass production must not be at the expense of important carbon sinks in the vegetation and in the soil.
Competition with food and local application biomass	The production of biomass for energy must not endanger the food supply and local biomass applications (energy supply, medicines, and building materials).
Biodiversity	Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity.
Environment	In the production and processing of biomass the soil and the soil quality are retained or improved.
	In the production and processing of biomass ground and surface water must not be depleted and the water quality must be maintained or improved.
	In the production and processing of biomass the air quality must be maintained or improved.
Prosperity	The production of biomass must contribute towards local prosperity.
Social well-being	The production of biomass must contribute towards the social well-being of the employees and the local population.

There are two levels distinguished by the testing framework: *The company level and the macro level*. Following this approach, the provider of bioenergy or biofuel in the Netherlands is the one who have to comply with the testing framework at the company level. Some criteria, like the reduction of greenhouse gas emissions fall into this level. Other elements such as conservation of soil quality and biodiversity, the local social impacts and a clean

production and processing of biomass will be tested also at the company level. But there are other elements which are only visible on regional, national or even supranational scales, particularly the effects that are caused by indirect changes in land use. In consequence, they are a responsibility of authorities. Dutch government will follow this macro effects in cooperation with the production countries and the various companies, with the support of international organizations such as the World Food Organization FAO. Some of these macro effects are:

- Land prices
- Food prices
- Property relations
- The availability of food
- Relocation of food production and cattle breeding
- Deforestation
- Change in type of vegetation

The Greenhouse gas reporting in the Testing Framework

According to the Testing Framework, the calculation of greenhouse gas balance must be done without ambiguity. For this task the project group designed a methodology, to be used for different bioenergy chains, which is described with detail in Kwant *et al* (2007).

To estimate the percentage GHG reduction achieved by a particular bioernegy production, its performance must be compared with a reference fossil chain. For electricity production the GHG emission reduction must now amount to at least 50-70%, for the application in transport fuels at least 30%. These percentages must increase further by innovation in the future. The basis for comparing biofuels for transport with conventional fuels is 1 km driving of a standard car on gasoline or diesel. The basis for comparing bio-electricity and fossil electricity is 1 kWhe delivered to the costumer. A calculation tool has been developed specifically for transport biofuels (Hamelinck, 2007) and will later be extended to bio-electricity and bio-heat. The biofuel chains that are included in the calculator are: Ethanol from sugar cane, sugar beet, wheat and corn; ETBE from ethanol from sugar cane, sugar beet, wheat and corn; Biodiesel from tallow, used cooking oil and fats, palm oil, soy, rapeseed and sunflower oil; Pure Plant Oil (PPO) from tallow, used cooking oil and rapeseed; NExBTL®from the Nesté Oil process; Bio-methane from anaerobic digestion and other processes. Some of the most important assumptions made for this methodology are the excluding of indirect land-use from the calculation (reporting and monitoring being required) and the use of system expansion to allocate emissions between product and co-products of different chains.

Verification of the reporting within the Testing Framework

Certification is envisioned as means to make the testing framework verifiable and enforceable. Companies must prove by means of certification that they are complying with the testing framework. The framework was designed as a universal framework in line with international biomass certification initiatives such as ***FSC hout (Wood certification), Round Table for Sustainable Palm Oil, Round Table for Sustainable Soy, the Dutch assessment guideline for wood and the Essent Green Gold Label*** system. These certification systems

already include many sustainability criteria for biomass and also contain minimum requirements. In the testing framework the project group has sought to keep in line as much as possible with these existing systems. Some certification systems already comply with a large part of the criteria of the testing framework. A comparison between the certification systems involved and the Dutch testing framework can lead to a declaration of equivalence. The reduction targets of greenhouse gases emission by a specific source for bioenergy do not form a part of any certification system, so this will always have to be tested additionally.

The project group also cooperated closely with the United Kingdom initiative (RTFO). As in the UK's RTFO, three different methods for certification are discussed in the document.

1. The track and trace system, in which the biomass is fully traceable to the source and is completely separated from the non-certified biomass, all the companies in the sustainable chain being certified. This system is applied by example in niche markets such as Fair trade flows or biological products.

2. The mass balance system, in which the biomass is only partially traceable to the source, during the production process the certified biomass will be mixed with non-certified biomass and all the companies in the "sustainable biomass chain are certified" as in the case of track and trace system.

3. Negotiable certificates (book and claim), in this system biomass is not traceable to the source and the end user submits certificates that guarantee the production of a certain quantity of sustainable biomass. According to the testing framework, the advantage of this system stems from the fact that the certified entity is the producer.

The verification system to be chosen is dependent on the route that is followed during the further implementation of bio-energy. With commodities, (large bulk quantities) the so-called book and claim verification system would be preferable. In smaller niche markets, such as, for instance, Fair Trade flows, track and trace must be recommended because of the traceability of the biomass. Finally, the complying with the set of sustainability criteria will be determined by independent auditors who compile a checklist on the basis of the criteria.

3. Low-Carbon Fuel Standard for California- The California-USA approach

The context of the California's Low-Carbon Fuel Standard

The Californian Government has fixed ambitious GHG emission reduction levels. By 2020, the objective is to reduce these emissions to the 1990 levels. The Global Warming Solution Act 2006 (AB32) demands the California Air Resources Board (CARB) to elaborate a mandatory reporting system for GHG emission's reduction. To this end, the Low Carbon Fuel Standard (LCFS) imposes a reduction of at least 10% in GHG emissions from transportation fuels by 2020. After a technical study, the LCFS was included in the State Alternative Fuels Plan (SAFP-AB 1007), a state plan to increase the production and use of renewable fuels in California. The implementation schedule of the LCFS is being analyzed by the CARB and the

regulatory process to implement the standard is expected to be completed in December 2008. The program will be reviewed in 2013.

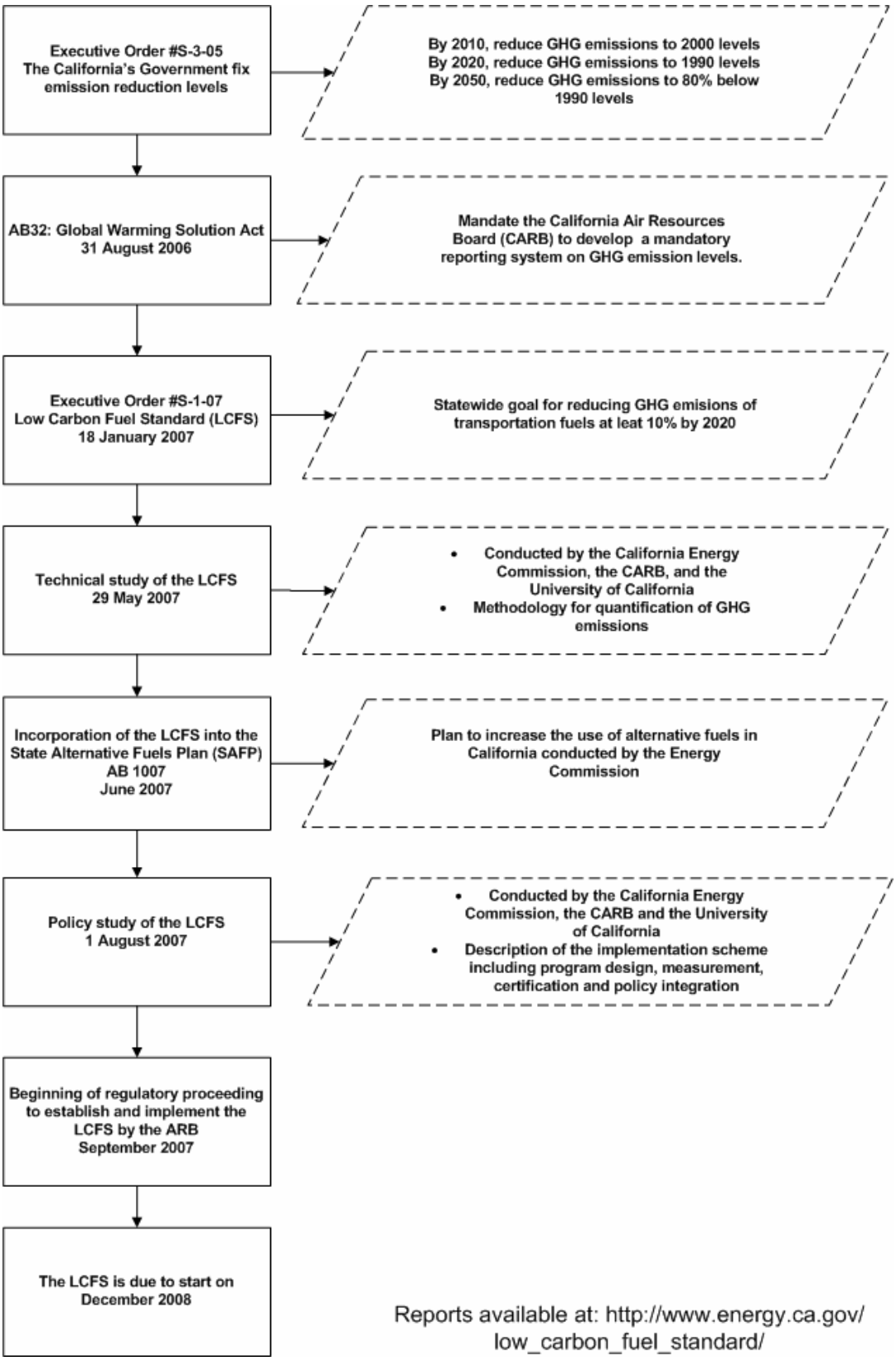


Figure 6. California's process to the Low-Carbon Fuel Standard.

The Standard has to be certified in order to commercialize biofuels in California and is being developed by the University of California, the California Energy Commission and other state agencies under the coordination of the California Environmental Protection Agency. However, it applies not only to biofuels but to all liquid fuels for road, flight and off-road application and non-liquid fuels (electricity, natural gas, propane and hydrogen).
A technical and a Policy Analysis report describe the proposed schedule (Farrell *et al.*, 2007a,b). The technical report describes the methodology to estimate the carbon intensity of the biofuel, the fuel characteristics, identifies the resources for low-carbon fuels and analyzes different scenarios of fuel-conversion technology to achieve the specified carbon intensity reduction target. The Policy report tackles the practical implementation of the LCFS describing the program design, the certification, auditing program and the chain of custody. Also, a trade and banking strategy for carbon credits is outlined.

The documentation of the LCFS is available in the California Energy Commission web-site: http://www.energy.ca.gov/low_carbon_fuel_standard/

The GHG reporting

The approach is based on the UK standard and applies the same LCA methodology to calculate the "carbon intensity" of the biofuel. Even though the approach in Well-to-Tank (WTT), system boundaries are limited to production, processing and transportation of the biofuel) the calculation takes into account the drive train efficiency of the vehicle by adjusting, with a factor, the GHG emissions per unit of fuel energy (CO_2eq/ MJ). As different vehicles have different efficiencies in converting the fuel in to motive power, GHG emissions are corrected to account for the motive energy (the energy delivered to the wheel to move the vehicle and associated to the fuel-conversion technology combination). The approach allows eliminating the constraints related to a detailed analysis of the use phase but accounting for the conversion efficiency.

Other sustainability criteria

The Standard is only limited to GHG emissions and do not include other sustainability criteria. However, the California Government recognizes the need of reporting on other sustainability issues by the fuel providers; it considers that it is too difficult to implement them for the moment due to lack of effective methods to measure these effects.
On the other hand, in a first phase, the CARB will perform periodical studies on sustainability issues of transportation fuels used in California. The criteria include environmental as well as social issues, namely: degraded air and water quality, soil erosion, loss of biodiversity, use of genetically modified organisms, loss of wilderness and natural habitats, increased concentration of land holdings and land appropriation, reductions in worker safety, and increases in food prices. Some of these criteria, such as biodiversity loss and soil erosion, are considered to be partially covered by the LCFS. They claim that due to the correlation between GHG emission reduction and the other criteria, the sustainability of the system is also improved. However, social issues are clearly not covered by the LCFS.
The CARB will be in charge of developing methods and metrics for measuring and reporting on sustainability issues of transportation fuels. The approach will include effects in California,

the U.S. and in the global scale, considering direct as well as indirect impacts. They expect to learn from the European experience and align the LCFS with the international initiatives.

Implementation

Fuel suppliers have to comply with the standard in order to commercialize fuels in California. The main mechanism for reporting is the annually self-reporting of fuel sales. The fuels with GHG emissions above the standard will pay a fee proportional to the exceeded GHG emissions and the fuel volume. The fee value will be determined as the cost to society of reducing a certain amount of GHG emissions. Fuels performing beyond the standard will benefit from emission reduction credits. These LCFS credits can be traded and hold. The CARB will act as record-keeper of the LCFS credits. Misreporting of GHG emission of a sold fuel is expected to have a severe fine of 100 U.S. $ per gallon (U.S. $ 26.4 per liter).
After certification of a fuel supplier, an auditing process by third parties to the supplier and to the licensed certifiers is foreseen to verify the compliance with the standard and the certification process. Finally, a chain of custody to track the carbon intensity data of the fuel, similar to the 'mass balance' RTFO UK or the RIN US-EPA approach is beard.

Link to the National level

In a broader approach, the US Environmental Protection Agency is implementing the Renewable Fuels Standard (RFS) Program, establishing specific targets for renewable fuels production and a trading system. A tracking number is assigned to each batch of renewable fuel (RIN) that can be sold in an open market where r obligated entities must buy RIN equivalents in order to meet the RFS. The aim of the Program is to encourage the production and trading of renewable fuels and do not include at present any environmental concerns. However, the US-EPA may consider adding environmental information (mainly GHG emissions) in the RIN report.

4. Roundtable on Sustainable Biofuels Production- The EPFL- Switzerland approach

The context of the RSB Initiative

The Roundtable on Sustainable Biofuels (RSB) was launched in November 2006 as an initiative of the Energy Center of the Swiss Institute of Technology, Lausanne (EPFL). The aim of the initiative is the development of sustainability standards for biofuels production through a consensual process between global stakeholders. According to the organizers of the RSB, this initiative aims to develop standards with characteristics such as broad accessibility and applicability, as well as easiness to implement and to verify. A strong characteristic of the approach defined by the organizers is expressed as follows: "all standards development work will be done in an open and transparent way, with ample comment periods according to the ISEAL code of good practice.
(http://www.isealalliance.org/index.cfm?fuseaction=page.viewpage&pageid=502)"

To achieve these goals, the RSB uses different tools to facilitate stakeholders' dialogue such as virtual meetings between experts in RSB working groups and a Bioenergy wiki website (http://www.bioenergywiki.net) in which every person who wants to contribute to the discussion can participate. There are four open Working groups coordinated by the RSB team: GHG life cycle analysis, Environmental Impacts, Social Impacts and implementation.

A first draft of the principles has been developed as a multistakeholder consensus result in June 5th 2007. In that draft, the RSB developed a series of principles based in this first stage on ongoing or existing bioenergy and biomass sustainability initiatives, such as those of the Low Carbon Vehicle Partnership in the UK, the Dutch Cramer Commission work (Testing Framework for Sustainable Biomass), and the Roundtable on Sustainable Palm Oil (RSPO). The draft has been edited and commented via the bioenergy wiki. After a second period of stakeholders' consultation, a second version of global principles for sustainable biofuels production was delivered in October 23th 2007 and can be found in: http://www.bioenergywiki.net/index.php/Template:Current_Version_of_Principles_2nd_round.

Sustainability principles

The principles developed so far in the framework of this initiative are described by the RSB as **highly aspirational**, meaning by this that these principles represents "ideal hopes" towards which all biofuels production should be directed to. Table 6 summarizes the eleven principles presented in the second version. The Working Groups are in the process of refining these principles and developing a set of criteria and indicators as well. The second round of comments is open until 31th December 2007.

Table 6. Sustainability principles for biofuels production according to the RSB

Issue	Principle
1. Legality	Biofuel production shall respect all applicable laws of the country in which they occur, and all international treaties and agreements to which the country is a signatory
2. Consultation	Biofuel projects shall arise through fully transparent, consultative and participatory processes that involve all relevant stakeholders
3. Climate Change and Greenhouse Gases	Biofuels shall contribute to climate stabilization by reducing GHG emissions as compared to fossil fuels. Emissions shall be estimated via a consistent approach to lifecycle assessment, with system boundaries from "root to tank". This shall include direct and indirect GHG emissions, for instance from fossil energy used in growing, transporting and processing biofuels. It shall also include GHG emissions resulting from land use changes as land is converted to biofuel crop production, or as other production is displaced
4. Human and labor rights	Biofuel production shall not violate human rights or labor rights, and shall ensure decent work and the well-being of workers
5. Socio-economic development	Biofuel production shall not violate land or water rights, and shall contribute to the social and economic development of local, rural and indigenous

	peoples and communities
6. Food security	Biofuel production shall not impair food security
7. Conservation	Biofuel production shall not directly or indirectly endanger wildlife species or areas of high conservation value
8. Soil	Biofuel production shall not violate human rights or labor rights, and shall ensure decent work and the well-being of workers
9. Water	Biofuel production shall not directly or indirectly contaminate or deplete water resources
10. Air	Biofuel production shall not directly or indirectly lead to air pollution.
11. Biotechnology	If biotechnologies are used in biofuels production, they shall improve the social and/or environmental performance of biofuels, and always be consistent with national and international biosafety and transparency protocols.

5. Sustainability Standards for bioenergy- World Wide Fund For Nature (WWF) Germany-Öko Institut

The context of the WWF Initiative

This study that finished in 2006 was commissioned by WWF Germany from the Institute for Applied Ecology (Öko Institut) and was an early attempt to provide an overview of key ecological and social impacts of bioenergy along with a set of sustainability standards for future bioenergy supplies. A set of criteria and indicators are to be developed from these standards, aimed at implementation into voluntary or legal systems. However the study did not take into account the certification, monitoring and verification processes. The study was based in existing studies as well as certification schemes such as ***American tree Farm System, European Green Electricity network (EUGENE), EUREPGAP Protocol for Fresh Fruit and Vegetables, Fair Trade label Organizations International (FLO), Flower Label Program (FLP), Forest Steewardship council (FSC), Green Gold Label Program, Impact Basel Criteria for responsible soy Production, Round Table for Sustainable Palm Oil, Sustainable Agricultural standards, Sustainable Forestry Initiative Standard (SFIS), Utz Kapeh-Codes of conduct.***

References of this study can be found at:

Fritsche UR, et al., 2006: Sustainability Standards for Bioenergy, published by WWF Germany.
http://www.wwf.de/fileadmin/fm-wwf/pdf_neu/Sustainability_Standards_for_Bioenergy.pdf

Sustainability principles

Table 7. Summary of sustainable Biomass Standards.

Standard	Scope	Time Horizon
Clarification of land ownership	Regional/local	Short-to medium term
Avoiding negative impacts from bioenergy-driven changes in land use	Global	Short term
Priority for food supply and food security	Regional/local	Medium-to-long term
No additional biodiversity impacts	Regional/local	Medium-to-long term
Minimization of GHG emissions	Global	Short term
Minimization of soil erosion and degradation	Regional/local	Short-to medium term
Minimization of water use and avoidance of water contamination	Regional/local	Short-to medium term
Improvement of labor conditions and worker rights	Regional/local	Short term
Ensuring a share of proceeds	Regional/local	Short term
Avoiding human health impacts	Regional/local	Medium-to-long term

The translation of these standards into criteria and indicators is envisioned through a discussion process between different stakeholders. The study also included a legal and policy framework at the international and European levels. For the implementation phase, the authors presented some possible instruments for framing sustainable standards for biomass. These set of instruments included Feed-in tariffs, tax exemption or reduction, the legal definition of mixture quotas which would increase over time, or import regulations.

6. Biofuels Initiative of UN Conference on Trade and Development- The UNCTAD approach

The context of the UNCTAD Biofuels Initiative

The UNCTAD biofuels initiative started on June 2005 aiming to assist developing countries in large scale biofuels production, use and trade. The Biofuels initiative is part of the UNCTAD Carbon Market Program on climate change and its focuses on economic and trade policy analysis, and capacity and consensus building on biofuels. The goal is to help countries in designing and implementing a bioenergy development strategy under the Clean Development Mechanism (CDM) that allows them to trade emission reduction credits with countries under the Kyoto Protocol.

They proposed county-specific assessment to determine those countries better positioned to produce biofuels in a sustainable way. To this end, they are working in collaboration with the Earth Council Geneva, CENBIO - São Paulo and the Tata Group in India. The UNCTAD is at present developing case studies in India, Thailand, Brazil and Philippines while the initiative will be initially implemented in Brazil, India, Mozambique, Philippines, and Uganda.

The initiative has the support of the UN Foundation and is aligned with other UN and non-UN organizations (FAO, World Bank).

Documents and presentations at the Expert Meetings as well as a description of the UNCTAD initiative on biofuels can be found at the UNCTAD Carbon Market Program web site: http://r0.unctad.org/ghg/.

Sustainability issues

An international advisory expert group was formed to discuss controversial biofuels issues. The first meeting took place in Geneva in November 2006. Even though the main issue of the Initiative is trade, sustainability issues are also concerned. The discussion touches the implementation of labeling and certification initiatives and how they can be use to ensure certain sustainability criteria without constraining trade opportunities for developing countries. They state the need for coordination of the different initiatives and analyze the UNCTAD position to assume this role.
A second meeting was held in June 2007 to discuss on, among other, sustainability issues of biofuels development in developing countries. Sustainability concerns are focused on land availability for biofuels production, competition with food crops and increase food prices, and social development (new jobs, social equity, poverty alleviation). The roles of second generation biofuels in introducing sustainable alternative fuels as well as the implementation of a certification scheme for fossil fuels are being discussed. Biofuels certification is stated as controversial for trade development as it can act as a barrier for trade. The role of genetically modified organisms is also being discussed.

7. International Bioenergy Platform (IBEP)- The FAO approach

The context of the FAO IBEP

The FAO IBEP is a six years' initiative started in May 2006 at New York, in the 14th Session of the Commission for Sustainable Development. The FAO program is structured toward two main actions, namely: Knowledge management, and mobilization and implementation at the country level. They promote a country-specific approach to tackle special issues such as knowledge building, estimation of bioenergy potentials, and assist in sustainability development strategies, provision of data on bioenergy consumption, capacity building, stakeholder's participation, partnership and cooperation. Similarly to the UNCTAD initiative, they promote the integration with other UN and non-UN programs on biofuels development and are aligned with the Millennium Development Goals.
A First Technical Consultation on Bioenergy and Food Security took place in April 2007 to begin discussion on bioenergy potentials, sustainability and environment.
The IBEP initiative is hosted by the Natural Resources Management and Environment Department at FAO available from the web-site:
http://www.fao.org/sd/dim_en2/en2_060501_en.htm.

Sustainability issues

The sustainability task is part of the knowledge management action in the IBEP. The objective is to assist local stakeholders and the international community in the development and implementation of:

- International certification mechanisms of sustainability production
- Definition of methodologies, criteria and indicators to measure the environmental and social impacts
- Sustainability impact analysis (SIA)
- Technology options for biofuels.

Moreover, they support capacity-building for including sustainable issues in biofuels project development and for knowledge transfer.

8. Global Bioenergy Partnership (GBEP)- The G8 +5 approach

The context of the GBEP

The Global Bioenergy Partnership (GBEP), as well as the FAO initiative, was born in May 2006 at the 14th session of the Commission on Sustainable Development. The initiative was launched by the G8 group plus five active countries in the bioenergy domain, namely: Brazil, China, India, Mexico and South Africa. The GBEP focused on sustainability and trade issues of bioenergy mainly in developing countries and aimed to play a mayor role in:

- Supporting national and regional bioenergy policymaking
- Facilitating international cooperation in bioenergy
- Promoting the development of bioenergy projects and markets
- Supporting biomass feedstock supply through information and research
- Encouraging the development and transfer of biomass conversion technologies

The GBEP has identified existing bioenergy networks, initiatives and institutions and has defined the missing action to be developed. Synergies with other international bioenergy and biofuels initiatives, such as the ones of FAO, UNCTAD and IEA, are considered to reinforce the work.
They have identified the need for developing international standards for feedstock and fuels and a sustainability certification procedure. To this end, they will work with IEA Task 40 and ISO to develop such standards and a voluntary certification scheme. Moreover, they give a high importance to the inclusion of private sector and they work in close collaboration with other international organizations (FAO, IEA, UNCTAD, UN/DESA, UNDP, UNEP, UNIDO, UN Foundation, World Council for Renewable Energy (WCRE) and European Biomass Industry Association (EUBIA).

At present, the GBEP work is centered in:

- Developing feasibility studies for market-building activities
- Developing Sustainability Principles and Criteria
- Identification of gaps in technology and policy
- Formulating standard guidelines to measure GHG emission reductions, including CDM project-specific baseline methodologies and monitoring tools

The White Paper and the documentation of the GBEP initiative can be found in the web-site: http://www.globalbioenergy.org/. The 2nd Technical Working Group held in New York in February 2007 addressed the sustainability issues of bioenergy, based on work by the UNEP.

The expected outcome of the Sustainability Working Group includes:

- Environmental and social sustainability criteria supported by the GBEP partners
- Advices on certification schemes for bioenergy production by an independent third party
- Guidelines on agricultural practices for bioenergy crops production on a crop by crop basis
- A tool for determining which crop suits best local conditions
- Best practice case studies and examples
- Recommendations for and by governmental and industrial decision-makers
- Authoritative reference document for decision-makers

Sustainability issues

The UNEP is developing an initial set of sustainability criteria based on existing national and commodity-based systems. The criteria were built up in the UNEP initiative Sustainability assurance system for growing biofuel feed stocks and then adopted by the GBEP.
The criteria concerns environmental and social risks, namely : GHG emissions, biodiversity loss, water overuse and contamination, soil degradation and erosion, food versus fuel, small versus big actors, and labour conditions. The list of preliminary criteria is shown in Table 8.

Table 8. UNEP preliminary set of sustainability criteria.

Biodiversity	- Avoid cutting down high value forests - Apply a precautionary approach regarding the use of GMOs - Protect native plants/ecosystems
Climate change	- Avoid cutting down existing carbon stocks - Make crop choices according to potential GHG emission reductions
Water	- Avoid overexploitation of water resources - Avoid water pollution, by avoiding use of (toxic) chemicals - Make use of rainwater harvesting techniques
Land use	- Make crop decisions taking into account potential impacts on food prices - Make crop decisions taking into account land depletion and degradation risks - Reduce use of agrochemicals - Reduce nutrient leeching - Reduce risk of soil erosion by applying appropriate agricultural techniques - Avoid overexploitation of soils - Avoid displacement and expropriation of the local population
Labour issues	- Ensure proper labour conditions - Increase local job creation

Source: UNEP: http://www.uneptie.org/energy/act/bio/assurance_system.htm.

Through a consultation process the UNEP has developed spreadsheets with the possible sustainability criteria that were distributed to the GBEP partners to agree in a qualitative description, indicators and strategies to mitigate risks. Strong emphasis is put in the influence of regional specificities and the compliance of the WTO rules not to create barriers as the balance between economic, environmental and social issues may be different at national or local levels. The regional/ sub-regional multi-stakeholder consultation process is supposed to finish in October 2007. The spreadsheets are divided in four stages of the lifecycle of

bioenergy production and for each stage an initial set of criteria is listed. Stake-holders are asked to rank these preliminary criteria and to add or remove others according to their priority. The scope and the hierarchy of principles, criteria and indicator will be subject of the 3rd Technical Working Group.
Then, the final sustainability criteria will be available in December 2008 to be tested at a pilot level. Instead of developing specific projects for this issue they prefer identifying current bioenergy projects and add the criteria testing as an additional component.
A GBEP Task Force on GHG methodologies meeting was held in Washington DC in October 2007 aiming to start developing an harmonized methodology to calculate GHG emissions from specific biofuel pathways. Preliminary discussion addresses controversial parameters in LCA implementation.

Implementation

The GBEP certification scheme is proposed as a voluntary international certification.

9. The European Commission Initiative The UE approach

The context of the European Commission Initiative

The European Commission (EC) is devoted to promote biomass use in heating, electricity and transport. In that sense, the Biofuels Directive (Directive 2003/30/EC of 8 may 2003) has set as reference values a 2 % market share for biofuels in 2005 and 5.75% share in 2010. The 2005 target share was not achieved and reviewing this initiative was necessary. In the context of the Biomass Action Plan (EC, 2006) this reference values were redefined in a longer time horizon. Therefore, The Renewable Energy Road Map (EC, 2006) proposed a binding 20 % target for the overall share of renewable energy and a 10 % binding target for the share of biofuels in gasoline and diesel in each Member State in 2020. The EC considers these targets feasible and desirable, expecting a reduction in annual CO_2 emission by 700 Mt in 2020.

From April to May 2007, the EC has also launched a consultation process intended to take into account the views of different stakeholders such as public authorities, businesses, non-governmental organizations, regarding the following questions:

- *How should a biofuel sustainability system be designed?* For this item the EC initially proposes a possible *way forward* which includes selecting a set of sustainability criteria. As a starting point, the EC proposes criteria such as achieving a minimum of GHG reductions based on the ranges given in the JRC/EUCAR/CONCAWE study and avoiding major reduction in carbon stocks and biodiversity through land use change. The Member States assume the responsibility of ensuring the targets.

- *How should overall effects on land use be monitored?* The question is raised if it is possible to link indirect land use effects to individual commitments. The initial statement is that only monitoring is possible to deal with this issue.

- *How should the use of second-generation biofuels be encouraged?* Stakeholders were asked on the way to encourage the production and use of second generation biofuels. Stakeholders were consulted regarding the definition of second generation biofuels. Additionally, a provisional *way forward* was put into consideration recommending that under national biofuel obligations, second generation biofuels would count extra to met the proposed targets. Higher subsidies and fiscal incentives for second generation biofuels are also envisioned.

- *What further action is needed to make it possible to achieve a 10% biofuel share?* The consultation aims to elucidate if market shares targets are achievable via blending biofuels directly with ordinary fuels and what blending rates are suitable to this goal. Stakeholders are also asked whether legislation should include measures to encourage the use of bio-methane, methanol and DME in transport and if a deadline must be established by the EC to review the target shares and its feasibility.

  The stakeholder's responses were received until Monday 4th June 2007. The contributions along with the other documents cited in this section can be found at http://ec.europa.eu/energy/index_en.html.

Sustainability issues

Finally, a proposal for a directive on promotion of renewable energy use has been launched on 23 January 2008. The directive focuses on renewable energy, but specific articles (15 to 18) for biofuels sustainability are addressed. The directive can be found at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0019:FIN:EN:PDF.

Regarding sustainability, the directive defined the environmental criteria for biofuels and other bioliquids in its Article 15. The criteria listed in this article are:

- The greenhouse gas emission saving from the use of biofuels shall be at least 35%.
- Biofuels shall not be made from raw material obtained from land with recognised high biodiversity value, namely, forest undisturbed by significant human activity; areas designated for nature protection purposes and highly biodiverse grassland.
- Biofuels shall not be made from raw material obtained from land with high carbon stock, namely, wetlands and continuously forested areas.
- Agricultural raw materials cultivated in the Community and used for the production of biofuels shall be obtained in accordance with the requirements and standards under the provisions listed in point A of Annex III to Regulation (EC) No 1782/2003 under the heading 'Environment' and in accordance with the minimum requirements for good agricultural and environmental condition defined pursuant to Article 5(1) of that Regulation.

If these criteria are fulfilled, then biofuels can be considered for measuring compliance with the requirements of the Directive concerning national targets, for measuring compliance with renewable energy obligations and for eligibility for financial support for the consumption of biofuels and other bioliquids.

Calculation of the GHG impact

The methodology for calculating GHG emissions savings from the biofuel pathways is presented in Article 17 and Annex VII of the Directive. These saving can be estimated based on defauld values (listed in part A and B of Annex VII) or calculated using the methodology described in Part C of Annex VII. The emissions considered are those from the extraction or cultivation of raw materials, from the carbon stock changes caused by land-use change, from the processing, from the transport and distribution, from the fuel in use. Emission saving from carbon capture and sequestration, from carbon capture and replacement and from excess electricity from cogeneration are subtracted. Emissions from the manufacture of machinery and equipment shall not be taken into account.
The emissions are expressed in gCO_{2eq}/MJ of fuel and the total saving is calculated as the difference between the total emissions from the biofuel and the total emissions from the fossil fuel comparator. The Global Warming Potnetials (GWP) are those listed by the IPCC, namely CO_2: 1, N_2O: 296 and CH_4: 23. The methodology to annualize emissions from land-use change is also presented.

Implementation

The proposed verification sheem is the mass balance approach, described in the Article 16 of the Directive. However, this will be reviewed in 2010 and 2012 and other methods can be proposed depending on the performance of the mass balance approach to verify the compliance with the environmental criteria for biofuels and other bioliquids.
Member States shall require economic operators to implement the verification method.
The contribution made by biofuels produced from wastes, residues, non-food cellulosic material, and ligno-cellulosic material is considered to be twice that made by other biofuels.

10.IEA Bioenergy Initiative
The International Energy Agency approach

The Context of the IEA Initiative

IEA Bionergy is an international collaborative research program on bioenergy set up 1978 by the International Energy Agency (IEA) with the aim of improving cooperation and information exchange between countries that have national programs in bioenergy research, development and deployment (http://www.ieabioenergy.com). The work of IEA Bioenergy is carried out through a series of Tasks, each having a defined work programme:

Task 29: Socio-Economic Drivers in Implementing Bioenergy Projects
Task 30: Short Rotation Crops for Bioenergy Systems
Task 31: Biomass Production for Energy from Sustainable Forestry
Task 32: Biomass Combustion and Co-firing
Task 33: Thermal Gasification of Biomass
Task 34: Pyrolysis of Biomass
Task 36: Integrating Energy Recovery into Solid Waste Management
Task 37: Energy from Biogas and Landfill Gas
Task 38: Greenhouse Gas Balances of Biomass and Bioenergy Systems

Task 39: Commercializing 1st and 2nd Generation Liquid Biofuels from Biomass
Task 40: Sustainable International Bioenergy Trade - Securing Supply and Demand
Task 41: Bioenergy Systems Analysis
Task 42: Biorefineries: Co-production of Fuels, Chemicals, Power and Materials from Biomass

Sustainability issues and implementation

Task 40, managed by the Copernicus Institute for Sustainable Development of the Utrecht University and Essent Sustainable Energy is intended to contribute to the development of sustainable bioenergy markets in a long-term process. In order to accomplish this goal, two working periods are planned concerning short and medium term objectives. The first working period (1-3 year), has started with a process of consultation of stakeholders (industrial partners, government bodies and NGOs) aiming at reviewing different bioenergy experiences, identifying sustainability criteria and defining implementation strategies. The second working period (4-10 year) will consider the creation of an international platform for bioenergy trade, the development of dynamic demand and supply models of bioenergy, the identification and analysis of options for integrating the production of biomass for energy and subsequent export into agricultural and agro-forestry systems especially in developing countries and the evaluation of the political, social, economic and ecological impact of biomass production and trade in these systems for the local people and for food production. As a first deliverable, Task 40 has issued an outline of initiatives on biomass certification, including the development of sustainability criteria (http://www.bioenergytrade.org). This paper is based on biomass certification systems and related policy developments within the Task 40 members countries (mainly the Netherlands, the UK, Belgium and Germany). It includes views from supranational organizations as well as NGOs. Task 40 has also delivered a report on sustainability of Brazilian bio-ethanol, commissioned by SenterNovem, The Netherlands Agency for Sustainable Development and Innovation, and carried out by the Copernicus Institute (University of Utrecht) and Brazil's State University of Campinas, Unicamp.

The paper on biomass certification recommends the translation of sustainability standards into effective policy instruments in order to assure the enforceability of the certification system. The document presents five main strategies for implementation of a biomass certification system:

- *Government regulation for biomass (minimum standards).* This approach could include also governmental incentives, along with mandatory GHG certification scheme combined with reporting obligation for environmental and social issues. The German WWF (2006) proposed this approach.

- *Voluntary certification system, bottom-up approach.* In this approach, standards and certification schemes are voluntarily adopted by a group of governments, companies and other parties. Initially certifications schemes would be restrained to cultivation and harvesting practices. Later, more complex systems including the complete biomass chain will be implemented based on this initial efforts.

- *Private label with higher standards than those mandated by law.* It includes 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. It is the approach followed by the UK where the

GHG certification is related to the RTFO and social end environmental criteria are covered by a separate voluntary scheme.

- *Voluntary bio-energy label combined with international agreement.* This approach consists of a system considering two pillars: a bio-energy labeling organization (BLO) and an International Agreement on Bio-energy (IAB). The BLO would establish general guidelines for direct actors involved from industry and civil society. The BLO is conceived as a Forest Stewardship Council (FSC) certification system, including Fair Trade based instruments. To avoid uncertain achievement of the objectives in case of exclusive reliance on voluntary consumers, governmental intervention is proposed as an IAB. This agreement could be UN based or restricted to industrialized countries.

- *Standardization of biomass minimum standards on international level.* It counts on the international regulation of biomass standards in a legally binding form either through adopting a multilateral environmental agreement (MEA) or by integrating the standards into existing international agreements or standards. On a regional supra national level the EC initiative could be classified into this kind of approach.

Finally the paper recommends a gradual development of a certification system with learning and expansion over time.

11. Comparison of Biofuels Initiatives

The reviewed initiatives were compared based on the following:

- Promoter

National Government
International Organization
Governmental consortium
Academia

- Objective

Policy instruments on sustainability
Production and Trade
Consensus establishment

- Geographical Scope

Regional
National
International

- Biomass use

Biofuel for transportation
Electricity and Heat
The term Bioenergy will include both of the aforementioned items.

- Implementation

Obligation
Voluntary certification
No-implementation

Most of the initiatives are in a development state. Therefore not much definition about other relevant aspects is available.

Initiative	Promoter	Objective	Geographical Scope	Biomass use	Implementation	Additional comments
Renewable Transport Fuels Obligation (RTFO)	Government	Policy instruments on sustainability	UK	Biofuels for Transportation	Obligation (GHG) Voluntary certification of other principles	• Divided in two reportings: Carbon and Sustainability • Mandatory Carbon reporting for companies willing to commercialize more than 450'000 litres of fossil fuels per year in UK • Definition of qualifying standards to meet the Meta-Standard • Proportional increment of reporting from 2008 to 2011. • Spreadsheets for GHG emissions calculation • Connection with international initiatives and WTO regulations • End use excluded from carbon reporting
Testing Framework for Sustainable Biomass	Government	Policy instruments on sustainability	The Netherlands	Biofuels for Transportation Bioenergy	Voluntary certification Obligation	• Universal, generic framework of criteria, applicable to all biomass and countries • No discrimination between biomass produced in the Netherlands and imported biomass • Connection with international initiatives and WTO regulations • Minimum requirements for 2007, including incentives for higher future performances • Where testable indicators are lacking, a reporting procedure is proposed •Net emission reduction related to fossil fuels of at least 30% for biofuels and 50-70% for electricity production. • Whole chain is taken into account (including end-use phase) • Indirect land use change effects monitored as a macro-effect
Low-Carbon Fuel Standard for California	Government	Policy instruments on sustainability	California	Biofuels for Transportation	Obligation	• Based on the RTFO approach • Implementation from December 2008 • Apply to all liquid fuels for road, flight and off-road application and non-liquid fuels • Only limited to GHG emissions reporting

Initiative	Promoter	Objective	Geographical Scope	Biomass end use	Implementation	Additional comments
Sustainability Standards for bioenergy	International Organization		International	Bioenergy	No-implementation	• The translation of these standards into criteria and indicators is envisioned through a discussion process between different stakeholders • The study was based in existing studies as well as certification schemes
Roundtable on Sustainable Biofuels Production	Academia	Consensus establishment on sustainability issues	International	Biofuels for Transportation	Possible Voluntary certification	• Multi-stakeholder approach • An initial draft of principles was delivered • The RSB encourage public commenting on these standards via the Bioenergy Wiki
Biofuels Initiative UNCTAD	International Organization	Production and trade, policy instruments	International	Biofuels for Transportation	No-implementation	• Development strategy under the Clean Development Mechanism (CDM)
International Bioenergy Platform (IBEP)	International Organization	Support on sustainability issues. Consensus establishment	International	Bioenergy	No-implementation	• Consultation process launched • Similarly to the UNCTAD initiative, they promote the integration with other UN and non-UN programs on biofuels development and are aligned with the Millennium Development Goals.
Global Bioenergy Partnership (GBEP)	Governmental consortium	Support on policy making, production and trade. Consensus establishment	G8+5	Bioenergy	Voluntary international certification	• Consultation process launched •Spreadsheets for bioenergy life cycle developed • Sustainability criteria expected
The European Commission Initiative	Governmental consortium	Policy instruments on sustainability	European Union	Bioenergy	Obligation	•The Renewable Energy Road Map (EC, 2006) propose a binding 20 % target for the overall share of renewable energy and a 10 % binding target for the share of biofuels in petrol and diesel in each Member State in 2020.
IEA Bioenergy	International Organization	Policy instruments on sustainability Production and Trade	International	Bioenergy	Voluntary certification Obligation	• Consultation process launched • Review of initiatives •a report on sustainability of Brazilian bio-ethanol

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ANNEXES

Sustainability principles, criteria and indicators

ANNEX I: UK Initiative: Environmental and Social principles, criteria and indicators

ANNEX II: Dutch Initiative: Environmental and Social principles, criteria and indicators

Annex 1. Environmental and Social sustainability principles, criteria and indicators for the RTFO Sustainable Biofuel Meta-Standard. Below, all criteria and indicators are 'minimum requirements' unless stated otherwise. Source: ECOFYS, 2007.

Principle 1: CARBON CONSERVATION	**Biomass production will not destroy or damage large above or below ground carbon stocks**
Criterion	**Indicators**
1.1 Preservation of above and below ground carbon stocks (reference date 30-11-2005).	• Evidence that biomass production has not caused direct land use change with a carbon payback time exceeding 10 years[4]. • Evidence that the biomass production unit has not been established on soils with a large risk of significant soil stored carbon losses such as peat lands, mangroves, wetlands and certain grasslands.

Principle 2: BIODIVERSITY CONSERVATION	**Biomass production will not lead to the destruction or damage of high biodiversity areas**
Criterion	**Indicators**
2.1 Compliance with national laws and regulations relevant to biomass production and the area where biomass production takes place.	• Evidence of compliance with national and local laws and regulations with respect to land ownership and land use rights, forest and plantation management, protected and gazetted areas, nature and wild life conservation, land use planning, national rules resulting from the adoption of CBD[5] and CITES. • The company should prove that: it is familiar with relevant national and local legislation, it complies with these legislations, it remains informed on changes in legislation
2.2 No conversion of high biodiversity areas after November 30, 2005.	• Evidence that production does not take place in gazetted areas. • Evidence that production does not take place in areas with one or more HCV areas: HCV 1, 2, 3 relating to important ecosystems and species, HCV 4, relating to important ecosystem services, especially in vulnerable areas, and HCV 5, 6, relating to community livelihoods and cultural values. • Evidence that production does not take place in any areas of high biodiversity as listed below this table.
2.3 The status of rare, threatened or endangered species and high conservation value habitats, if any, that exist in the production site or that could be affected by it, shall be identified and their conservation taken into account in management plans and operations.	• Documentation of the status of rare, threatened or endangered species and high conservation value habitats in and around the production site. • Documented and implemented management plan on how to avoid damage to or disturbance of the above mentioned species and habitats.
Recommendation	
2.4 Preservation and/or improvement of biodiversity on production sites	• Evidence that a minimum of 10% of the production area is set aside and properly managed for nature conservation and ecological corridors. • Evidence of good agricultural practices with respect to the conservation and improvement of biodiversity on and around the production site.

[4] Guidance on the 'carbon pay back time' calculations is given in the Technical Guidance.
[5] http://www.biodiv.org/com/convention/convention.shtml

Principle 3: SOIL CONSERVATION	**Biomass production does not lead to soil degradation**
Criterion	**Indicators**
3.1 Compliance with national laws and regulations relevant to soil degradation and soil management.	• Evidence of compliance with national and local laws and regulations with respect to Environmental Impact Assessment, waste storage and handling, pesticides and agro-chemicals, fertilizer, soil erosion, compliance with the Stockholm convention (list of forbidden pesticides). • The company should prove that: It is familiar with relevant national and local legislation, it complies with these legislations, and it remains informed on changes in legislation
3.2 Application of *good agricultural practices* with respect to: o Prevention and control of erosion o Maintaining and improving soil nutrient balance o Maintaining and improving soil organic matter o Maintaining and improving soil pH o Maintaining and improving soil structure o Maintaining and improving soil biodiversity o Prevention of salinisation	• Documentation of soil management plan aimed at sustainable soil management, erosion prevention and erosion control. • Annual documentation of applied good agricultural practices with respect to: prevention and control of erosion, maintaining and improving soil nutrient balance, maintaining and improving soil organic matter, maintaining and improving soil pH, maintaining and improving soil structure, maintaining and improving soil biodiversity, prevention of salinisation. *Recommendations* • Records of annual measurements of : soil loss in tonnes soil/ha/y, N,P,K balance, SOM and pH in top soil, and soil salts content
Recommendation	
3.3 The use of agricultural by-products does not jeopardize the function of local uses of the by-products, soil organic matter or soil nutrients balance.	• Evidence that the use of by-products does not occur at the expense of important traditional uses (such as fodder, natural fertilizer, material, local fuel etc.) unless documentation is available that similar or better alternatives are available and are applied. • Evidence that the use of by-products does not occur at the expense of the soil nutrient balance or soil organic matter balance.

Principle 4: SUSTAINABLE WATER USE	**Biomass production does not lead to the contamination or depletion of water sources**
Criterion	**Indicators**
4.1 Compliance with national laws and regulations relevant to contamination and depletion of water sources.	• Evidence of compliance with national and local laws and regulations with respect to: Environmental Impact Assessment, waste storage and handling, pesticides and agro-chemicals, fertilizer, irrigation and water usage. The company should prove that: it is familiar with relevant national and local legislation, it complies with these legislations, and it remains informed on changes in legislation
4.2 Application of *good agricultural practices* to reduce water usage and to maintain and improve water quality.	• Documentation of water management plan aimed at sustainable water use and prevention of water pollution. • Annual documentation of applied good agricultural practices with respect to: efficient water usage, responsible use of agro-chemicals, and waste discharge *Recommendations* • Records of annual measurements of: water sources used (litres/ha/y),and BOD level of water on and nearby biomass production and processing.

Principle 5: AIR QUALITY	**Biomass production does not lead to air pollution**
Criterion	**Indicators**
5.1 Compliance with national laws and regulations relevant to air emissions and burning practices	• Evidence of compliance with national and local laws and regulations with respect to: Environmental Impact Assessment, air emissions, waste management, and burning practices • The company should proof that: it is familiar with relevant national and local legislation, it complies with these legislations, it remains informed on changes in legislation
5.2 No burning as part of land clearing or waste disposal.	• Evidence that no burning occurs as part of land clearing or waste disposal, except in specific situations such as described in the ASEAN guidelines on zero burning or other respected good agricultural practices.

Principle 6. Biomass production does adversely effect workers rights and working relationships

Criteria	Indicators	
C 6.1 Compliance with national law on working conditions and workers rights	Certification applicant should comply with all national law concerning working conditions and workers rights.	MR
C 6.2 Contracts	Certification applicant should apply to all categories of employees (including temporary workers) with a legal contract which covers the criteria mentioned here.	MR
C 6.3 Provision of information	Certification applicant must show evidence that all workers are informed about their rights (incl. bargain rights).	MR
C 6.4 Subcontracting	When labour is contracted or subcontracted to provide services for the certification applicant, the certification applicant must demonstrate that the subcontractor provide its services under the same environmental, social and labour conditions as required for this standard.	MR
C 6.5 Freedom of association and right to collective bargaining	Certification applicant must guarantee the rights of workers to organize and negotiate their working conditions (as established in ILO conventions 87 en 98). Workers exercising this right should not be discriminated or suffer repercussions.	MR
C 6.6 Child labour	Certification applicant must guarantee that no children below age of 15 are employed. Children are allowed to work on family farms if not interfering with children's educational, moral, social and physical development (workday inclusive school and transport max. 10 hours).	MR
C 6.7 Young workers	The work carried out shall not be hazardous or dangerous to the health and safety of youth workers (age 15 -17). It shall also not jeopardise their educational, moral, social and physical development.	MR
C 6.8 Health and safety	All certification applicants should be required to meet basic requirements including potable drinking water, clean latrines or toilettes, a clean place to eat, adequate protective equipment and access to adequate and accessible (physically and financially) medical care. All certification applicants shall ensure that workers have received regular health and safety training appropriate to the work that they perform. All certification applicants shall identify and inform workers of hazards, and adopt preventive measures to minimise hazards in the workplace and maintain records of accidents.	MR
C 6.9 Wages/compensation	Wageworkers must be paid wages at least equivalent to the legal national minimum wage or the relevant industry standard, which ever is higher.	MR
	Workers must be paid in cash, or in a form that is convenient to them and regularly.	MR
	The certification applicant must pay the workers for unproductive time due to conditions beyond their control.	R
	Housing and other benefits shall not be automatically deducted from the minimum wage/or relevant industry wage as an in kind payment.	R
	Where the certification applicant uses pay by production (piecework) system, the established pay rate must permit the worker to earn the minimum wage or relevant industry average (which ever is higher) during normal working hours and under normal operating conditions).	R
C 6.10 Discrimination	In accordance with ILO Conventions 100 and 111, there is no discrimination (distinction, exclusion, or preference) practiced that denies or impairs equality of opportunity, conditions, or treatment based on individual characteristics and group membership or association like: Race, Caste, National Origin, Religion, Disability, Gender, Sexual Orientation, Union Membership, Political Affiliation, Age, marital status and those with HIV/AIDS, seasonal, migrant and temporary workers.	MR
C 6.11 Forced Labour	Standards shall require that the certification applicant not engage in or support forced labour including bonded labour as defined by ILO conventions 29 and 105. The company must not retain any part of workers' salary, benefits, property, or documents in order to force workers to remain on the farm. The company must also refrain from any form of physical or psychological measure requiring workers to remain employed on the farm. Spouses and children of contracted workers are not required to work on the farm.	MR
C 6.12 Working hours	Usual working hours shall not exceed eight hours a day and 48 hours a week.	R
	Workers must have a minimum of 24 hours rest for every seven day period.	R
	Overtime during seasonal peaks is allowed but needs to be voluntary and should be paid at premium rate. Adequate brakes (every 6 h, 30 minutes). For heavy or dangerous work shorter periods and longer breaks should be allowed.	R

7. Biomass production does not adversely affect existing land rights and community relations

Criteria	Indicators	
C 7.1 Land right issues	The right to use the land can be demonstrated and does not diminish the legal or customary rights of other users and respects important areas for local people.	MR
C 7.2 Consultation and communication with local stakeholders	No new plantings are established on local peoples' land without their free, prior and informed consent. The farm can demonstrate that it has and implements policies and procedures for consulting and communicating with populations and local interest groups regarding plans for expansion, construction, sale or change of owner, administrative or operative restructuring or other changes that could affect these groups.	MR

Annex 2. Environmental and Social sustainability principles, criteria and indicators for "Testing Framework for sustainable biomass" - The Netherlands approach. Source: Cramer *et al*, 2007.

Principle 1: The greenhouse gas balance of the production chain and application of the biomass must be positive

Criterion 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.	**Indicator 1.1.1 (minimum requirement)** The emission reduction of greenhouse gases amounts to at least 50-70% for electricity production and at least 30% for biofuels, calculated with the method described in chapter 4. These are minimum requirements. Here the basic principle must be that policy instruments should promote a higher percentage above the minimum requirement by differentiating strongly on the basis of the emission reduction of greenhouse gases.

Principle 2: Biomass production must not be at the expense of important carbon sinks in the vegetation and in the soil.

Criterion 2.1: Conservation of above-ground (vegetation) carbon sinks when biomass units are installed.	**Indicator 2.1.1 (minimum requirement)** The installation of new biomass production units (BPUs) must not take place in areas in which the loss of above-ground carbon storage cannot be recovered within a period of ten years of biomass production. The reference date is 1 January 2007, with the exception of those biomass flows, for which a reference date already applies from other certification systems (currently under development).
Criterion 2.2: The conservation of underground (soil) carbon sinks when biomass units are installed.	**Indicator 2.2.1 (minimum requirement)** The installation of new biomass production units must not take place in areas with a great risk of significant carbon losses from the soil, such as certain grasslands, peat areas, mangroves and wet areas. The reference date is 1 January 2007, with the exception of those biomass flows for which a reference date already applies from other certification systems (currently under development).

Principle 3: The production of biomass for energy must not endanger the food supply and local biomass applications (energy supply, medicines, building materials).

Criterion 3.1 Insight into the change of land use in the region of the biomass production unit	**Reporting 3.1.1 (only at the request of the Dutch government)** Information on changed land use in the region, inclusive of future developments (if information is available)
Criterion 3.2 Insight into the change of prices of food and land in the area of the biomass production unit	**Reporting 3.2.1(only at the request of the Dutch government)** Information about changes in prices of land and food in the region, inclusive of future developments (if information is available)

Principle 4: Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity.

Criterion 4.1:	**Indicator 4.1.1 (minimum requirement)**
No violation of national laws and regulations that are applicable to biomass production and the production area.	Relevant national and local regulations must be complied with, with regard to land ownership and land use rights, forest and plantation management and exploitation, protected areas, wildlife management, hunting, spatial planning, and national rules arising from the signing of international conventions CBD (Convention on Biological Diversity) and CITES (Convention on International Trade in Endangered Species).
Criterion 4.2:	**Indicator 4.2.1 (minimum requirement)**
In new or recent developments, no deterioration of biodiversity by biomass production in protected areas.	Biomass production must not take place in recently cultivated areas that have been recognized as 'gazetted protected areas' by the government, or in a 5 km zone around these areas. The reference date is 1 January 2007, with the exception of those biomass flows for which a reference date already applies from other certification systems (currently under development). If biomass production does take place in the above areas, then only if this is a part of the management to protect the biodiversity values.
Criterion 4.3:	**Indicator 4.3.1 (minimum requirement)**
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.	Biomass production must not take place in recently cultivated areas that have been recognized as 'High Conservation Value' (HCV) areas by the parties involved, or in a 5 km zone around these areas. The reference date is 1 January 2007, with the exception of those biomass flows for which a reference date already applies from other certification systems (currently under development). The following areas are considered HCV areas: Areas with endangered or protected species or ecosystems, on the basis of the criteria of HCV categories 1, 2 and 3; Areas with high vulnerability (e.g. slopes and wetlands), on the basis of the criteria of HCV category 4; Areas with high nature and cultural values, on the basis of the criteria of HCV categories 5 and 6 and criteria for 'high nature value farmlands'. By means of a dialogue with the local parties involved it must be determined where the HCV areas are to be found. If biomass production does take place in the above areas, then only if this is a part of the management to protect the biodiversity values.
Criterion 4.4:	**Indicator 4.4.1 (minimum requirement)**
In new or recent developments, maintenance or recovery of biodiversity within biomass production units	If biomass production is taking place in recently cultivated areas (after 1 January 2007), room will be given to set-aside areas (at least 10%). **Reporting 4.4.2** If biomass production is taking place in recently cultivated areas (after 1 January 2007), it has to be indicated: in which land use zones the biomass production unit can be found, how fragmentation is discouraged, if ecological corridors are applied, if the restoration of degraded areas is involved here.
Criterion 4.5:	**Reporting 4.5.1**
Strengthening of biodiversity where this is possible, during development and by the management of existing production units.	Good practices will be applied on and around the biomass production unit for the strengthening of biodiversity, to take into account ecological corridors and to prevent disintegration as much as possible.

Principle 5: In the production and processing of biomass, the soil, and soil quality must be retained or even improved.

Criterion 5.1:	**Indicator 5.1.1 (minimum requirement)**
No violation of national laws and regulations that are applicable to soil management.	Relevant national and local regulations must be complied with, with respect to waste management, the use of agrochemicals (fertilizers and pesticides), the mineral system, the prevention of soil erosion, environmental impact reporting, and company audits. At least the Stockholm convention (12 most harmful pesticides) must be complied with, also where national legislation is lacking.
Criterion 5.2:	**Reporting 5.2.1**
In the production and processing of biomass best practices must be applied to retain or improve the soil and soil quality.	The formulation and application of a strategy aimed at sustainable soil management for the prevention and control of erosion, the conservation of nutrient balance, the conservation of organic matter in the soil, the prevention of soil salination.
Criterion 5.3:	**Reporting 5.3.1**
The use of residual products must not be at variance with other local functions for the conservation of the soil.	The use of agrarian residual products must not be at the expense of other essential functions for the maintenance of the soil and the soil quality (such as organic matter, mulch, straw for housing). The residual products of the biomass production and processing must be used optimally (so, for example, no unnecessary burning or removal).

Principle 6: In the production and processing of biomass ground and surface water must not be depleted and the water quality must be maintained or improved.

Criterion 6.1: No violation of national laws and regulations that are applicable to water management.	**Indicator 6.1.1 (minimum requirement)** Relevant national and local laws and regulations must be observed, with respect to the use of water for irrigation, the use of ground water, the use of water for agrarian purposes in catchment areas, water purification, environmental impact assessments, company audits.
Criterion 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.	**Reporting 6.2.1** The formulation and application of a strategy aimed at sustainable water management with regard to efficient use of water, and responsible use of agrochemicals.
Criterion 6.3: In the production and processing of biomass no use must be made of water from non-renewable sources.	**Indicator 6.3.1 (minimum requirement)** Irrigation or water for the processing industry must not originate from nonrenewable sources.

Principle 7: In the production and processing of biomass the air quality must be maintained or improved.

Criterion 7.1: No violation of national laws and regulations that are applicable to emissions and air quality.	**Indicator 7.1.1 (minimum requirement)** Relevant national and local regulations must be observed with respect to air emissions, waste management, environmental impact assessments, and company audits.
Criterion 7.2: In the production and processing of biomass best practices must be applied to reduce emissions and air pollution.	**Reporting 7.2.1** The formulation and application of a strategy aimed at minimum air emissions, with regard to production and processing, and waste management.
Criterion 7.3: No burning as part of the installation or management of biomass production units (BPUs).	**Indicator 7.3.1 (minimum requirement)** Burning must not be applied in the installation or the management of biomass production units, unless in specific situations as described in ASEAN guidelines or other regional good practices.

Principle 8: The production of biomass must contribute towards local prosperity.

Criterion 8.1: Positive contribution of private company activities towards the local economy and activities.	**Reporting 8.1.1** Description of: the direct economic value that is created, policy, practice and the proportion of the budget spent on local supply, companies, and the procedures for appointment of local staff and the share of local senior management. On the basis of Economic Performance Indicators EC 1, 6 & 7 of GRI: (Global Reporting Initiative).

Principle 9: The production of biomass must contribute towards the social well-being of the employees and the local population.

Criterion 9.1 No negative effects on the working conditions of employees.	**Indicator 9.1.1 (minimum requirement)** Comply with the Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy (compiled by the International Labour Organisation).
Criterion 9.2 No negative effects on human rights	**Indicator 9.2.1 (minimum requirement)** Comply with the Universal Declaration of Human Rights of the United Nations. It concerns here: non-discrimination; freedom of trade union organisation, child labour; forced and compulsory labour; disciplinary practices, safety practices and the rights of indigenous peoples.
Criterion 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	**Indicator 9.3.1 (minimum requirement)** Comply with the following requirements: No land use without the informed consent of original users, land use must be carefully described and officially laid down, and official property and use, and customary law of the indigenous population must be recognized and respected
Criterion 9.4 Positive contribution to the well-being of local population	**Reporting 9.4.1** Description of programmes and practices to determine and manage the effects of company activities on local population. On the basis of the Social Performance Indicator SO1 of the GRI: (Global Reporting Initiative).
Criterion 9.5 Insight into possible violations of the integrity of the company	**Reporting 9.5.1** Description of: degree of training and risk analysis to prevent corruption, actions taken in response to cases of corruption. On the basis of the Social Performance indicators SO2, SO3 and SO4 of the GRI (Global Reporting Initiative).

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