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BIOFUELS SUSTAINABILITY CERTIFICATION SCHEMES: CHALLENGES, FEASIBILITY AND POSSIBLE APPROACHES

Presented by Gloria Visconti

PhD Coordinator
Prof. Andrea Segrè

Supervisor
Prof. Andrea Segrè

Co-supervisor
Prof. William C. Clark

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Introduction

1. Research focus and rationale

The focus of this research is to develop and apply an analytical framework for evaluating the effectiveness and practicability of sustainability certification schemes for biofuels, especially in a developing country's perspective, being certification "*the process of verifying that a product, process or service adheres to a given set of standards and/or criteria*"[1].

The main question that drives the research analysis is "Which are the main elements of and how to develop sustainability certification schemes that would be effective and practicable in certifying the contribution of biofuels in meeting the goals Governments and other stakeholders have set up?".

The goals that biofuels have been called to meet are multiple and, in some cases, also conflicting.

The environmental goals, especially from an European perspective, represent a priority especially in terms of greenhouse gases reduction, and we ended up in a quite complicated situation where still exist scientific uncertainty on indirect land use change effects on GHG Life Cycle assessment, as well as on effective methodologies to measure them.

Another goal is related to energy security, and the need of differentiating the spectrum of countries we rely upon for energy import with a new potential geopolitical asset in terms of energy supply. In this perspective, as it has been underlined by Hausmann R. and Wagner R. (2009)[2] "*Brazilian sugarcane farmers would compete with Iranian and Russian oil magnates, not Iowa corn farmers*".

At the same time we know that some of these goals present also some conflicts.

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[1] Matus, Kira JM. 2009, "Standardization,Certification and Labeling: Lessons from Theory and Practice." CID Graduate Student and Research Fellow Working Paper No. 37. Center for International Development at Harvard University, May 2009.

[2] Hausmann R. and Wagner R. (2009) "Industrial Development and the making of a Global Market for Biofuels" prepared for the Conference on Biofuels Certification at Harvard University, October 2009

The energy security goal goes in clear conflict with agricultural policies, especially in the European Union and in the United States of America, whose policies are clearly protecting local farmers through subsidies and protectionist measures (in the US the $0.54 per gallon tariff on imported ethanol is a clear signal in this respect).
On the other hand, developed countries are devoting considerable amount of financial support for the development of poorer countries, in the form of money, capacity building, transfer of new technologies. In this respect, as we have already pointed out, biofuels can represent an occasion for industrial development, but protectionist measures driven especially by agriculture policies, make hard this development.
Environmental goals, such as the increase in the use of mechanization for harvesting in order to avoid sugarcane burning represent positive element for protecting air quality but it can also increase the number of unemployed people, especially in developing countries.

All the above elements suggest that it is time to look at the "operationalization" of sustainability standards and to move from theory to practice. In other terms, we have to be sure that it will be possible for producers and farmers to demonstrate compliance with the standards that voluntary and mandatory schemes require to be met.

This study wants to start a discussion on this new phase more related to the implementation.
Towards this effort, this study wants to provide an analytical framework that will assign a value, through the development of an ad hoc matrix, in terms of effectiveness and practicability, to the different dimensions, environmental, social and economical, that a certification scheme implies. These dimensions will be evaluated according to key elements such as transaction costs, traceability and data elaboration and collection along the supply chain, as well as governance and conflicts with WTO requirements. While the elements listed above might be considered as part of a "administrative feasibility" basket, they have repercussions on the "political and economical feasibility" of the policies and measures that Governments design and implement for climate, economical, and social reasons.

A certification system, for reasons linked to costs, lack of expertise, inadequate infrastructure, absence of an administrative and legislative support, can represent an intensive burden and can act as a serious impediment for the industrial and agriculture development of developing countries, going against the principle of equity and level playing field.

Having realized from the experience of existing policy instruments, that it is very difficult for a single instrument to successfully address multiple goals, the research does not pretend to have as a result the "ideal" certification scheme that will, in absolute terms, represent the most effective and practicable tool to measure all the relevant criteria and indicators for biofuels sustainability.

The present research has been inspired by the new emerging field denominated "Sustainability Science", I have had the privilege to be exposed to at Harvard University in the quality of practitioner fellow at the Sustainability Science Program[3].

In order to characterize the "Sustainability Science" a quote by Prof. William Clark (2007) [4] can help: ".. *sustainability science is a field defined by the problems it addresses rather than by the disciplines it employs*". This concept implies several issues.

The first one is related to the Sustainability Science's focus on the complex dynamics that interlink between human and environment systems, that entail the need to create a real interdisciplinary and coordinated work among people with different knowledge and expertise.

In the field of biofuels, this complexity is quite clear as the experience of the last four years has shown us that a too specific mono-dimension focus, as for example GHG, can provoke intended and unintended externalities on other key dimensions such as biodiversity, food security, social and agricultural development .

[3] http://www.hks.harvard.edu/centers/cid/programs/sustsci

[4] Clark W.C., "Sustainability Science: A Room of its Own", Proceedings of the National Academy of Science of the U.S.A. 104 (2007):1737-1738

Another implication of the Sustainability Science, given by its characterization of "*use –inspired basic research*" (Clark 2007)[5] is the clear intent to link knowledge with action.

The Sustainability Science's goal is to produce knowledge that is useful and can be used in decision making processes.

This is a challenge both for academia and policy makers. For academia to be able to produce ad-hoc knowledge, often in a "short noticed way", that will concern not only rigorous approaches and innovations, but also that will be applicable to reality conditions. For the policy makers because it might not always be "politically profitable" to promote policies that are scientifically based, as other rationales are more easy to prevail such as political opportunism. Some criteria and indicators that fall into the list of sustainability certification schemes for biofuels, raise a "façade rationale" doubt.

This research that falls under the rationale of the Sustainability Science Program, has as main objective to close the gap between the research and policy makers worlds in the field of sustainability certification schemes for biofuels.

The value of the research's outcome is therefore to provide to policy makers, as well as to different stakeholders involved in the sustainability of biofuels, an analytical framework for assessing those certification tools that will, at the same time, best measure the achievement of a particular goal and that will be implementable.

In fact, some certification schemes will be best suited to effectively measure GHG reductions, one of the most prominent goals of the European Union; other schemes will best certify social gains such as the positive returns of biofuels production and use on workers.

This will depend not only on the level of accuracy in both defining the standard that has to be chosen to reach the overarching goal and the certification procedures to measure the compliance to that goal, but also on the local, starting, conditions that characterize a particular country. An example in this respect is given by the Forest Stewardship Council's (FSC) that has demonstrated to be particularly effective in

[5] Clark W.C., "Sustainability Science: A Room of its Own*",* Proceedings of the National Academy of Science of the U.S.A. 104 (2007):1737-1738

developing countries for the social dimension of the certification scheme, as the FSC Corrective Action Requests[6] have been focused in developing countries especially on social aspects, such as compliance with worker's rights, workers safety, communications and conflicts with stakeholders and indigenous communities.

A trade off of compliance with sustainability criteria and indicators will be highlighted and specified, instead of following a "one size fits all" approach that, in our opinion, is not feasible and effective for biofuels, a complex sector at the intersection among agriculture, energy, environment, security and economic development.

Biofuels have been identified by Governments and different stakeholders as a promising tool to reach a variety of goals: climate change protection, energy security, agriculture development, and, especially in developing countries, economic development.

Once the goals have been identified, and ambitious mandatory targets for biofuels use agreed at national level, concerns have been raised by the scientific community on the negative externalities that biofuels production and use can have at environment, social and economic level.
Therefore certification schemes have been recognized as necessary processes to measure these externalities, and examples of such schemes are in effect, or are in a negotiating phase, both at mandatory and voluntary levels (EU directive on Renewable Energy and GBEP respectively).

The research focus has emerged by the concern that the ongoing examples are very demanding in terms of compliance, both for those that are subject to certification and those that have to certify, on the quantity and quality of information to be reported.

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[6] Corrective Action Requests (CARs) are the actions that have to be met in case forestry operations do not fully meet the Forest Stewardship Council criteria and standards. Their compliance are conditional to validate the certificate and have to be resolved in a specific timeframe. Source: FSC (2009), "FSC impacts and outcomes – Extracts from FSC literature review 2009"

Moreover, the multiplicity of sustainability certification schemes and the unclear interrelations that exist among them is overwhelming producers, affecting effectiveness and demonstrating a lack of coordination and synergy.

This affirmation comes from my experience as "practitioner" in different phases related to the development of sustainable biofuels both at international and regional level.
From a "policy" perspective due to my previous job at the Italian Ministry of the Environment, the possibility to have been closely involved in the design of the Global Bioenergy Partnership and in the negotiation of the criteria and indicators for certifying the sustainability of biofuels, as well as in the discussion related to the transposition of EU RES Directive in the Italian law (Task Force on Sustainability of the Italian Biofuels Platform), has given me specific insights on the "political" rationale related to sustainability certification for biofuels.

From a "producer" perspective due to my present job at the Inter-American Development Bank (IDB), the possibility to evaluate, in terms of co-financing and monitoring, project proposals related to biofuels development in the Latin America and Caribbean Region (LAC), both for domestic use and export, is giving me a "grounded" knowledge and experience on the challenges producers and LAC Governments face in implementing sustainability certification schemes for biofuels.

My first hand experience tells me that for the majority of sustainability certification schemes for biofuels, the doability of implementation, especially in a developing countries perspective, is not a major driver.

The lack of focus on doability can have two main negative consequences.
The first one is the lack of clarity and the possibility to cheat, and the possible collapse of the certification system.
This will not only affect the credibility of the entire certification system for biofuels, but will pose into question also the validity/reputation of the public policies that have promoted "sustainable" biofuels development. Policy makers have been very uncomfortable with the recent accusation by media and NGOs on the potential damages that biofuels could have caused in rising deforestation in Indonesia and

Malaysia due to the acceleration in palm oil cultivation and in increasing food price due to the switch in the use of corn from food to fuel purposes. The true can be very far from these accusations, and we can argue that the rise in food commodities prices has been linked to the increase in the price of oil and therefore of fertilizers, the speculation in the financial markets, as well as that Malaysian and Indonesian palm was sold mainly for the food market and not as a feedstock for biodiesel.
What is certain is that the manipulation and the lack of a correct information related to biofuels externalities managed principally by media and some NGOs, has created lively and troublesome accusation to policy makers claiming their "direct" responsibilities in creating an alarming situation especially for the availability and affordability of food in developing countries. This uncomfortable political situation has also questioned for sometime a possible moratoria on the biofuels target the European Union has established in a legally binding EU Directive.

The second consequence is more focused on developing countries situation. Complex and ambitious certification schemes could have the effect to leave developing countries out of the global biofuels market, especially when developed countries have mandatory targets to be met.
This is the case for example of the EU Renewable Directive that has established for the European Member States a mandatory target of 10% of consumed sustainable (have to meet 35% reduction in GHG respect to conventional fuels) biofuels.
European countries can import in principle not certified biofuels from developing countries, but they will not count for their 10% target. Most likely EU countries will not have incentives to import from countries that, for lack of capacity building and data, will not be able to provide certification on their products.
The EU Directive can therefore represent a trade barrier for developing countries exports of biofuels.
While this research recognizes the importance of comprehensiveness and ambition in designing an important tool for the measurement of sustainability effects of biofuels production and use, it stresses the need to focus on the effectiveness and practicability of this tool in measuring the compliance with the goal.

We would be better served by different single certification schemes that clearly address single goals, and that could be implemented in different stages, rather than

by one single certification scheme difficult to implement and no clear in its requirements.

Ambition has to be traded off with practicability, especially in a first, pivotal phase.

2 Sustainability Science: a framework and inspiring research model

As it has already been briefly discussed, the Sustainability Science is the natural framework where this research fits and has found guidance and inspiration.

Sustainability Science goal is "*understanding the fundamental character of interactions between nature and society*" (Kates R. et Al 2001[7]). In order to understand the originality of Sustainability Science in addressing this overarching and complex goal, it will be worth it to look at what Sustainability Science is about.

First of all we can define Sustainability Science as an "emerging field" of use inspired research and innovation. It means that it is not purely a basic, not an applied research field. Rather "*it is an enterprise centred on the use inspired basic research*" Clark (2007), also defined by Donald Stroke as the Pasteur' quadrant of the modern science and technology enterprise (Figure 1).

Figure 1: Beyond basic vs applied research: Science in Stoke's Quadrants[8]

Research inspired by…	Considerations of use? No	Considerations of use? Yes
Quest for fundamental understanding? No	"Soaking and poking"	Applied research (Edison)
Quest for fundamental understanding? Yes	Basic research (Bohr)	*Use-inspired research (Pasteur)*

Source: Clark W. C. (2007) "*Sustainability Science: A room of its own*", pag.1737, Fig.1.

Another, complementary, way of characterizing sustainability science is that it is "*defined by the practical problems, specifically the one of sustainable development, to be addressed and solved, rather then by the disciplines*" (Matson P. 2009)[9].

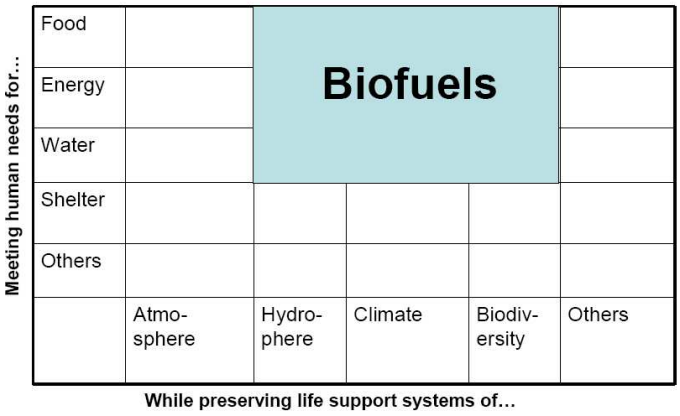
[7] Kates R. et Al (2001) "Sustainability Science", Science Vol 292, pp 641-642, 27 April 2001.
[8] Clark W. C. (2007) "Sustainability Science: A room of its own", The National Academy of Science of USA, PNAS, vol.14, n.6, 1737-1738

Examples of problems related to sustainable development range from energy access, to protection of biodiversity, climate change protection. While there is a tendency in addressing the above problem in a static, compartmental way, sustainability science tries to look at a problem through a multidimensional and dynamic approach.

Biofuels are a great example in this regard. The lens through policy makers have seen biofuels as a tool to reach a particular goal, weather it was reduction of GHG or energy security, have been too narrow and not interlinked with other issues such as food production, water and air quality, trade externalities

The Sustainability Science Program at Harvard University has chosen as research area, also following a specific request from the policy makers world, biofuels and its interactions with sustainability, trade and industrial development as a key area of study[10], promoting in this way an interdisciplinary approach.

Figure 2: Biofuels as a driving research issue for Sustainability Science[11]



Source: Clark W. C. (2009)

In addressing complex and multidimensional problems related to sustainability, Sustainability Science is interdisciplinary by definition. It combines expertises that range from economics, to psychology, political science, chemistry, as well as

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[9] Matson, P. (2009) "The Sustainability Transition". Issues in Science and Technology. 25(4):39-42.

[10] The "Biofuels and Globalization Program" housed at The Sustainability Science Program, Harvard University. Documents and Info available at http://www.hks.harvard.edu/centers/cid/programs/sustsci/activities/program-initiatives/biofuels-and-globalization/overview downloaded on December 16th, 2009

[11] Clark W. C. (2009) "Sustainability Science: an emerging interdisciplinary frontier", Opening Ceremony XXIV Cycle Phd Programme in International Cooperation and Sustainable Development Policies, May 6, 2009, University of Bologna

different types of experience and knowledge, both from the academic and practitioner worlds.

Although some mature programmes are in place, like the one at Harvard Kennedy School co-directed by Prof William Clark and Nancy Dickson[12], there is no academic centre fully dedicated to the disciple.
There are instead programs that have nurtured networks of international researchers, scholars, fellows and practitioners interested in the new field and thrilled to share and put together their own experience and expertise.
The Phd program on International Cooperation and Sustainable Development policies at the University of Bologna, constitute in practice an additional cell for the developing and strengthening of sustainability science. The diversity of expertises involved and the integration of research themes follow the rationale that is guiding the Sustainability Science.

I have been personally fascinated by the gap that Sustainability Science is trying to close between the policy makers and academia worlds. After 10 years of professional experience in the Italian administration dealing with sustainable development policies, mainly at international level, this disconnection between the two worlds has become clear especially in dealing with the development of biofuels policies.

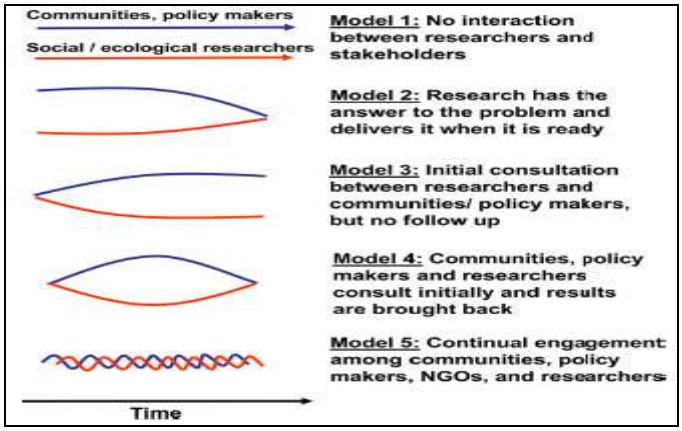
I had the clear feeling that the way policies have been put forward, in terms of mandated targets, had little regard of scientific findings. On the other hand, it was difficult at that time, to get scientific knowledge available, and comprehensive in a multidimensional way, for informing the highly stressed decision policy maker had to take.

A simple figure (Fig. 3), used to describe evolution of models to link knowledge with action in other sector under the framework of Sustainability Science by Reid et

[12] Sustainability Science Program at Harvard Kennedy School, Centre for International Development http://www.hks.harvard.edu/centers/cid/programs/sustsci

Al (2009)[13], can represent a good visual example of the current gap, or insufficient integration, between the research and policy makers world in the biofuels sector presenting in model 1 to model 3, according to progressive positive development, the situation as it stands now. Model 4, and even better model 5, show how the continuous engagements among research and policy makers, as well as with other stakeholders, should be.

Figure 3: Evolution of models to link knowledge to action



Source: Reid et Al (2009), PNAS[14]

A Phd on International Cooperation and Sustainable Policies focused on Biofuels and sustainability, seemed to me the best way to try to address my doubts deepening my understanding of the issue. The continuous exposure in the last three years to the work the Sustainability Science program at Harvard is delivering in the Biofuels and Globalization Program has been and is an incredible source of inputs and has equipped me with rigorous analytical tools for policy analysis.

The following core question of sustainability science inspired and has driven my research: "*What systems of incentive structures – including markets, rules, norms, and scientific information – can most effectively improve social capacity to guide*

[13]Reid R. S, et Al (2009) "Knowledge Systems for Sustainable Development Special Feature Sackler Colloquium: Evolution of models to support community and policy action with science: Balancing pastoral livelihoods and wildlife conservation in savannas of East Africa**",** Proceedings of the National Academy of Science 2009: 0900313106v1-pnas.0900313106 available at http://www.pnas.org/content/early/2009/11/02/0900313106.full.pdf+html?sid=623a01f3-a128-4849-9645-a825ac968143 downloaded on February 10, 2009.

[14] Reid R. S, et Al (2009) "Knowledge Systems for Sustainable Development Special Feature Sackler Colloquium: Evolution of models to support community and policy action with science: Balancing pastoral livelihoods and wildlife conservation in savannas of East Africa**",** Proceedings of the National Academy of Science 2009: 0900313106v1-pnas.0900313106

interactions between nature and society toward more sustainable trajectories?" (Kates R. et Al 2001)[15]

An incentive structure can be the one represented by sustainability standards and certification, both voluntary and/or mandatory, and we have seen that in the last decade this scheme has been used in different sectors, ranging from energy efficiency, to forest protection, and organic food.

What it is not clear, and this research will try to shed some light on, is the effectiveness of sustainability certification schemes, their implementation, penetration into the market, "operationalization", barrier or opportunity for developing countries.
Through the application of first hand information and thoughts coming from direct experience both in the policy makers process and in the producers concerns, this research will look specifically at the applicability and the success in measuring and meeting the goals that biofuels sustainability standards and certification schemes try to achieve.

Biofuels in fact interfere in the interactions between nature and society, in terms of availability of natural resources and their potential depletion, but also as a opportunity for economical and industrial development.
The way biofuels sustainability certification schemes can work to guide (and hopefully) improve this interaction is at the core of this thesis.

3. Methodology adopted

As it has been underlined also in the previous parts of the Introduction, this research is characterized by a practitioner eye to the issue of biofuels sustainability standards and certification schemes.
With more than 10 years of professional experience in biofuels, both at policy and more recently at development level, I have started to look at the issue applying some

[15] Kates R. et Al (2001) "*Sustainability Science*", Science Vol 292, pp 641-642, 27 April 2001.

of the underlying concepts of the Sustainability Science program, namely multidisciplinarity and interest in action focused research.

The methodology used for the analysis and the evaluation of the effectiveness of biofuels sustainability certification schemes has utilized different tools for pooling knowledge and finally getting to personal judgment to the issue.

First of all I have examined the existent literature dealing with both biofuels opportunities and challenges. This has implied the elaboration of environmental, agricultural and economical data in order to have comparable information for dissimilar statistics belonging to different countries. I have tried to use, as far as possible, national statistics that should guarantee higher objectivity respect to the one of industrial associations. This has not have been always possible due to the lack of data, or updated one.

The examination of literature sources related broadly to the tool of certification schemes, including its governance and interlinkages with other policy measures, has represented the second important step. As we know, standard and certification tools are relatively new instruments and, even if there is an increasing number of published research in international journals on the topic, still the evaluation of certification schemes implementation and effectiveness is moving its first steps. The fact that major stakeholders representing principal multinational[16] are, under the hosting framework of the US National Academy of Science, building in 2010 the basis for an ad hoc research program on this issue is a clear (and promising) sign in this respect.

I have moved than to a comparative analysis of the main characteristics and governance aspects of certification schemes other than biofuels one, such as Energy Star, Forest Stewardship Council (FSC); Leadership in Energy and Environment

[16] Exploratory meeting convened by David and Lucile Packard Foundation, MARS, Inc and Walton Family Foundation at the National Academy of Science in September 2009 to discuss the need for a comprehensive assessment effort for determining the effectiveness of certification and standard systems

Design (LEED) and Organic Food Products in Europe examining internal evaluation reports and articles.
Next step has been represented by the analysis of the main elements and implementation challenges of biofuels certification schemes, both in place or under definition. To this end, working documents, not published, that serve as a basis of internal meetings (expert meetings, steering committee, etc) have been also considered.

Having been, and currently being, professionally involved in the area of renewable energy and biofuels policies, the bulk of my sources and data collection has been based mainly on the personal active participation in working meetings of GBEP, RSB, IDB and at the Ministry of Environment of Italy for the transposition of the EU Directive on Renewables.
The first hand exposure to such debates has not only given me the possibility to get an overall picture of the main challenges represented by sustainability certification schemes, but also access for interviews[17] to main stakeholders that operate at different levels in the biofuels field.

In order to have a sense of the level and number of meetings I have actively participated in, a list is attached (Attachment 1) to the Introduction section.

One workshop, I have convened at IDB in January 2010 on "Assessing Challenges for Implementation of Biofuels Sustainability Criteria" (Agenda in Attachment 2 to the Introduction section), I have cited many times in the thesis, has been particularly useful for sharing consensus on some key challenge issues and trade off related to sustainability certification schemes. The participation in the workshop of private sector representatives operating especially in Latin America, sustainability certification scheme "designers" and auditors has provided a platform for enhancing clarity and providing concrete examples of implementation challenges on specific criteria, both in the developed and developing countries.

[17] Experts interviewed will not be cited. A private book source has been prepared.

The analysis of literature in the field of biofuels, the participation to relevant discussions both at policy and development level on biofuels, as well as the information gathered in the course of interviews with principal stakeholders, have delineated a kind of consolidated picture of where the different stakeholders stand with respect to sustainability biofuels certification schemes.
We can group them in the following way:

- Regulators or designers of sustainability standards and certification schemes: this group belongs more often to developed countries, at least in the inception phase. They are moved by the concern that the targets already set up in their policies could have negative externalities, especially from a greenhouse gas perspective and contradict, and even worsen, their own goals. Especially in Europe, regulators are under the "watchdog" pressure of NGOs.

  For the Regulators in developing countries a distinction has to be made. While regulators from LAC, Colombia and Central America countries, have seen a regulation on biofuels use as a way to promote industrial development and a concrete possibility for lowering their dependence from oil and even for exporting, countries such as China and India, hit by the spark in food commodities prices in 2007-2008, wanted to regulate the biofuels sector especially in a logic of food versus fuel.

  A completely unique case is represented by Brazil, where targets and specific policies for biofuels use are in place since the '70s and only recently, due to NGOs accusation of deforestation (direct and indirect) of Amazon have started to pay attention and put in place specific regulations, on both social and environmental standards of biofuels.
  In any case Brazil Government is always very critical on the creation of new and stringent standards for biofuels sustainability certification, worried of the creation of impediments to a global market of biofuels, business where they represent a key actor.

- Private sector: with the set up of pushing policies for the promotion of the use of biofuels, the business sector, including big oil companies, have seen

the opportunities of business and have started ad hoc research programs, also in collaboration with prestigious Universities[18], to find the most promising biofuels technologies to be used in the market.
This process has been driven principally by big oil multinational in developed countries, as well as by ethanol producers in Brazil.

As we will see in the following chapters, challenges exist for small producers and farmers that want to enter into this market.
While at the beginning, sustainability standards have found some resistance from the industry, once they became mandatory especially in the EU and now in the US, industries became major actors for they definitions especially in the framework of voluntary roundtables.
Now, as we have seen recently, industries are more worried on how to make it operational these standards, or in other words how to demonstrate that they are in compliance with these standards, than the standards themselves.

- NGOs: NGOs are playing a "watchdog" role, both demanding the prove that biofuels do not worsen the environment and social conditions of farmers. It is interesting to note that, especially in the last decade, with the development of voluntary certification schemes, NGOs have moved from a traditional approach of "blame and shame" with respect to industry to a more cooperative one.

All the analysis of literature and data, as well as the active participation in meetings and interviews with key stakeholders has made possible the consolidation and synthesis of my own judgment related to sustainability certification schemes challenges, feasibility and possible approaches, that goes "over and above" the data and information sourced.

[18] Examples in this regards is $500 mil funding of BP to the University of California at Berkeley for the creation of the Energy Biosciences Institute info available at http://www.energybiosciencesinstitute.org/images/stories/pressroom/FINAL_EXECUTED_11-14.pdf and the partnership between Chevron and University of California a Davis and the Georgia Institute of Technology

4. Organization of the dissertation

The dissertation starts looking in Chapter 1 at the opportunities that biofuels can bring in terms of reduction of greenhouse gases, increase in energy security, opportunity of economic, industrial and agricultural development. These opportunities have been, with different set of priorities, pursued through public policies, and different Governments, with an acceleration in the last five years, have set up targets for biofuels use.

We will look at the principal policies put forward by Brazil, a grandfather in this realm, US, EU, China and, with less details, by other developing countries.

In Chapter 2 we will move from opportunities to potential externalities, especially negative ones, the development of biofuels can cause. We will classify these challenges along the three pillars of sustainable development: environmental, social and economical.

The environmental one, especially for reasons linked to the current debate on measures to tackle climate change will present a more focused level of discussion. Issues like direct and indirect land use change, as well as the measurement of co-products contribution in terms of GHG, are particularly hot in the political agenda.

We will then examine in Chapter 3, Certification as a particular tool, to measure the compliance of biofuels towards the challenges identified in the second chapter. We will look at certification schemes through their main characteristics, making differentiation between product and process based certification, exploring the interaction between certification and other policy tools and we will try to get some conclusions on the experience gathered so far by certification in terms of its functioning and effectiveness, especially from a developing country perspective.

We will then translate and examine the above elements that characterize certification in relation to schemes that have already some degree of experience in sectors other than biofuels, such as in energy efficiency (Energy Star and LEED), forest and organic food.

In Chapter 4 we will start to address the core of the present dissertation: sustainability certification schemes for biofuels.

We will start to examine the characteristics of the ones that are in place, or are under negotiations, both with voluntary and mandatory roles. We will devote greater attention to the one established by the European Directive 2009/28/CE examining its main elements and looking also at its challenges and presence of grey zones for implementation. The same approach will be devoted to the examination of EPA GHG scheme (still under development), the one of California, the UK one, as well as the voluntary schemes such as GBEP, RSB, RSPO, BSI, CSB and RRS.

In the second part of Chapter 4 we will look, also through interviews to principal global stakeholders ranging from big and small producers, regulators and certifiers, to the main implications that the compliance to sustainability standards entail: transaction costs, traceability and data elaboration along the supply chain, governance aspects at different levels and trade compatibility. The above will represent our "indicators" in order to assess the operationability (implementability) of sustainability certification schemes, especially from a developing country and a small farmer point of view.
The organization of a workshop at IADB, that has gathered around 30 stakeholders - ranging from LAC producers (big and small), NGO, Regulators and certifiers - on these implementation aspects of biofuels sustainability certification schemes has been an excellent source for brainstorming and information on the ground.

Chapter 5 will make a synthesis of all the data and analysis elaborated in the previous chapters, through the design of an analytical framework in form of a matrix. Different certification schemes, also the one not related to biofuels examined in article 3, will be weighted according to the main dimension analysed in article 4 (cost, governance, traceability and data elaboration along the supply chain, trade compatibility). The matrix wants to provide a first hand tool to policy makers and other stakeholders to assess the practicability of sustainability certification of biofuels.

We will, finally, drop some conclusions coming from the analysis of the entire research study.

Annex 1 of the Introduction

Meetings attended on Biofuels Sustainability listed in order of time *(most recent first)*

1. World Biofuels Market (Amsterdam, March 15th-17th, 2010). Presenter on "Promoting Biofuels that Reduce GHG's, Protect Biodiversity and Food Production" and on "Developing a Domestic Energy Resource";

2. Expert Reviewer, International Panel on Climate Change (IPCC) Special Report Renewable Energy Sources, Chapter 2 on Bioenergy (Dec. 2009-Feb.2010);

3. The David and Lucile Packard Foundation "Sustainability standards and biofuels policies: Perspectives from regulators and standard setters" (Washington DC, January 26th and 27th, 2010). Presenter on "IDB perspectives on biofuels development";

4. Inter-American Development Bank "Assessing Challenges for Implementation of Biofuels Sustainability Criteria" (Washington DC, January 25 – 26th ,2010);

5. Global Bioenergy Partnership Workshop on Sustainability Indicators for Biofuels (Buenos Aires, October, 19-21, 2009);

6. Certification and Standards Assessment Meeting, National Academy of Sciences (Washington, DC, September 22-23, 2009);

7. GBEP Steering Committee (Commission on Sustainable development, United Nations New York, May 14th, 2009);

8. Kennedy School of Government, Harvard University, Sustainability Science Program "Certification Processes for Biofuels", (Cambridge,)May 11-12, 2009;

9. GBEP Technical Working Group and Task Force on Sustainability Indicators for Biofuels (Heidelberg, March 18- 20th, 2009);

10. GBEP Steering Committee (FAO, Rome December 15, 2008);

11. GBEP Steering Committee (Rio de Janeiro, June 18, 2008);

12. International Conference of Biofuels, (Rio de Janeiro, 18-19 June) 2008;

13. Kennedy School of Government, Harvard University, Sustainability Science Program "Biofuels and Sustainable Development" (San Servolo Island, Venice, Italy May 19-20, 2008);

14. World Food Prize (Des Moines, October 18, 2007). Presenter on "EU perspectives on Biofuels and Biofood: The Global Challenges of Emerging Technologies";

15. Kennedy School of Government, Harvard University, Sustainability Science Program, Workshop on "the Future Implications of a Global Biofuels Market for Economic Development, Environment and Trade" (Cambridge, May 9, 2007);

16. GBEP Steering Committee (Commission on Sustainable Development, United Nations, New York, May 8th, 2007);

17. Yale University and REIL "Roundtable on Renewable Energy and Law" (New Heaven, April 28 and 29, 2007);

18. World Biofuels Market (Brussels, March 5th, 2007). Presenter on Global Bioenergy Partnership (GBEP) program;

19. GBEP Technical Working Group (New York, February, 26-27th, 2007);

20. UN Foundation International Meeting on Bioenergy (Bonn, October, 13, 2006). Presenter on GBEP;

21. Partnership Initiatives Effectiveness (Paris, OECD, September 2006);

22. Preparatory meeting of the G8 Dialogue on Climate Change, Energy and Sustainable Development (Mexico City, June 2006). Presenter on GBEP;

23. International Conference on Bioenergy (Paris, October 2005). Presenter on GBEP

Annex 2 of the Introduction

Assessing Challenges for Implementation of Biofuels Sustainability Criteria
Agenda
January 25 – 26th (half-day), 2010

Inter-American Development Bank, 1350 New York Avenue, Washington DC 20005
Room B – 300

To date, there are many certification schemes and assessment tools for biofuels, both mandatory and voluntary, under development, or in use. The EU Directive 2009/28/EC, California Low Carbon Fuel Standard, the Roundtable Sustainable Biofuels and the Global Bioenergy Partnership are some examples in this regard. Given the range of schemes being developed, the implementation of sustainability criteria in order to access the diverse markets can be overwhelming. Furthermore, there exists a steep learning curve for exactly how sustainability criteria will be implemented at the project level.

To address some of these challenges, the IDB will bring together biofuels producers with sustainability criteria authors and auditors to identify the primary barriers to implementation, identify pilot testing scenarios to assess on the ground implementation, and start to develop potential solutions. The goal of the meeting is to highlight practical challenges in complying with sustainability certification schemes and share experiences on how to overcome specific implementation issues. The involvement of both the private sector and the sustainability certification scheme "designers" will provide a platform for enhancing clarity and providing concrete examples of implementation challenges and potential solutions on specific criteria, both in the developed and developing countries.

January 25th

8:30 Coffee/Registration

9:00-9:30 Welcome/Introduction – IDB and UNEP
Brief participant's introductions

9:30-9:45 **Anticipated challenges for implementation and verification of sustainability criteria**
Matt Rudolf, Roundtable on Sustainable Biofuels

9:45-10:45 Discussion

10:45-11:00 Coffee

11:00-11:10 **Accounting for co-products in the cultivation and production cycle**
Keynote by Karen D. Laughlin, EPA

11:10- 12:00 Discussion

12:00- 01:00 Lunch

01:00- 01:15 **Measuring compliance and verification through the supply chain**
Keynote by Theresa Almonte, SGS

01:15-02:00 Discussion

2:00 – 2:30 **Case study on environmental implementation challenges and potential solutions** – Martijn Veen, SNV and Alfonso Robelo, Taboga

02:30- 02:45 Coffee

02:45- 04:00 **Parallel Working groups** to discuss the primary barriers and potential solutions for implementation of <u>environmental</u> sustainability criteria

Guiding questions for discussion:

- <u>General issues</u>:
  - -Are the challenges presented by the speaker/case study indicative of an average biofuels project?
  - -If not, what are the principal challenges for biofuels producers?

- <u>Green House Gas Emissions</u>
  - What are the biggest challenges in measuring GHG lifecycle emissions?
  - Where in the supply chain is the biggest hurdle?
  - Attributing GHG emissions to co-products

- Water Use
  - What are the biggest challenges in measuring water use?
  - Addressing project impact on water scarcity in a given region, current and future, how?

- Land Management
  - How to ensure/measure that project does not have negative impact on surrounding areas?
  - Calculation of fertilizers' negative externalities on water, air, and soil pollution?
  - To what extent good practices in fertilizers management can be implemented in different regional contexts?
  - How can biofuels projects help to promote greater biodiversity in agricultural production?

- -The way ahead
  - What are the remaining barriers that need to be addressed to make sustainability certification manageable for producers?
  - Given the barriers/challenges, what are the potential solutions over the next (6), (12), (18) months?
  - What are the biggest needs/gaps in order to develop/provide these solutions?
  - Who are the principle actors necessary to meet these needs/gaps?

04:00- 4:45 Plenary presentation of results of working groups and discussion

04:45-05:00 Wrap up and closure of first day

5.00 – 6.15 Cocktail IDB Terrace co-hosted with UNICA

January 26th

8:30 Coffee

9.00 – 9:30 **Case study on social implementation challenges** – Luiz Fernando do Amaral, UNICA, Brazil

9:30 - 11:15 Parallel Working groups to discuss the primary barriers for Implementation of social sustainability certification

Guiding questions for discussion:

- General issues:
  - Are the challenges presented by the speaker/case study indicative of an average biofuels project?
  - If not, what are the principle challenges for biofuels producers?

- Food Security
  - Measuring impact on food security at the project level? The watershed (or other relevant unit of management level)
  - Human Rights
  - Avoiding discriminatory or exploitative practices
  - Dealing with community health, safety and socio-cultural vulnerability
  - Security and use of force
  - Access to information, grievance mechanisms and fair treatment with respect to project benefits and opportunities

- Labor Rights
  - Number of jobs vs. quality of jobs
  - Migrant workers bad or good—minimum conditions
  - Gender issues
  - Child labor

- Resource and Land rights and access
  - Dealing with disputed land areas?
  - Dealing with impact on and participation by small farmers
  - Dealing with resource reallocation and related disputes
  - Effects on livelihoods, food security and cultural practices (short and long term) and effective mitigation/compensation

- Consultation
  - Verification of occurrence and quality of consultation and implementation of results
  - Effective and continuous stakeholder engagement

11:15-11.30 Coffee

11.30– 12.15 Plenary presentation of results of working groups and discussion

12.15 – 1.00 Conclusions and next steps

Chapter 1

The context: Why Biofuels?

1.1 Climate, energy security, economic development and agriculture drivers

International attention towards biofuels, as an alternative to liquid fossil fuels, has increased considerably in the last years. Different reasons have been raised to motivate the focus on biofuels, both internationally and domestically.

The reduction of greenhouse gases emissions, the need to increase energy security enlarging the spectrum of countries exporting "energy" as well as the support to the agriculture sector can all be identified as the main reasons behind the biofuels focus, at least for developed economies.

If we look at the issue through the lens of developing countries, biofuels could represent a driver for economic development and export opportunities. Moreover, biofuels can provide access to energy in remote rural areas.

1.1.1 The Climate driver

According to the International Energy Agency (IEA) World Energy Outlook 2009[19] (WEO 2009) Reference Scenario[20], world primary energy demand grows on average by 1.5% per year in the timeframe 2007-2030, which corresponds to an increase of about 40% overall in the same period.

It is interesting to note that this percent increase is smaller than the one estimated in the WEO 2008[21]

(45%) because of the impact of the financial and economic crisis. In fact, according to IEA; energy demand declines by 0.2% on average per year between 2007-2010 (driven by a drop of approximately 2% in 2009), should start to increase at a

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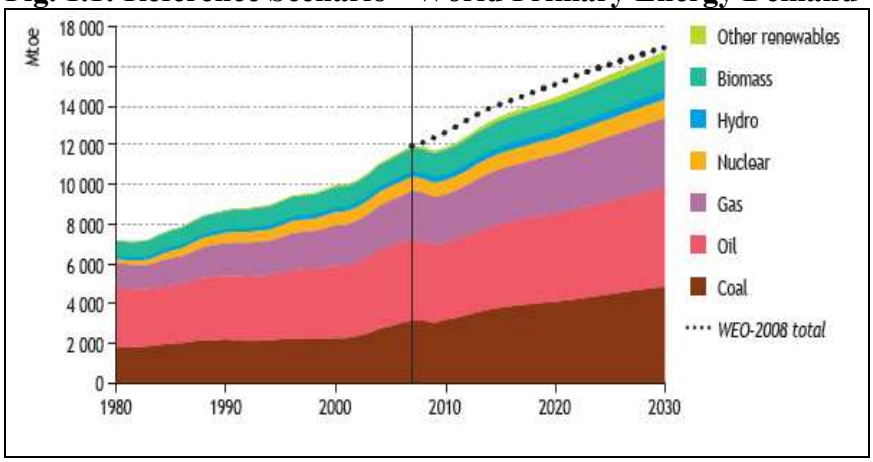
[19] International Energy Agency, World Energy Outlook 2009, available on http://www.worldenergyoutlook.org

[20] Reference Scenario "takes into consideration all government policies and measures that were enacted or adopted by mid 2009, including those that have not yet been fully implemented". "The projections in this scenario cannot be considered forecasts of what is likely to happen. Rather, they should be seen as a baseline vision of how energy markets are likely to develop should government policy making develop no further". Definition of Reference Scenario extracted from WEO 2009

[21] International Energy Agency, World Energy Outlook 2008

percentage of 2.5 per year in 2010-2015 and decreasing again progressively at an average of 1.5% per year in the period 2015-2030[22].

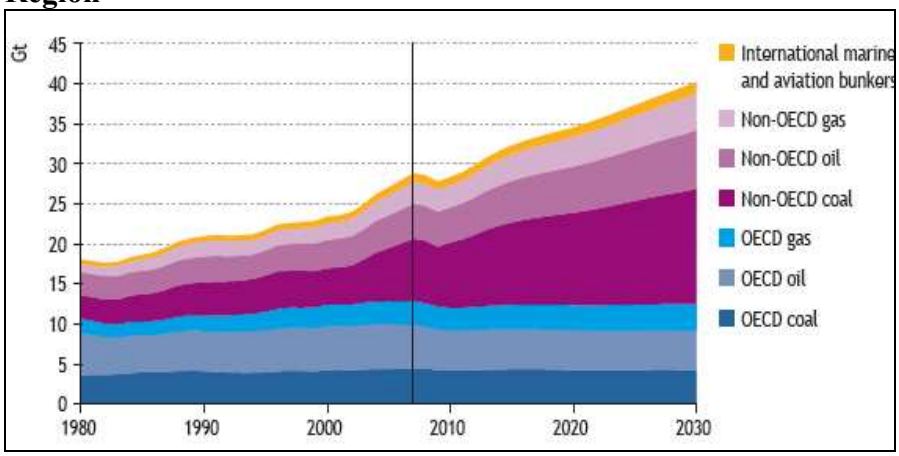
Fig. 1.1: Reference Scenario - World Primary Energy Demand



Source: IEA WEO 2009, pag 75

As a consequence, global energy-related CO2 emissions are predicted to increase by approximately 40% (28.8Gt in 2007 to 40.2 Gt in 2030)[23], an average rate of growth of 1.5% per year over the full projection period. Both the increase in energy demand and in CO2 emissions is generated by non –OECD countries, especially China and India, even if the per capita CO2 emissions of these countries still remain by far lower than the OECD one.

Fig. 1.2: Reference Scenario - Energy related CO2 Emissions By Fuel and Region



Source: IEA WEO 2009, pag 113

[22] International Energy Agency, World Energy Outlook 2009
23 International Energy Agency, World Energy Outlook 2009

The International Panel on Climate Change (IPCC) in the IV Fourth Assessment Report of 2007[24] showed that the highest "safe" level would be stabilising CO2 equivalent concentrations at 445 to 490 parts per million, which requires reaching peak CO2 emissions by 2015 and reducing them by 50 to 80 % by 2050, if the long-term mean global temperature rise is to be limited to between 2 and 2.4 degrees centigrade.

At the 2009 L'Aquila G8 Summit, Heads of State and Government reiterate their willingness "*to share with all countries the goal of achieving at least a 50% reduction of global emissions by 2050, recognising that this implies that global emissions need to peak as soon as possible and decline thereafter*". They also supported "*a goal of developed countries reducing emissions of greenhouse gases in aggregate by 80% or more by 2050 compared to 1990 or more recent years*"[25].

In order to reduce GHG emissions as indicated by IPCC, a "technology revolution" has to take place, through a massive development and deployment of low carbon technologies.
The IEA Blue Map Scenario[26] of the Energy Technology Perspectives 2008[27] shows in Figure 2 an estimate of the potential role that different low carbon technologies will have in meeting the goal of the reduction of 50% GHG by 2050.

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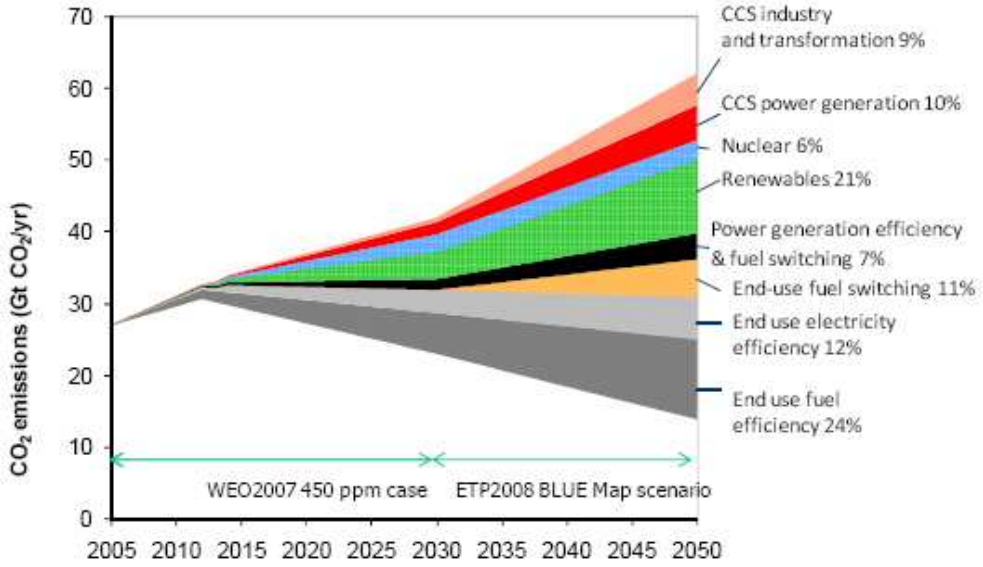
[24] IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)]. IPCC, Geneva, Switzerland, 104 pp. Available at http://www.ipcc.ch/ipccreports/ar4-syr.htm (June 13 2009)
[25] G8 L'Aquila Summit declaration (2009) "Responsible Leadership for a Sustainable Future", para 65 available at http://www.g8italia2009.it/static/G8_Allegato/G8_Declaration_08_07_09_final,2.pdf on July 11 2009
[26] "The BLUE Map scenario explores the energy implications of a reduction of global Greenhouse Gas (GHG) emissions to 50% of current levels by 2050. In this scenario, CO2 emissions would peak in the next decade, fall to 14 Gt in 2050, and stabilise afterwards. This most ambitious scenario could result in a stabilisation of CO2 concentrations at 450 ppm." Definition extrapolated from IEA Energy Technology Perspectives 2008.
[27] IEA, Energy Technology Perspectives 2008 – Scenarios and Strategies to 2050

Figure 1.3: Cutting Energy Related CO2 Emissions – An Energy Technology Revolution



Source: IEA, Energy Technology Perspectives 2008

As we can see from Figure 1.3, Renewable energies, which includes biofuels, are estimated to have a considerable weight in the IEA Blue Map Scenario(21%) in the reduction of GHG emissions.

As it has been stressed many times, all the technologies indicated by the IEA are needed; it is not about picking one of them.

In this situation, the effects of the "current" financial and economic crisis have to be taken into account.

While the reduction in production and consumption could have a "helping effect" in lowering GHG emissions at least in the short term, investments in low carbon technologies, including renewables, have been shrunk.

According to the United Nations Environment Program "Global Trends in Sustainable Energy Investments 2009"[28] (Figure 1.4), while the year 2008 confirmed an increase of investments in renewables, accounting to a total of $155 billion

[28] UNEP, 2009 "Global Trends in Sustainable Energy Investments 2009 - Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency". http://sefi.unep.org/english/globaltrends2009.html

invested in companies and projects globally, in comparison with the year 2007, the growth only accounted for 5%. The global financial crisis had a significant impact on investment in the second half of the year: accounting for a constraint of 17% on the first half, and down 23% on the final six months of 2007.

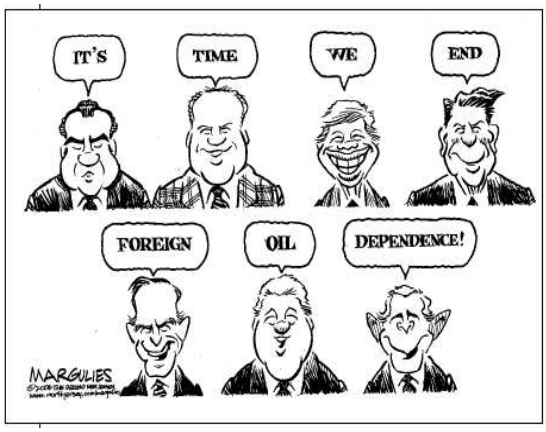
Fig. 1.4: New Investments in Sustainable Energy, 2002-2008, $ billions

Source: UNEP Global Trends in Sustainable Energy Investments 2009

1.1.2 The Energy security driver

The development and deployment of biofuels is also strictly linked to the need to reduce the dependency from oil, and from countries exporting oil, especially those considered politically less stable, like the Middle East and some Latin America countries.

This has been the primarily reason for United States of America in promoting biofuels policies.



Source: It's time we end foreign oil dependence – Cartoon by Jimmy Margulies @2006 The record New Jersey, found at http://www.brookings.edu/~/media/Files/Press/Books/2008/whatdowedonow/whatdowedonow_chapter.pdf June 18, 2009

In February 2007 State of the Union address former President G. W. Bush precisely the need "*…to diversify America's energy supply*" with the need *"….to expand the use of clean diesel vehicles and biodiesel fuel. We must continue investing in new methods of producing ethanol -- using everything from wood chips to grasses, to agricultural wastes*"[29]. This is not a new story as already President Nixon in 1973, and almost all US Presidents have called for energy independence.

Looking at the data and figures of the Energy Information Administration (EIA)[30], total US petroleum consumption in 2008 was equal to 19,419 thousands barrels/day[31], of which 8,964 destined to motor gasoline consumption[32]. Transportation as percent of total petroleum demand accounts to about 70%33.

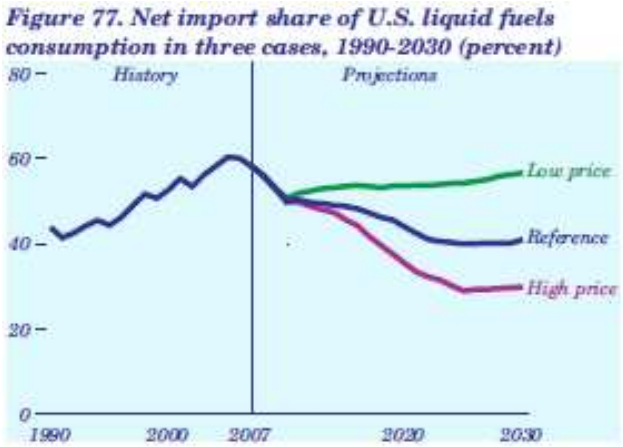
Being the US annual crude oil production in 2008 equal to 4,955 thousands barrels/day[34], the US net petroleum imports in the same year accounted for 11,041 thousands barrels/day[35], representing a percentage of 56.8% in foreign dependence in net petroleum imports.

While the United States imports of liquid fuels have been grown considerably during the last 20 years, in 2008 the net imports percentage of liquid fuel consumption fell to 56.8 % from 60.3% level in 2005. According to EIA Annual Energy Outlook of

[29] Extract from President George W. Bush State Of the Union Address, January 23, 2007
[30] Energy Information Administration (2009) - Official Energy Statistics from the US Government – Petroleum Basic Statistics available at http://www.eia.doe.gov/basics/quickoil.html downloaded on June 18th 2009
[31] EIA http://tonto.eia.doe.gov/dnav/pet/pet_cons_psup_dc_nus_mbblpd_a.htm downloaded on June 19, 2009
[32] EIA http://tonto.eia.doe.gov/dnav/pet/pet_cons_psup_dc_nus_mbblpd_a.htm downloaded on June 19, 2009
[33] Elaboration from Energy Information Administration data (2009) Official Energy Statistics from the US Government
[34] EIA http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbblpd_a.htm downloaded on June 19, 2009
[35] EIA http://tonto.eia.doe.gov/dnav/pet/pet_move_neti_a_ep00_IMN_mbblpd_a.htm downloaded on June 19, 2009

2009[36], in a reference scenario[37] this percentage should go down to 41% in 2030, also thanks to the increase in the use of biofuels.

Figure 1.5: Net Import share of US liquid fuel consumption (EIA)



Source: http://www.eia.doe.gov/oiaf/aeo/gas.html

US imports of total crude oil and products in the year 2008 mainly came from Canada (19.8%), Saudi Arabia (13.8), Venezuela (10.5%), Nigeria (8.9%) and Mexico (8.5%). OPEC countries overall accounted for 53.4%, the Persian Gulf 21.4%[38].

As regard as EU 25, according to EUROSTAT data[39], gross inland energy consumption of crude oil and petroleum in 2007 accounted for 641,616 Mtoe[40], of which for final energy consumption by transport[41] - (1 000 toe) 369,895 Mtoe[42].

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[36] EIA (2009) "Annual Energy Outlook 2009" available at http://www.eia.doe.gov/oiaf/aeo/index.html downloaded on June 17, 2009

[37] Assumptions of the reference case are that real GDP grows at an average annual rate of 2.5 percent from 2007 through 2030, supported by a 2.0 percent per year growth in productivity in nonfarm business and a 0.9 percent per year growth in nonfarm employment. world oil prices increase quickly after the recession ends, reaching $110 per barrel in 2015 ($128 per barrel in nominal terms), as growth in world oil demand rebounds and investment in production capacity lags this expansion in demand. After 2015, real prices rise gradually as demand continues to grow and higher cost supplies are brought to market. In 2030, the average real price of crude oil is $130 per barrel in 2007 dollars, or about $189 per barrel in nominal dollars.

[38] Elaboration from EIA US net imports by countries, total crude oil and products for year 2008 http://tonto.eia.doe.gov/dnav/pet/pet_move_neti_a_ep00_IMN_mbblpd_a.htm

[39] Eurostat Energy Statistics main tables http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/data/main_tables June 19, 2009

[40] Eurostat Energy Statistics main tables http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/data/main_tables June 19, 2009

Being the EU primarily production of crude oil in 2007 equal to 110,449Mtoe, net imports of crude oil and petroleum products accounted to 577,604 Mtoe, representing an import dependency of more than 80%.

According to the data published by DG TREN in the "*Market Observatory for Energy – Report 2008*"[43], if current trends and policies will continue, oil dependency from foreign countries could also continue to increase, reaching over 92% by 2030.
In 2006 about 19.8% of imports of crude oil come from Russia, 19.6% from Norway, 37.5% from OPEC (mentioning the main ones: Saudi Arabia 11.3%, Libya 8.4%; Iran 6.4%, Nigeria 4.3%, Algeria 4.0%)[44]

Although the energy imports, specifically the one of crude oil, are very high in the European Union, it varies considerably from country to country. The range in fact goes from Denmark who is completely independent, to Italy where the energy supply imported accounts to about 85%[45].

While the climate change driver is rather clear, when it comes to the energy security things get more complicated.
First of all it is questioning what it really means energy security and oil independence in a globalized world.
The decrease in oil imports from "political sensitive countries" like it could be for example Iran, will not shorten that country's possibility to exports (and financial support for extra activities) to other countries, for example to China and India.

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[41] Final energy consumption by transport covers the consumption of energy products in all types of transportation, i.e. rail, road, international and domestic air transport and inland navigation/coastal shipping, with the exception of maritime shipping
[42] EIA (2009) "Annual Energy Outlook 2009" available at http://www.eia.doe.gov/oiaf/aeo/index.html downloaded on June 17, 2009
[43] Directorate General Transport and Energy "Market Observatory for Energy – Report 2008" available on http://ec.europa.eu/energy/publications/doc/2008_moe_maquette.pdf
[44] Eurostat (2006) "EU integration seen through statistics" 2006 Edition available on http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-71-05-691/EN/KS-71-05-691-EN.PDF
[45] Eurostat (2009)"Panorama of Energy – Energy Statistics to support EU policies and solutions", 2009 edition, available on http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-GH-09-001/EN/KS-GH-09-001-EN.PDF June 16, 2009

Moreover, as Prof Lee explains "*The United States is not its own oil market, but rather part of a larger international market*"[46].

Therefore the key issue should be trying to reduce the imports of oil through tighter CO2 standard in cars consumption, the implementation of environmental and climate policies, more efficient energy infrastructures and, and enhancing international cooperation.

1.1.3 The Economic Development Driver

The experience of Brazil ethanol shows us that biofuels industry can represent a driver of economical development. As we will describe in more detail in Chapter 2, the ethanol industry in Brazil has overall made it possible the saving of about US $20 billion[47] over 20 years in the reduction of oil imports, taking also into account the amount of money spent by the Brazilian Government in subsidies.

In US similar calculations have been made, and the contribution of the domestic ethanol industry, as reported by the Renewable Fuel Association[48], account to the avoidance of importing about 321.4 million barrels of oil in 2008.

Biofuels production can satisfy part of the domestic demand for conventional oil and reduce the oil imports, or for those countries that have oil fields, release more quantities for export.

Climatic conditions, availability of land and, in some cases, preferential trade market, are all elements that in principle can favour the development of biofuels production.

On the other side of the coin the lack of infrastructures, such as road and ports, the absence of a reliable governance environment (including the risk of expropriation)[49]

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[46] Lee, H. (2009). "Oil Security and the Transportation Sector." Chap. 4 in "Acting in Time on Energy Policy" pag. 58, Washington, D.C.: Brookings Institution Press, May 2009.

[47] Goldemberg J (2007) "Ethanol for a Sustainable Energy Future", Science vol 315, February 9, 2007

[48] LEGC, LLC (2009) "Contribution of the Ethanol Industry to the Economy of the United States"

[49] Hausmann R. and Wagner R. (2009) "Industrial Development and the making of a Global Market for Biofuels" prepared for the Conference on Biofuels Certification at Harvard University, May 2009 available at

for attracting investments and technology transfer, the inadequacy of local expertise in both dealing with production and international markets, are all elements that refrain developing countries from boosting a biofuels business.

The development of a biofuels industry can also have "*stepping stone effects*", as highlighted by Lee and Devereaux (2009),[50] in increasing the number of jobs, in building infrastructure that can be used also for purposes other than the movement of biofuels products, creating complementary activities and acting as a cluster.
It is interesting to see the first steps of South-South cooperation in the field of biofuels. Brazil has already started technology transfer and capacity building activities in Mozambique for the production of ethanol. Others are in place with Angola and China.

1.1.4 The Agriculture/Social driver

Biofuels feedstocks, at least as far as concern first generation, are strictly linked to the agricultural sector. Wheat, maize, sugar cane are harvested both in developed and developing countries and processed into fuels. It is therefore impossible to look at biofuels without considering the weight and power that the agriculture sector has especially in EU and USA. Biofuels development has, sometimes more openly than others, justify also as a driver for agriculture and rural development.

If we look at US, according to USDA Economic Research Services, Agricultural Outlook: Statistical Indicators[51], the Gross value Added by the Agriculture Sector to the US Economy was in 2008 equal to 165.6 billions representing the 1.2% of US

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http://www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/pdfs/centers-programs/centers/cid/ssp/docs/events/workshops/2009/biofuel/hausmann_global_market_biofuels_working_paper_draft_may_2009.pdf

[50] Devereaux, Charan and Lee, Henry, "Biofuels and Certification: A Workshop at Harvard Kennedy School" Discussion Paper 2009-07, Cambridge, Belfer Center for Science and International Affairs, June 2009 Available at http://belfercenter.ksg.harvard.edu/files/Biofuels%20and%20Certification%20Harvard%20Workshop%20Report%2009%20web.pdf on July 13 2009

[51] USDA Economic Research Services, Agricultural Outlook: Statistical Indicators, Table 29 –Value Added to the US Economy by Agricultural Sector http://www.ers.usda.gov/publications/agoutlook/aotables/2009/05May/aotab29.xls

GDP (in 2008 equal to US$14.29 trillion [52]at PPP). While gross value of the agriculture sector in 2008 increases of about 60% compared to 1998 levels, the incidence on GDP remains almost the same 1.22%.

Employment rate in the agriculture sector fell in the last decades. According to the US National Agricultural Statistics Service[53], in 2009 hired workers in US farms and ranches in the week of April 12-18, 2009 accounted to 903.000,00 reflecting a decrease of about 25% respect to year 1990 (1.24 million) and 73% compared to 1980 (3.44 million). In macro terms it means that people employed in the agriculture, forestry and fisheries sector in the US represent 0.9% of the population[54], while in the 70's 4 % of employed labour force worked in agriculture, in 2002 this percentage fell to 1.9%.

The number of farms in the US in 2008 accounted to 2,2 million of unit, total land in farms is estimated at 919.9 million acres, and the average farm size is about 418 acres[55]. The number of farms and land in farms in US are experiencing a "constant" decline in the last years due to the consolidation of operations and diversion of agricultural land to other uses non agricultural.

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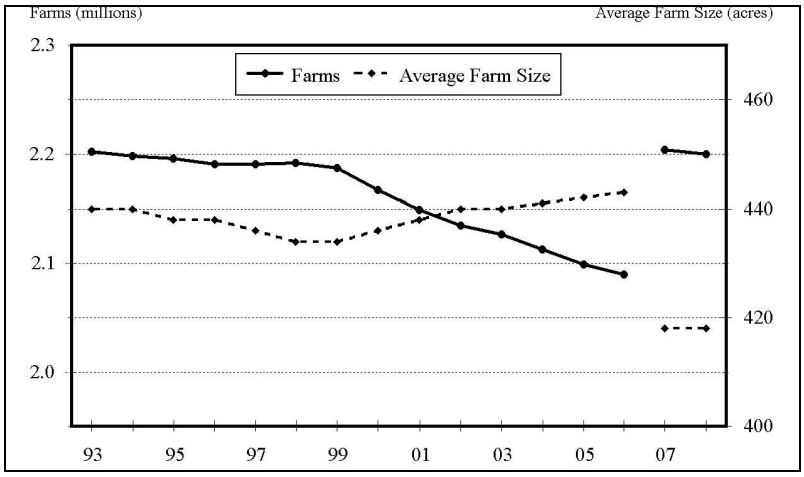
[52] Bureau of Economic Analysis - Department of Commerce - National Income and Product Accounts Table 1.3.5. Gross Value Added by Sector (revised on May 2009) http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=24&ViewSeries=NO&Java=no&Request3Place=N&3Place=N&FromView=YES&Freq=Year&FirstYear=1995&LastYear=2009&3Place=N&Update=Update&JavaBox=no

[53] Elaborations from US National Agricultural Statistics Service, Farm Labour data, http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1063 downloaded on June 22, 2009

[54] Central Intelligence Agency – The World Fact book United States of America https://www.cia.gov/library/publications/the-world-factbook/geos/US.html last updated April 2009

[55] USDA (2009) "Farms, Land in Farms, and Livestock Operations", 2008 Summary, February 2009, pag 2 http://usda.mannlib.cornell.edu/usda/current/FarmLandIn/FarmLandIn-02-12-2009.pdf June 20, 2009

Figure 1.6: Number of Farms and Average Farm Size US 1993-2008



Source: (USDA) "Farms, Land in Farms, and Livestock Operations – 2008 Summary", pag 7, February 2009.

The average age of U.S. farm operators increased from 55.3 in 2002 to 57.1 in 2007. The number of operators 75 years and older grew by 20 percent from 2002, while the number of operators under 25 years of age decreased by 30 percent[56].

According to the US 2007 Census of Agriculture, in 2007 the market value of crops sold (including nursery and greenhouse crops) was equal to 144,657 million US$ vs 153,562 million US$ coming from livestock, poultry and their products[57].
Of the almost $300 billion in agricultural products sold in 2007, grains and oilseeds accounted for 26%, cattle and calves for 21%, poultry and eggs for 12%, milk for 11%, and fruits and nuts for 6%.

The value of agricultural exports for the U.S. in 2007 fiscal year totaled $81.9 billion[58], up 53% from 1998 levels. In 2007 principal value of exports were represented by: feed grains (11,847.7 – 14.4%), Soybeans and Products (11,027.2-

[56] 2007 Census of Agriculture – Demographics - http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/demographics.pdf
[57] USDA The 2007 Census of Agriculture - Table 1 historical highlights: 2007 and earlier census years http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/New_Jersey/st34_1_001_001.pdf downloaded on June 22, 2009
[58] USDA - Economic Research Service -Value of U.S. agricultural exports by commodity group, last 5 fiscal years http://www.ers.usda.gov/data/stateexports/

13.4%), Wheat and Products (8,457.7-10.3%), Live animals and Meat (6,787.0 – 8.28%), Fruits and Preps (5,026.3-6.13%)[59].

Let's examine the EU 25 situation.

According to EUROSTAT the Gross Value Added (GVA) of the agriculture industry at producer price in 2007 accounted to €143 billion[60] (equal to $197.34 at an exchange rate Euro/US$ of 1.38) in the EU-27, representing about 1.8% of the GDP PPP (in 2007 equal to 10,522.00US $ billions[61]).

More than 85% of this value is generated in the 15 old Member States (EU-15) where France, Italy, Spain and Germany account for around 70% of it.

In 2007 EU 27 accounted for about 14 million[62] agriculture holdings[63] experiencing a decrease of about 9% compared to 2003 levels. About 70% of the agriculture holdings in 2008 were less than 5 hectares in size, with Romania accounting for 36.6% of them, Poland the 17%, Italy 13%). About

18% cover an area included between 5 and 20 hectares, 5.8% an area between 20 and 500 acres and finally 5% major than 50 acres (France 28%, Spain 14%)[64].

As far as employment concern, the agriculture sector in 2007 about 12 million people had an occupation in farms, accounting for a decrease of 12% compared to 2003 levels. It represents about 5.6% of the entire EU 27 work force (CIA data)[65]

The value at producer price of agriculture output corresponded in 2008 to 369 billion Euros of which 52% crop output and 41% animal outputs.

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[59] Bureau of Economic Analysis - Department of Commerce - National Income and Product Accounts Table 1.3.5. Gross Value Added by Sector (revised on May 2009)

[60] EUROSTAT - Gross value added of the agricultural industry - basic and producer prices - (million ECU/EUR)
http://epp.eurostat.ec.europa.eu/portal/page/portal/agriculture/data/main_tables

[61] International Monetary Fund - World Economic and Financial Surveys - World Economic Outlook Database
http://www.imf.org/external/pubs/ft/weo/2009/01/weodata/index.aspx

[62] EUROSTAT –Number of Agriculture holdings
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tag00001&plugin=1

[63] Definition by EUROSTAT: Agricultural holding: a single unit both technically and economically, which has single management and which produces agricultural products. Other supplementary (non-agricultural) products and services may also be provided by the holding. The smallest farms (less than 1% of national agricultural activity) do not have to be surveyed.

[64] Elaboration from EUROSTAT–Number of Agriculture holdings

[65] CIA the World Fact Book https://www.cia.gov/library/publications/the-world-factbook/geos/EE.html June 22, 2009

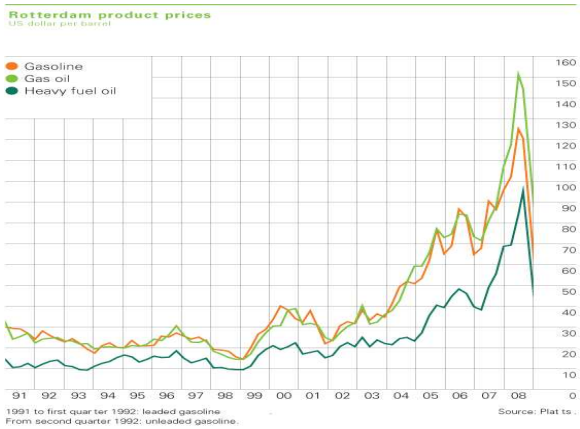
In 2008, EU agricultural exports in value were made up for 64% by processed final products. The overall value of EU agricultural exports increased strongly by 9.9 % compared to 2007 levels, and it was particularly marked for wheat (grains) (+163.8%), sugar alcohols (+116.0%), fatty acids and alcohols (+109.4%) and soy beans (+103.9%). Export values fell for essential oils (-29.9%), wool and silk (including cocoons) (-18.3%), raw sugar (-16.2%) and, among others, for dairy products (-2.3% for butter and -0.6% for milk, crème, yoghurt, whey). The overall value of agricultural imports in 2008 as compared to 2007 rose by 12.4%[66].

1.2 Governments push biofuels development

Starting from 2005 attention has been focus especially in the EU and US on the promotion of public policies and mandates to develop the production and use of biofuels.

As described above there have been different reasons behind this political interest, and maybe the main one has been related to the steady increase in oil price starting from the year 2004.

Figure 1.7: Crude oil Prices 1990-2008



Source: BP WEO 2009[67]

[66] European Union Directorate-General for Agriculture and Rural Development – Agriculture in the European Union Statistical and Economic Information 2008, March 2009 http://ec.europa.eu/agriculture/agrista/2008/table_en/2008enfinal.pdf

[67] BP (2009) "Statistical Review of World Energy" June 2009, pag. 17 http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2008/STAGING/local_assets/2009_downloads/oil_section_2009.pdf

While Brazil can be considered the first mover in promoting since the 70's policies directed to the development of the ethanol domestic industry and to the mandatory blending of ethanol in cars, EU and US started a massive policy towards biofuels promotion in 2000.

Countries that have seen their consumption of oil increasing at high rates, such as China, India, and South Africa started policies developing specific targets for the consumption of biofuels. Other developing countries, such as Mozambique, Indonesia or the Caribbean started production of biofuels both for domestic use and exports, converting in some cases former sugar activities.

Here is a brief overview of the policies putting in place by EU, US, Brazil, China and other developing countries.

1.2.1 Brazil

With the Brazilian National Alcohol Programme, known as Proalcool, the Brazilian Government started the world largest program for the development of ethanol from sugarcane becoming the world leader in industry and in consumption.

The reasons behind the launch of Proalcool program were essentially two: to decrease dependence from imported petroleum, accounting at that time for about 80%[68], and to revamp domestic sugar industry that was in a very bad shape at that time.

The initial goal of the program was to replace about 20% of gasoline with ethanol by 1980, which corresponded to about 3.5 billion litres. The modest level of ethanol blend required, below 20%, did not implied modifications to motor engines and the favourable credit program that was implemented made the goal achieved by the end of the 70's.

A new goal of 2.8 million gallons of alcohol produced was set in 1979 and the blending target was progressively raised to 25%. Additional favourable policies were put in place such as the cap of ethanol price, the reduction of registration tax

[68] Hira A., de Oliveira L.G (2009). "No substitute for oil? How Brazil developed its ethanol industry". Energy Policy 37 (2009) 2450-2456

for alcohol based car, making the sales of new straight alcohol cars increasing from 1% of total cars sales in January 1980 to 73% by the end of that year[69].

The years among 1985-2002 represented a period of crisis for the Proalcool program, due essentially to the decrease of oil price as well as the increase in world sugar prices, and it closed officially in 1991.

In 1993 the Government, in order to reshape the ethanol industry established the requirement that 22 percent anhydrous ethanol must be added to all gasoline distributed at retail gas stations in Brazil.

A new shape was given in 2003 by the Flex Fuel Vehicle (FFV)[70] program, fixing tax breaks and in early 2005 the sale of FFVs surpassed gas vehicles[71].

At the same time Brazilian Government put forward a new program started in 2003 to increase also the production and use of biodiesel to achieve the 2% blend of biodiesel with diesel (B2) in early 2008, 5% by 2013.

It is interesting to note that the Brazilian Biodiesel Program has been linked to the social plan called "Social Fuel Seal"[72] that gives producers tax benefits and credit when they purchase biodiesel feedstock from family farmers and enter in a legally binding with them that guarantee specific income levels, as well as technical assistance and training.

In 2008 the sales of flex fuels light vehicles accounted for the 89% of the total sales[73].

In 2008/2009 the total production of ethanol has been accounted to 26.7 billion liters[74], with an increase from 2006/07 levels of 47%.

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[69] Hira A., de Oliveira L.G (2009). "No substitute for oil? How Brazil developed its ethanol industry". Energy Policy 37 (2009) 2450-2456

[70] Flex Fuels vehicles can run on two source of fuel such as gasoline and ethanol or gasoline and natural gas. They can run on nay blend of gasoline and ethanol.

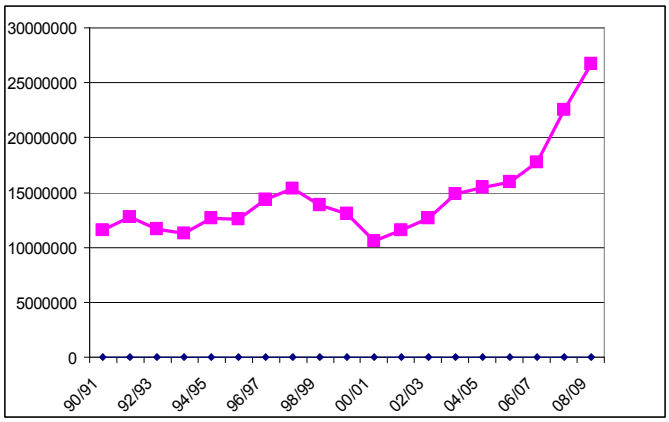
[71] Banco Nacional de Desenvolvimento Econômico e Social (BNDES) and Centro de Gestao e Estudos Estrategiscos (CGEE) (2008) "Sugarcane-Based Bioethanol – Energy for Sustainable Development" presented on the occasion of the International Conference of Biofuels, Rio de Janeiro, November 2008

72 Programa Nacional de Produção e Uso de Biodiesel available at http://www.biodiesel.gov.br/ downloaded on January 16th, 2010

[73] Elaboration from UNICA data on Brazilial light vehicles sales by fuel tipe http://www.unica.com.br/downloads/estatisticas/eng/VEHICLES%20SALES%20IN%20BRAZIL.xls June 23 2009

[74] USDA Foreign Agricultural Service GAIR Report Brazil Biofuels Annual Ethanol 2008 http://www.fas.usda.gov/gainfiles/200807/146295224.pdf June 25 2009

Figure 1.8: Brazil total ethanol production (Thousand liters)[75] 1990-2008 (Million Liters)



Source: elaboration from UNICA and USDA Foreign Agricultural Service Data

As far as the production of biodiesel concern, in 2008 it accounted to 1,100 billion liters[76].

On the demand side, ethanol domestic demand in 2008/09 (all uses) has reached 22,452.00 million liters (an increase of about 58% from 2006/07 level), while biodiesel demand in 2008/2009 accounted for 1,005.00 liters[77].

Brazil is very active not only at domestic level for the development of biofuels, but also internationally forging different bilateral cooperation agreements, some also in the optic of South-South cooperation. Examples in this regard are the Memorandum of Understanding between Brazil and the United States signed in March 2007[78] to advance cooperation on biofuels focused on the standardization of technical specifications to facilitate trade as well as on promoting investments and technology transfer of biofuels in third countries. Examples of South-South cooperations are the formation of the Brazil-Indonesia Consultative Committee on Biofuels[79] to promote

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[75] Elaboration from UNICA data on Brazil total ethanol production (Thousand litres) http://www.unica.com.br/downloads/estatisticas/eng/BRAZILIAN%20ETHANOL%20PRODUCTION.xls June 23, 2009 and USDA Foreign Agricultural Service GAIR Report Brazil Biofuels Annual Ethanol 2008 http://www.fas.usda.gov/gainfiles/200807/146295224.pdf June 25 2009

[76] USDA Foreign Agricultural Service GAIR Report Brazil Biofuels Annual Biodiesel 2008 http://www.fas.usda.gov/gainfiles/200808/146295495.pdf June 25 2009

[77] USDA Foreign Agricultural Service GAIR Report Brazil Biofuels Annual Biodiesel 2008 http://www.fas.usda.gov/gainfiles/200808/146295495.pdf

[78] Memorandum of Understanding between the United States of America and Brazil to advance cooperation on Biofuels signed and entered into force on March 9th, 2007.

[79] Brazil-Indonesia Consultative Committee on Biofuels available at http://extranet.agricultura.gov.br/pubacs_cons/%21ap_detalhe_noticia_cons_web?p_id_publicacao=9523

biofuels agribusiness and the creation of a division of EMBRAPA, the state owned Brazilian Agricultural Research Corporation, in Ghana to promote biofuels.

1.2.2 The United States of America

On the basis of reasons tightly linked to energy security and to the need of lowering the dependence from foreign oil, in the 2005 Energy Policy Act[80] US Government boosted the development and use of renewable fuels, mandating the use of 5.4 billions of gallons by 2008 and 7.5 billion gallons of renewables fuels for the transport sector to be reached by 2012.

Two years later, the 2007 Energy Bill, named Energy Independence and Security Act, committed U.S. to increase the volume of renewable fuels used each year, beginning with 9 billion gallons in 2008, leading to 36 billion gallons by 2022.

In February 2010, EPA has finalized the revision of the National Renewable Fuel Standard Program (RFS) that establish new volume standards (Table 1.1) for renewable fuels to be used in transportation, in addition to setting new definitions of both renewable fuels and GHG emissions thresholds calculated on the basis of lifecycle analysis.

In a country were in 2008 the transport sector accounted for 70% of the country's oil consumption[81] and for 32.43% of the GHG emission, not forgetting that globally the US petroleum consumption as percent of world petroleum consumption accounts to 24.2%[82], the implementation of these mandates could have an impact in terms of GHG reductions and RD&D boosting in the energy sector.

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[80] 2005 Energy Policy Act of United States of America http://www.epa.gov/oust/fedlaws/publ_109-058.pdf

[81] Energy Information Administration (2009) - Official Energy Statistics from the US Government – Petroleum Basic Statistics available at http://www.eia.doe.gov/basics/quickoil.html downloaded on June 18th 2009

[82] Bureau of Transport Statistics-Research and Innovative Research Administration (RITA) "National Transportation Statistics", Table 4-1: Overview of U.S. Petroleum Production, Imports, Exports, and Consumption http://www.bts.gov/publications/national_transportation_statistics/html/table_04_01.html June 24, 2009

Table 1.1: EISA Renewable Fuel Volume Requirements (Billion Gallons)

	Cellulosic biofuel requirement	Biomass-based diesel requirement	Advanced biofuel requirement	Total renewable fuel requirement
2009	n/a	0.5	0.6	11.1
2010	0.1	0.65	0.95	12.95
2011	0.25	0.80	1.35	13.95
2012	0.5	1.0	2.0	15.2
2013	1.0	a	2.75	16.55
2014	1.75	a	3.75	18.15
2015	3.0	a	5.5	20.5
2016	4.25	a	7.25	22.25
2017	5.5	a	9.0	24.0
2018	7.0	a	11.0	26.0
2019	8.5	a	13.0	28.0
2020	10.5	a	15.0	30.0
2021	13.5	a	18.0	33.0
2022	16.0	a	21.0	36.0
2023+	b	b	b	b

Source: EPA(2010) Office of Transportation and Air Quality 420-F-10-007[83]

The estimated GHG reduction due to the full implementation of RFS program in 2022 should account to 138 million metric tons. The reduction is equivalent to take out of the roads about 27 million vehicles[84].

EPA estimates that the RFS program, when the 36 billion gallons target will be reached in 2022, will displace about 13.6 billion gallons of petroleum-based gasoline and diesel fuel, representing 7% of expected gasoline and diesel consumption. In addition, it is expected RFS will determine a decrease of oil imports of about $41.5 billion , resulting in energy security benefits of additional $2.6 billion[85].

According to the data provided by the Renewable Fuel Association in the 2009 Ethanol Industry Outlook, US Ethanol production in 2008 accounted for 9 billion gallons (equivalent to approximately 34 billion liters) , meeting the standard set by

[83] EPA (2010) Office of Transportation and Air Quality "EPA Finalizes Regulations for the National Renewable Fuel Standard Program for 2010 and Beyond", EPA-420-F-1007

[84] EPA (2010) Office of Transportation and Air Quality "EPA Finalizes Regulations for the National Renewable Fuel Standard Program for 2010 and Beyond", EPA-420-F-1007

[85] EPA (2010) Office of Transportation and Air Quality "EPA Finalizes Regulations for the National Renewable Fuel Standard Program for 2010 and Beyond", EPA-420-F-1007

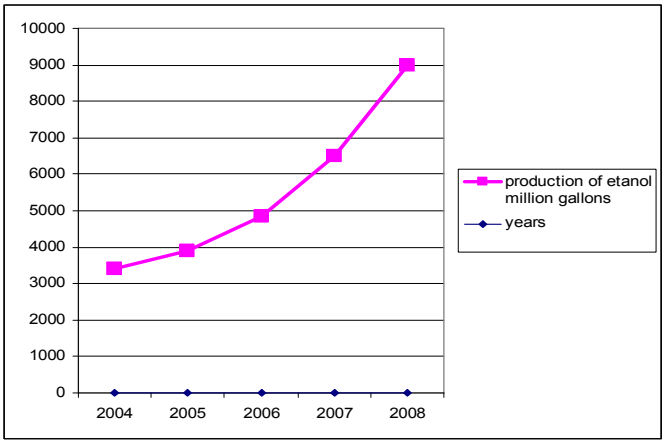
the Energy Act. In 2008 the demand of ethanol accounted for 9.636.9 million gallons, experiencing an increase of 130% from 2005 levels[86].

Biodiesel production in 2008 has been of 2.0 billion liters[87].

From an economic perspective, the 9 billion gallons of ethanol domestic production (equivalent to 34 billion liters)[88], assuming they have all consumed, have avoided the import of 5% of total US crude oil imports, or replaced 321.4 million barrels of oil in 2008[89]. Moreover the US Ethanol

Industry has been estimated to have added to the US GDP in 2008 more than 65$ billion in combination of spending per annual operations, ethanol transportation and capital spending for new plants under construction[90].

Figure 1.9: Production of Ethanol (million gallons)



Source: elaboration from RFA statistics on US ethanol production

[86] RFA statistics http://www.ethanolrfa.org/industry/statistics/

[87] REN 21 (2009) "Renewables 2009 Global Status Report" *http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf*

[88] U.S. liquid gallon is defined as 231 cubic inches and is equal to 3.785411784 litres or about 0.13368 cubic feet.

[89] LEGC, LLC (2009) "Contribution of the Ethanol Industry to the Economy of the United States" February http://www.ethanolrfa.org/objects/documents/2187/2008_ethanol_economic_contribution.pdf . The explanation of the replacement of 321.4 million barrels oil is reported as the following: "According to EIA one 42 gallon barrel of crude oil produces 18.4 gallons of gasoline. Ethanol has a lower energy content (84,400 btu/gal) than gasoline (124,000 btu/gal) so it takes 1.46 gallons of ethanol to provide the same energy as a gallon of gasoline. Therefore, 9 billion gallons of ethanol are the equivalent of 5.9 billion gallons of gasoline. Since one barrel of crude produces 18.4 gallons of gasoline, it takes 321.4 million barrels of crude to produce 5.9 billion gallons of gasoline, the amount displaced by ethanol. This oil was valued at the 2008 average price for West Texas Intermediate crude of $99.67/bbl".

[90] RFA statistics http://www.ethanolrfa.org/industry/statistics/

1.2.3 The European Union

The European Union's efforts to increase the consumption of biofuels started in 2003 with the entering into force of Directive 2003/30/EC[91] (Biofuels Directive).

The Directive required Member States to reach the indicative targets of biofuels in the transport sector, as a minimum proportion of the fuel sold in their territory, of 2% by December 2005 and 5.75% by December 2010, compared to a level of 0.6% in 2002.

The targets set up by the EU were not mandatory and the 2005 target was far to be reached: on average EU accounted by that year a percentage of 1.0 of transport fuel. Apart from Germany that reached a % of biofuels of 3.75% and Sweden of 2.23%, all the others were at levels below 1%[92].

As part of the EU strategy to reduce the GHG emission of 20% by 2020 compared to 1990 levels, the March 2007 European Council adopted the Action Plan Energy Police for Europe and endorsed the following targets:

"- *a binding target of a 20 % share of renewable energies in overall EU energy consumption by 2020;*

− *a 10 % binding minimum target to be achieved by all Member States for the share of biofuels in overall EU transport petrol and diesel consumption by 2020, to be introduced in a cost-efficient way. The binding character of this target is appropriate subject to production being sustainable, second-generation biofuels becoming commercially available and the Fuel Quality Directive being amended accordingly to allow for adequate levels of blending*"[93].

On the energy efficiency side, the European Council stressed also the need to achieve in the EU the objective of saving 20 % of the EU's energy consumption compared to projections for 2020.

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[91] Directive 2003/30/EC on the Promotion of the Use of Biofuels or other Renewable Fuels for Transport http://ec.europa.eu/energy/res/legislation/doc/biofuels/en_final.pdf

[92] Commission of the European Communities, Communication from the Commission to the Council and the European Parliament. Biofuels Progress Report on the progress made in the use of biofuels and other renewable fuels in the Member States of the European Union http://ec.europa.eu/energy/energy_policy/doc/07_biofuels_progress_report_en.pdf

[93] Quote by Presidency Conclusions of the Brussels European Council (8/9 March 2007). 7224/1/07, pag 21
REV 1 http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf

The European Parliament and the Council have finally agreed in December 2008 to the new Directive on Renewable Energy 2009/28/CE (that revise the "Biofuel Directive") that call for each Member State to ensure that the share of energy from renewable sources in all forms of transport in 2020 is at least 10 % of the final consumption of energy in transport in that Member State[94].

The Directive, as we will see in the section dedicated to the sustainability certification scheme for biofuels, specifies that to count in the 10% percentage, the greenhouse gas emission saving shall be at least 35 %. With effect from 1 January 2017, the saving percentage needs to be increased to 50 %. And finally by 1 January 2018 GHG saving shall be at least 60 % for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017[95].

The need to have a mandated quantifiable net GHG emission saving came out after the publication of different studies[96] that questioned the real potential of biofuels in getting GHG savings. The EU was attacked by NGOs and media[97] of favoring, through its ambitious mandates, the acceleration of palm oil not sustainable practices in Indonesia and Malaysia with consequent negative effects in deforestation practices and GHG release.

In 2007 according to the European Biodiesel Board (EEB)[98], the production of biodiesel in EU 27 was of 5,713 (000 Ton) experimenting an increase of 16.8% compared to 2006 levels.

More than half of the biodiesel (i.e. nearly 3.3 billion litres in 2007) in the EU is today produced in Germany. Germany is followed by France, Italy, and Austria, the four countries accounting for more than 75% of biodiesel production in the EU.

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[94] DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Art. 3 para 4, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

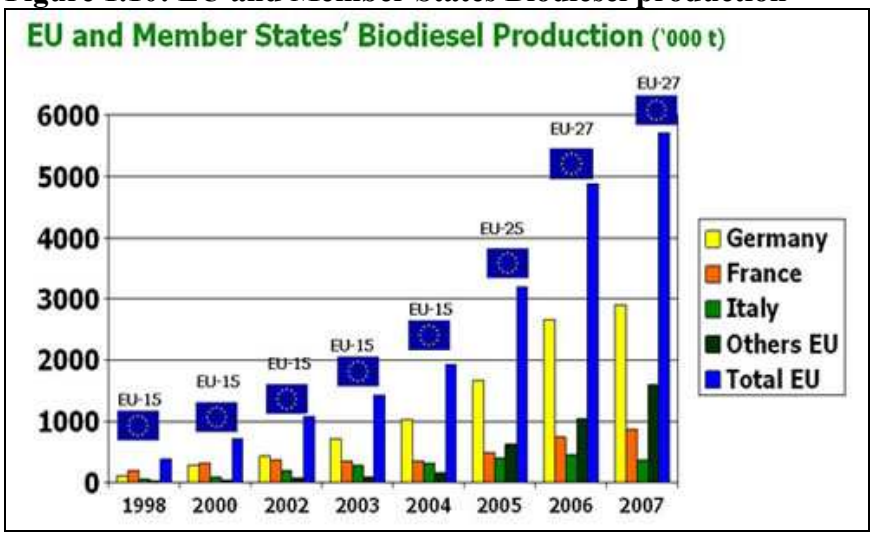
[95] DIRECTIVE 2009/28/EC, Art 17 para 2

[96] J. Fargione, J. Hill, D. Tilman, S. Polasky and P. Hawthorne (2008), "Land clearing and the biofuel carbon debt", Science, 2008, 319, 1235–1238, DOI: 10.1126/science.1152747 and Searchinger T. et All "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change"; Sciencexpress February 2008

[97] The Guardian Apri 4th 2007: "Palm oil: the biofuel of the future driving an ecological disaster now" http://www.guardian.co.uk/environment/2007/apr/04/energy.indonesia July 8th 2009

[98] European Biodiesel Board Statistics - The EU biodiesel industry http://www.ebb-eu.org/stats.php June 24 2009

Figure 1.10: EU and Member States Biodiesel production



Source: EEB

According to DG Tren In 2006 final consumption of biodiesel in EU 27 were 4440Kto and 882 Kto of biogasoline [99]. To the same source in 2006 production of biodiesel accounted for 4753 and biogasoline 827 Ktoe[100]

1.2.4 China

In 2007 the National Development and Reform Commission of China issued the Renewable Energy Plan that has established targets and conditions for the production of biofuels towards the year 2020.

The Plan established that the use of non-grain fuel ethanol will reach 2 Million Metric Tons and the one of biodiesel 200,000 Metric Ton by 2010.

By the year 2020 the use of fuel ethanol (both grain based and non grain based) will reach 10 million Metric Tons and the one of biodiesel 2 Million Metric Tons[101].

The Chinese Government made it clear the goal of not creating competition between the crops used for fuels and food. To this end NDRC will not approve new plants that will use corn or other grains used as feedstock.

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[99] DG Tren http://ec.europa.eu/energy/publications/doc/statistics/part_4_energy_pocket_book_2009.xls#'4.4.1 Final Energy Consumption'!A1

[100] DG Tren http://ec.europa.eu/energy/publications/doc/statistics/part_4_energy_pocket_book_2009.xls#'4.4.1 Final Energy Consumption'!A1

[101] USDA Foreign Agricultural Service GAIN Report China, People Republic, Biofuels Annual 2008 http://www.fas.usda.gov/gainfiles/200806/146295020.pdf June 25 2009

While research projects are on going on the use of tubers (sweet potatoes and cassava) sweet sorghum and oil from tree nuts, there are (2008 data) 5 plants that already have been licensed for ethanol production. Their production totalled 1.4 Million Metric Tons in 2007.

In 2002 China launched the National Fuel Ethanol Program mandating the use of a 10% blend of bioethanol into gasoline (E10). By 2008, 27 cities[102] located in 10 different Provinces participate into the programme

In 2008 Ethanol production has accounted to 1,550,000 Metric Tons, making China the third global producer of ethanol, after US and Brazil. The production is growing considerably over the years, it increased by 68% compared to 2005 levels[103].

Production of biodiesel in 2007 was far lower, estimated at around 300,000Metric Tons, suffering the lack of feedstock supply.

[102] USDA Foreign Agricultural Service GAIN Report China, People Republic, Biofuels Annual 2008 http://www.fas.usda.gov/gainfiles/200806/146295020.pdf June 25 2009

[103] USDA Foreign Agricultural Service GAIN Report China, People Republic, Biofuels Annual 2008 http://www.fas.usda.gov/gainfiles/200806/146295020.pdf June 25 2009

1.2.5 Other countries blending mandates (Source REN21)[104]

Australia	E2 in New South Wales, increasing to E10 by 2011; E5 in Queensland by 2010
Argentina	E5 and B5 by 2010
Bolivia	B2.5 by 2007 and B20 by 2015
Canada	E5 by 2010 and B2 by 2012; E7.5 in Saskatchewan and Manitoba; E5 by 2007 in Ontario
Chile	E5 and B5 by 2008 (voluntary)
Colombia	E10 and B10 existing (cities where population exceeding 500000)
Dominican Republic	E15 and B2 by 2015
India	E5 by 2008 and E20 by 2018; E10 in 13 states/territories
Jamaica	E10 by 2009
Malaysia	B5 by 2008
Paraguay	B1 by 2007, B3 by 2008, and B5 by 2009; E18 (or higher) existing
Peru	B2 in 2009; B5 by 2011; E7.8 by 2010
South Africa	E8–E10 and B2–B5 (proposed)
Thailand	E10 by 2007 and B10 by 2012; 3 percent biodiesel share by 2011
Uruguay	E5 by 2014; B2 from 2008–11 and B5 by 2012

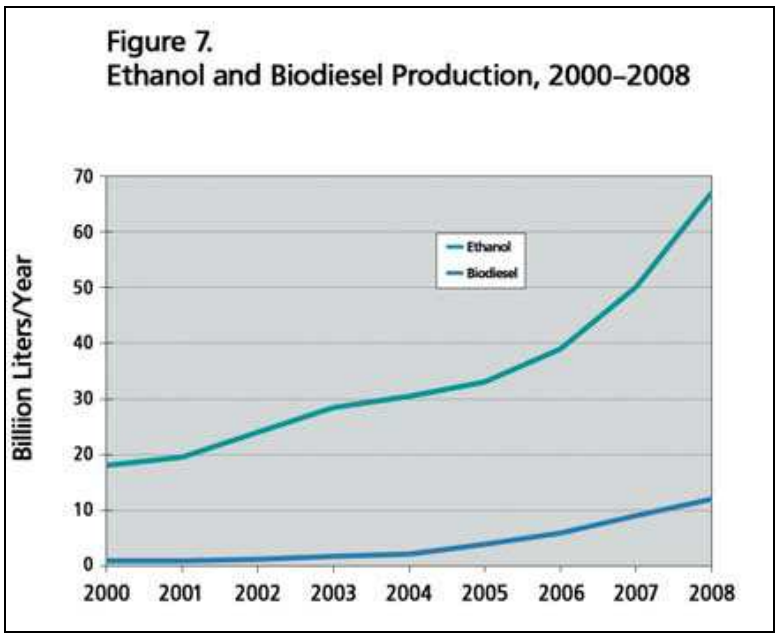
Source: adaptation from REN 21 RENEWABLES 28 GLOBAL STATUS REPORT | 2009 Update

[104] REN 21 (2009) "Renewables 2009 Global Status Report"
http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf

1.2.6 Present status and scenarios of global biofuels production

According to the latest REN 21 Renewable Global Report (2009)[105], in 2008 global ethanol production accounted for 67 billion liters, experiencing an increase of about 34% compared to the previous year (50 billion). Biodiesel production in 2008 has reached 12 billion liters, with an increase of 33% from the previous year.

Figure 1.11: Ethanol and Biodiesel Production 200-2008



Source: REN 21 (2009) "Renewables 2009 Global Status Report" pag 13

Top five countries in ethanol production in 2008 have been (ranking order) US, Brazil, China, France and Canada[106]. US has been the leader world producer with 34 billion liters in 2008, followed by 27 billion liters by Brazil (Figure 1.11)

Top five countries in production of biodiesel have been Germany, US, France, Argentina and Brazil. The EU overall is responsible for about two-thirds of world biodiesel production.(Figure 1.12).

[105] REN 21 (2009) "Renewables 2009 Global Status Report" http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf
[106] REN 21 (2009) "Renewables 2009 Global Status Report" http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf

Figure 1.12: Global ethanol production trends in the major producing countries IEA

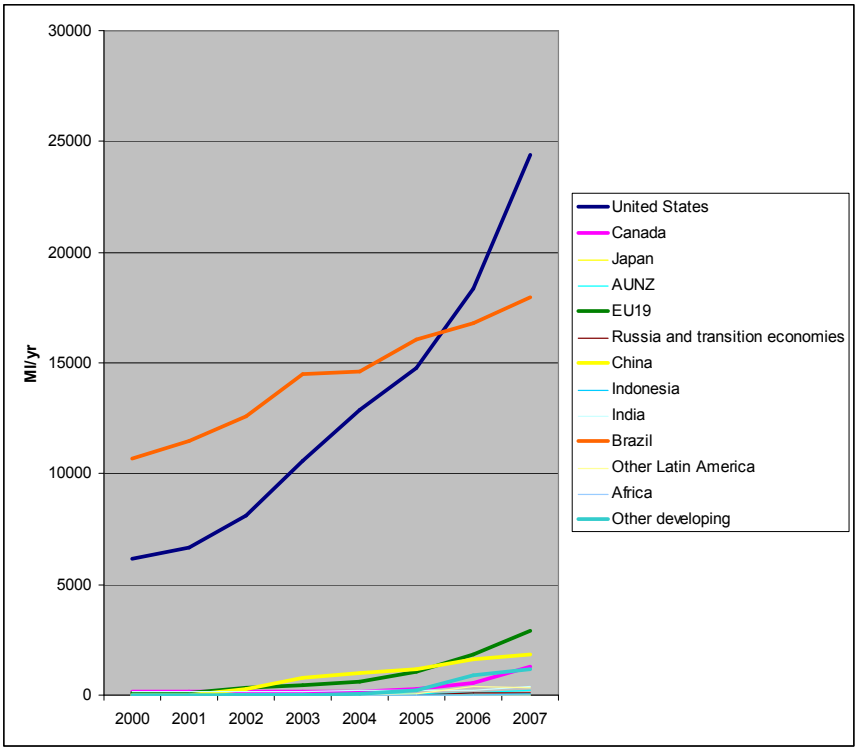
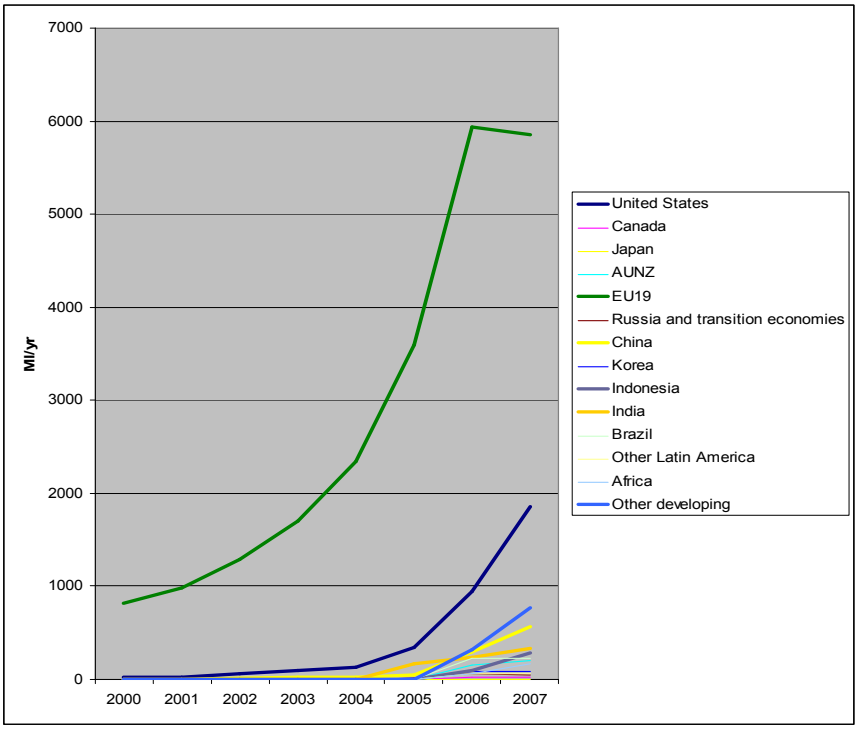


Figure 1.13: Global biodiesel production trends in the major producing countries - IEA

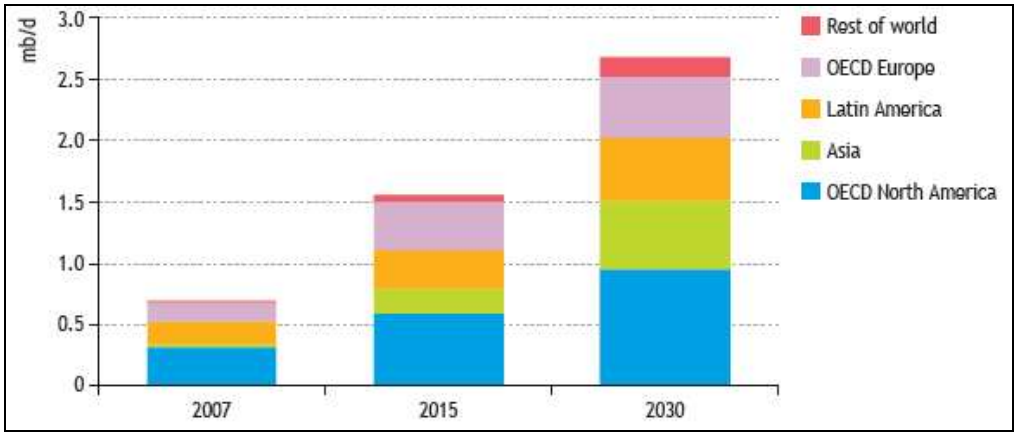


Source: IEA From 1st to 2nd Generation biofuels 2008
http://www.iea.org/textbase/papers/2008/2nd_Biofuel_Gen.pdf

If we look at the International Energy Agency projections in the World Energy Outlook 2009 reference case[107], world biofuels supply should reach, by 2030, 2.7 mb/d representing about 5% of total world road-transport fuel demand up from about 2% of today.

Most of the this increase will be determined by second-generation biofuels technologies, that it is expected to be developed especially in the United States, boosted by the EPA finalized rules for renewable fuels for transport standards.

Figure 1.14: Biofuels demand by Region IEA WEO 2009 Reference Scenario



Source: IEA WEO 2009 Reference Scenario, pag. 88

[107] International Energy Agency, World Energy Outlook 2009, available on http://www.worldenergyoutlook.org/

Chapter 2

Why do we care about the sustainability of biofuels?

2.1 The environmental impact

As described in Chapter 1, one of the main reasons for biofuels development is the reduction of Green House Gases emissions (GHG) for the protection of climate.
This end up with the research for energy solutions that are less energy intensive and biofuels, compared to fossil fuels, pretend to be.

Biofuels in fact are, in principle, "carbon neutral". The carbon they emit to the atmosphere when burned is offset by the carbon that plants absorb from the atmosphere when they grow. At the same time biofuels are renewable; they are not finished resources and can be cultivated in different parts of the worlds[108].

The issue is rather complicated and many research papers have been published on the real carbon neutrality of biofuels. One common denominator to many available studies is that a Life Cycle Assessment[109] is an useful tool to be used in order to calculate the net benefit of biofuels terms of GHG balance[110].

Moreover, other environmental impacts have to be evaluated linked to the production and use of biofuels, such as air pollution, water pollution and use, soil quality, biodiversity.
The outcomes of the various studies can differ on the basis of the different assumptions that are made, and major uncertainties still remain as regard as the direct and indirect impacts of land use change.

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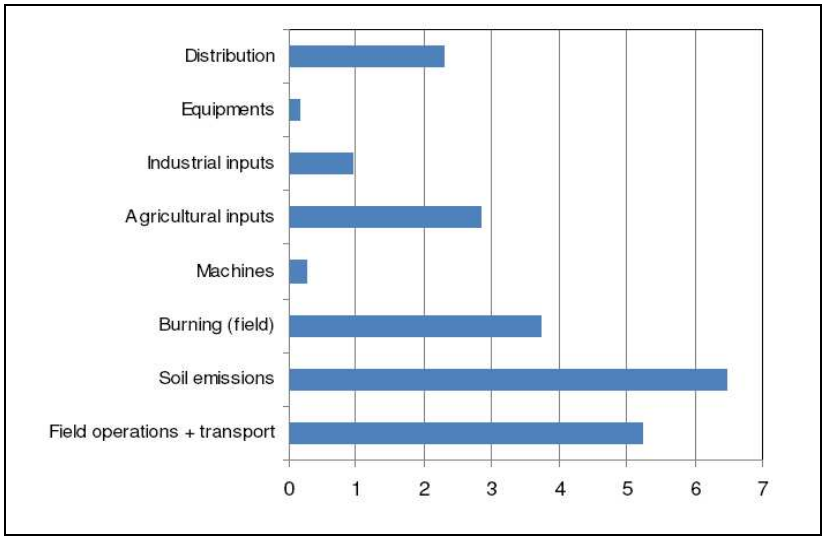
[108] The Royal Society (2008), "Sustainable Biofuels: prospects and challenges", Policy document 01/08, January 2008 available at http://royalsociety.org/displaypagedoc.asp?id=28914 July 1, 2009
[109] Lifecycle assessment of a product is the evaluation of the inputs, outputs and the potential environmental impacts of this product through its lifecycle (ISO 2006). In the case of biofuels it means an evaluation that goes from raw materials extraction and acquisition, to energy conversion, material production and manufacturing, to use, end of life treatment and fine disposal.
[110] Pin Koh L., Ghazoul J (2008)., "Biofuels, biodiversity, and people: Understanding the conflicts and finding opportunities", Biological Conservation 141 (2008) 2450-2460

2.1.1 Biofuels and Green House Gases Emissions (GHG)

Studies on the net impact of biofuels production and use on GHG emissions can differ substantially, according to the premises and the different assumptions made.

As it has been pointed out previously biofuels are in principle carbon neutral. In practise there are GHGs emissions that have to be taken into account especially in the production process, such as the ones generated from using fertilizers, producing and harvesting the feedstocks, processing and handling the biomass, transporting feedstock and biofuels. Moreover there are emissions coming from the soil, due to the harvesting of biomass and the related change in carbon stored in the field[111].

Figure 2.1: GHG emission along the lifecycle of ethanol from sugarcane (gCO2eq/MJ)



Source: Walter et Al (2008)[112]

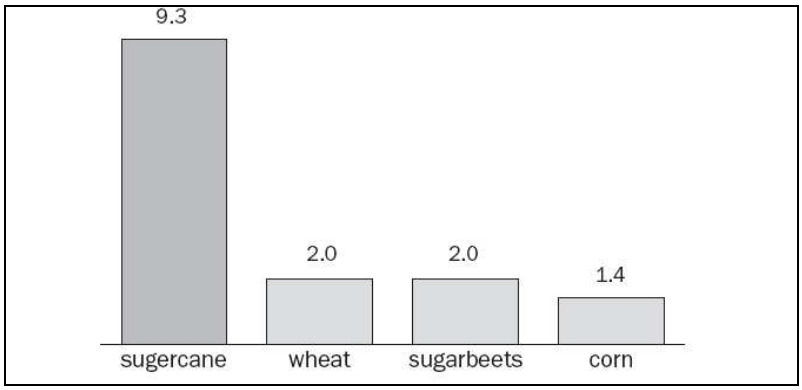
A first step to evaluate the net benefit of biofuels on GHG emissions is to calculate the ratio between the outputs of biofuels energy per unit of fossil fuel energy input. The one for sugar ethanol was 9.3 in 2006 and it is projected to reach 11.6 by 2020, while the ratio for maize ethanol in the US is 1.4, for sugar beet in Europe is 2.1, for cellulosic ethanol

[111] Cherubini F. et All (2009), "Energy and greenhouse gas-based LCA of biofuels and bioenergy systems: Key issues, ranges and recommendations", Resources, Conservation and Recycling 53 (2009) 434-447

[112] Walter et All (2008), "A Sustainability Analysis of the Brazilian Ethanol", UNICAMP November 2008, pag. 43, from Macedo et All 2008, pag.48

10.0[113], for biodiesel (rapeseed, soy, and sunflower) in the range of 2.5-3.3 and for FT-diesel from biomass in the range of 4.2-4.6[114].

Figure 2.2: Ratio between the outputs of biofuel energy per unit of fossil fuel energy input



Source: do Amoral et All "Environmental Sustainability of sugarcane ethanol in Brazil[115]

As far as concern the reduction of GHG emissions compared to the ones of gasoline, ethanol use in Brazil accounted to 79% in 2006 and is projected to increase to 86% in 2020, if only ethanol is considered, or from 86% (2006) to 95% (2020) if all co-products credits and emissions are considered from ethanol[116].

The GHG avoided in case of ethanol by maize and wheat would be around 35%[117] and from sugar beet around 50%[118].

[113] Fischer et All (2008), "Land use dynamics and sugarcane production" from Sugarcane ethanol, Contributions to climate change mitigation and the environment, edited by Peter Zuurbier and Jos van de Vooren, Chapter 2, pp. 29–62, Wageningen Academic Publishers,

[114] Cherubini F. et All (2009), "Energy and greenhouse gas-based LCA of biofuels and bioenergy systems: Key issues, ranges and recommendations", Resources, Conservation and Recycling 53 (2009) 434-447

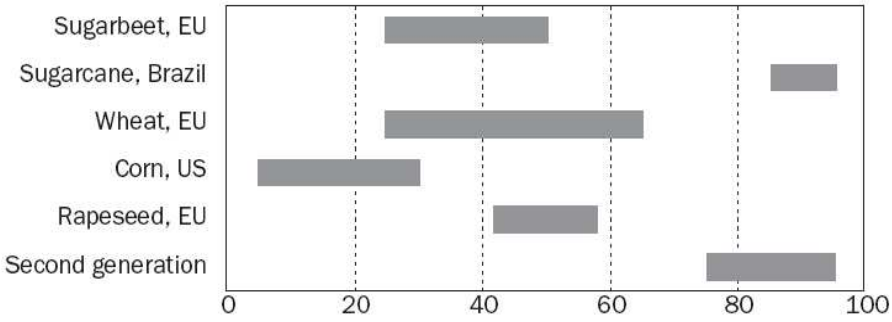
[115] do Amoral et All (2008)"Environmental Sustainability of sugarcane ethanol in Brazil" Chapter 5 in "Sugarcane Ethanol: contributions to climate change mitigation and the environment" edited by Zuurbier P. and Van de Vooren J.

[116] Macedo I.C. and Seabra J. (2008) "Mitigation of GHG emissions using sugarcane bioethanol" Chapter 4 in "Sugarcane Ethanol: contributions to climate change mitigation and the environment" edited by Zuurbier P. and Van de Vooren J.

[117] Walter et All (2008), "A Sustainability Analysis of the Brazilian Ethanol", UNICAMP November 2008, pag. 43, from Macedo et All 2008, pag.48

[118] OECD, (2008) "Biofuels: linking support to performances", February 2008, pag. 28

Figure 2.3: GHG Emissions avoided with ethanol or biodiesel replacing gasoline



Source: do Amoral et All "Environmental Sustainability of sugarcane ethanol in Brazil[119]

One of the main reasons why the ethanol from sugarcane has a more convenient net saving is because the bagasse produced during the production of ethanol is re-used in the process as a source for heat and electricity in the preparation of ethanol[120].
An issue that makes the calculation of GHG Life cycle assessment of biofuels difficult is the existence of co-products or by-products[121] and how to calculate their real impact.
We will come back to this issue in Chapter 4 when we will examine some specific aspects of sustainability certification schemes that pose implementation challenges.

A GHG pollutant to be seriously taken into consideration in the net balance of GHG emissions is N2O. According to the studies performed by Crutzen et All[122] in 2007 and 2008, the emissions of N2O during the agricultural stage could offset the benefits of fossil fuel substitution.

A controversial issue, subject to additional research, is the calculation of GHG emissions due to land use change. Land is in fact a large store of carbon and the

[119] do Amoral et All (2008)"Environmental Sustainability of sugarcane ethanol in Brazil" Chapter 5 in "Sugarcane Ethanol: contributions to climate change mitigation and the environment" edited by Zuurbier P. and Van de Vooren J.
[120] Goldemberg J. (2008) "The Challenge of Biofuels", Energy and Environment Science., 2008,1, 523 - 525
[121] Co-product is a product produced along with the main product and has similar financial revenues as the main product. A by-product is a product produced along with the main product that has smaller financial revenues that the main product (Roundtable on Sustainable Development, 2008)
[122] Crutzen et Al, (2008) "N2O release from agro-biofuel production negates global warming reduction by replacing fossil fuels"; Atmos. Chem. Phys., 8, 389–395, 2008

conversion of this land to agricultural uses result in the loss of this significant carbon sink.

There has to be made a distinction between direct land use change and indirect land use change derived from an increase in the production of biofuels feedstock.

The first one happens when non agricultural lands, or diverse agroforestry systems, are converted to grow biofuels crops[123].

The indirect land use change happens when the cultivation of biofuels feedstock cause the displacement of agricultural activities to other regions. This might be the case, for example, of the deforestation of Cerrado in Brazil due to the displacement of pasturelands from the San Paolo area where an increase in ethanol production has happened.

Indirect land use changes are very difficult to assess because they can happen well outside the geographical and temporal boundaries of the LSA.

The issue of the effects of direct and indirect land use change and their contributions to GHG emissions have been raised by two papers published in 2008, Searchinger et Al (2008)[124] and Fargione et Al (2008)[125].

Searchinger et All (2008) concluded that an increase in the production of corn based ethanol (they refer to meeting a target of 56 bbl by 2016) would divert about 12.8 mil ha of existing cropland in US. The effect would be the expansion of corn production in other countries, for example Brazil, China, India that, according to the authors, would cause the release of 3.8 billion MT of CO2, a biofuels "carbon debt" for approximately 167 years.

Fargione et All (2008) estimated carbon debts for different scenarios of directly converting native habitats to grow biofuels feedstock. It included Malaysian growth of oil palm in the tropical rainforest, Brazilian Cerrado for sugarcane and soybean. They calculated the carbon debts for all this land diversions, and the impact on GHG releases, and the years to pay back these debts.

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[123] Pin Koh L., Ghazoul J (2008)., "Biofuels, biodiversity, and people: Understanding the conflicts and finding opportunities", Biological Conservation 141 (2008) 2450-2460

[124] Searchinger, et Al (2008) "Use of US croplands for biofuels increases greenhouse gases through emissions from land-use change". Science 319, 2008, 1238–1240.

[125] Fargione J et Al. (2008) "Land clearing and the biofuel carbon debt". Science 2008; 319:1235–8.

Both studies have been highly controversial, and have been criticized for presenting extreme scenarios that difficultly could happen in practice, for example in Brazil[126].

2.1.2 Air Quality

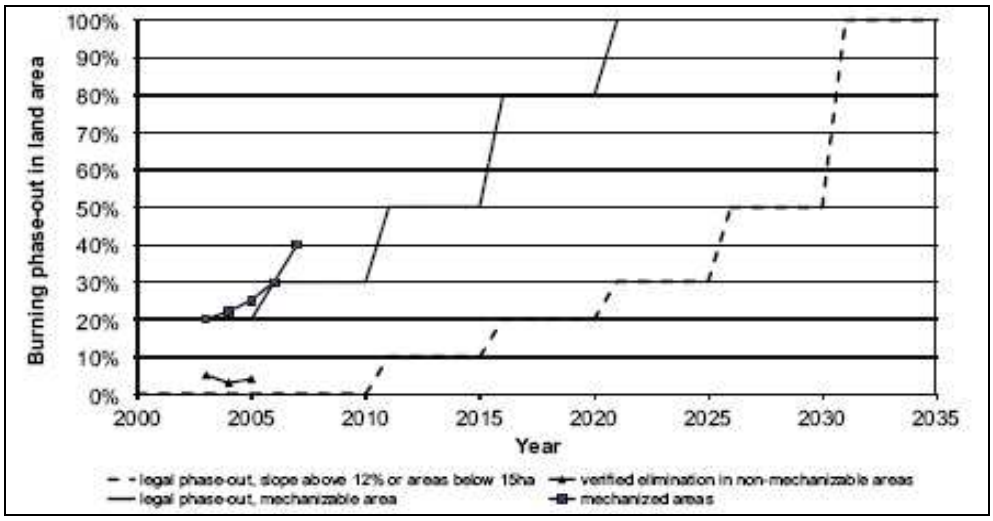
The literature related to the impact of biofuels production on air quality and consequently on health is limited and further research is needed.

From a general point of view, the impact of biofuels on air quality is limited at regional level and, contrary to GHG emissions, biofuels do not credit for the carbon that is initially absorbed from the atmosphere during the feedstock growth.

The highest impact on air quality is given by sugarcane burning in the case of ethanol production. It is in fact common practice to burn sugarcane before harvesting to make it easier the manual harvest of the stalks and also to eliminate dangerous animals such as spiders and snakes.
The dimension of sugar burning is quite huge as sugarcane harvesting in Brazil is mechanized only for 25%, and in the San Paolo area for 40%[127].
However, the State of São Paulo has implemented in 2002 a State law that mandates the gradual elimination of sugar burning. The practice will be allowed until 2021 for mechanized areas, and until 2031 for non-mechanized ones.
In June 2007, UNICA signed a voluntary agreement with the State of São Paulo anticipating the ban sugar cane burning in the state by 2017, well before 2031 target mandated by a state law.

[126] Searchinger, et Al, 2008. "Use of US croplands for biofuels increases greenhouse gases through emissions from land-use change". Science 319, 2008, 1238–1240. Fargione J et All, "Land clearing and the biofuel carbon debt". Science 2008; 319:1235–8.
[127] Ribeiro H (2008)., "Sugar cane burning in Brazil: respiratory health effects", in Rev Saude Publica 2008; 42 (2)

Figure 2.4: Sugar cane harvest burning phase out in Sao Paulo State



Source: Goldemberg J. et Al (2008), "The sustainability of ethanol production from sugarcane", in Energy Policy 36 (2008) 2086-2097, pag 2089

The State Law, as well as UNICA voluntary agreement, are very important because the burning of sugarcane is associated to the increase of CO, CH4, non methane organic compound, PM and it is also responsible for the increase of troposphere ozone concentration[128].

The studies available, even if with some uncertainties, point out to the increase of asthma phenomena, tumours, cardiovascular diseases especially on children and aged population associated with the sugar burning.

The problem of sugar cane burning is of course not limited to Brazil, and studies have been conducted also in the US, India and Malaysia.

In the State of Louisiana for example the practice is allowed by the law, as it has not been demonstrated, with scientific evidence, a direct link between burning sugar cane and negative health impact. Although a study conducted during 1998-1999 on hospital visits of 6498 patients diagnosed with asthma indicated that that was in increase of asthma related hospitalization during the months of sugar cane burning[129].

[128] Goldemberg J. et Al (2008), "The sustainability of ethanol production from sugarcane", in Energy Policy 36 (2008) 2086-2097

[129] Boopathy R et Al (2002), "Sugar cane (Saccharum officinarum L) burning and asthma in Southeast Louisiana, USA", Bull Environ Contam Toxicol. 2002;68(2):173-9

On the positive side, In Brazil the introduction of ethanol had the effect of eliminating the use of lead in gasoline by 1991, well ahead of many developed countries including Europe where it became mandatory by law in 2000. It had also positive effects in eliminating benzene and reducing the content of sulphur in fuels[130].

Referring to research findings presented by Hess et All (2009) [131], the use of both E10 and E85 decreases the emissions of SOX (-10% and -85% respectively) and CO (both -10%), while NOX (+7% and +5%) and VOC (+20% and +2%) can increase.
As far as concern the impact of biodiesel on air quality, once again there is considerable uncertainty among the different studies and additional research is needed.

According to Lane B. (2006) [132] the use of biodiesel can lower particulate emissions in the range of 4%-55% compared to those of mineral diesel (the reduction depending on the blend used). Carbon monoxide is also reduced by up to 40%. On the contrary, NOx emissions can increase compared to mineral diesel fuel by as much as 13%.
On the basis of the studies of Hess et All (2009)[133], biodiesel from soy (B20) can reduce all the pollutant emissions except for VOC (co-products credits are included).

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[130] Goldemberg J. et Al (2008), "The sustainability of ethanol production from sugarcane", in Energy Policy 36 (2008) 2086-2097
[131] Hess et Al, (2009) "Air Quality Issues Associated with Biofuel Production and Use", pages 169-194, in R.W. Howarth and S. Bringezu (eds) Biofuels: Environmental Consequences and Interactions with Changing Land Use. Proceedings of the Scientific Committee on Problems of the Environment (SCOPE) International Biofuels Project Rapid Assessment, 22-25 September 2008, Gummersbach Germany. Cornell University, Ithaca NY, USA. (http://cip.cornell.edu/biofuels/)
[132] Lane, B. (2006) "Life cycle assessment of vehicle fuels and technologies". Final Report. Ecolane Transport Consultancy on behalf of the London Borough of Camden, Bristol UK.
[133] Hess et All, (2009) "Air Quality Issues Associated with Biofuel Production and Use", pages 169-194, in R.W. Howarth and S. Bringezu (eds) Biofuels: Environmental Consequences and Interactions with Changing Land Use. Proceedings of the Scientific Committee on Problems of the Environment (SCOPE) International Biofuels Project Rapid Assessment, 22-25 September 2008, Gummersbach Germany. Cornell University, Ithaca NY, USA. (http://cip.cornell.edu/biofuels/

2.1.3 Water Use and Quality

The increases in the population growth, climate change externalities, and change in dietary habits have all had effects on the availability and quality of water.
While there are few studies that have evaluated the impact of biofuels production and use on water, some preliminary considerations can be made.
All the studies declare that more data are needed and that the results gained so far can differ considerably depending on the geographical area taken into account, as well as on the feedstock used and the processing methods used for the production of biofuels[134].

As a first point, irrigation of feedstocks can have a potential significant incidence in the quantity of water used. In a country as US where irrigation is already the first voice of "consumptive use of water"[135], accounting for 80% of the fresh water that is pumped[136], an increased consumption in energy crop can overstress the situation especially at regional and local level where a shortage of water does already exist.
At global level agriculture uses about 70% of the fresh water pumped.

As far as concern Brazil, the use of crop irrigation is minor, as most of the sugarcane production is rain-fed. Irrigation is used in dry season, or for combating small droughts[137].
On the contrary, use of water for the conversion of cane into ethanol could have more incidence. However, according to Goldemberg J (2008)[138] significant improvements have been made in water reuse/recycling so far.

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[134] The Royal Society (2008), "Sustainable Biofuels: Prospects and Challenges", Policy Document 01/08
[135] National Academy of Sciences (2008) "Water Implications of Biofuels Production in the United States", Free executive summary pag 3
[136] Pimentel D., Pimentel M.H. (2008), "Food, Energy and Society" Third Edition, CRC Press Taylor and Francis Group
[137] Goldemberg J. et Al (2008), "The sustainability of ethanol production from sugarcane", in Energy Policy 36 (2008) 2086-2097
[138] Goldemberg J. et Al (2008), "The sustainability of ethanol production from sugarcane", in Energy Policy 36 (2008) 2086-2097

As far as related to other emerging economies, like for example China and India, the problem can become more acute as these countries have already exploited most of their available natural water resources for agriculture[139].

Also related to the use of water, particular attention has to be paid to biorafineries. It has been estimated that biorafineries consume 4 gallons of process water per gallon of bioethanol produced, for petroleum refining the quantity is 1.5 gal/gal[140].

In addition to the "quantitative" aspects, the quality of water can be affected by biofuels production and use in many ways.

As far as concern the production of sugar based ethanol, vinasse that is produced in consistent volume and contains high organic load and has a Ph of 4-5[141].

It is estimated that for each liter of ethanol produced in Brazil, about 10-13 liters of a vinasse, are also produced.

The Government of Brazil has stated illegal to discharge vinasse directly into surface waters, but implementation is lacking especially for small mills.

On the other hand vinasse, if mixed with wastewater, can have a positive effect being recycled and substituting commercial fertilizers.[142]

In addition to vinasse, fertilizers containing Nitrogen and Phosphorous can have very negative effect as they infiltrate in the groundwater and create "die zone" where hypoxia takes place as for example happened in some areas of the Gulf of Mexico.

The choice of the biofuels feedstock can make a difference in the use of fertilizer and therefore in the impact on water quality.

Biodiesel requires just 2% and 8% of the N and P needed for corn ethanol.

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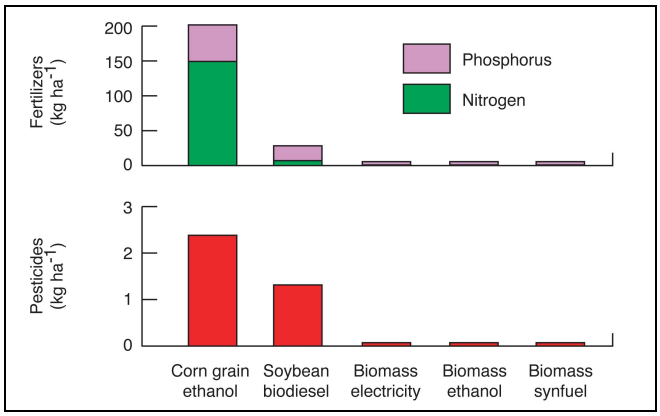
[139] Muller et Al (2008) "Some insights in the effect of growing bioenergy demand on global food security and natural resources". Water Policy 10 (S1): 83–94.

[140] National Academy of Sciences (2008) "Water Implications of Biofuels Production in the United States", Free executive summary pag 3

[141] Walter et Al (2008), "A Sustainability Analysis of the Brazilian Ethanol", UNICAMP November 2008, pag. 43, from Macedo et All 2008, pag.48

[142] Martinelli L.A., Filoso S. (2008), "Expansion of Sugar Cane Production in Brazil: Environmental and Social Challenger", Ecological Applications, 18(4), 2008, pp. 885–898

Figure 2.5: Comparison of fertilizer (top) and pesticide (bottom) application rates



Source: Tilman et Al 2006[143]

Advanced biotechnology as well as the implementation of Best Management Practices (BMPs) can lower the impact of biofuels production and use on water.

2.1.4 Deforestation and Biodiversity

Few quantitative studies exist on the impact of biofuels production on biodiversity and deforestation. There is a lack of data available in terms of species and habitat loss[144]. And the data that do exist might be not completely reliable as they are often provided directly by the Government of the countries involved in the development of biofuels policies.

As far as concern deforestation, there might be both direct and indirect effects driven by biofuels expansion. As far as regard Brazil, it could predominantly be an indirect effect. The increase in the sugarcane production has take place also in fields previously used for pasturelands that have ended up to move in forested areas.

Concerns have been raised for the expansion of sugarcane ethanol in the Brazilian Cerrado (Savannah Region) considered a world biodiversity site. In 2002 about 40% of a total 205 million ha have been converted in both pasturelands and soybeans.[145]

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[143] Tilman, D., J. Hill, and C. Lehman. (2006) "Carbon-negative biofuels from low-input high-diversity grassland biomass". Science 314:1598-1600.

[144] Sala, O.E., D. Sax, H. Leslie. (2009). "Biodiversity consequences of biofuel production". Pages 127-137 in R.W. Howarth and S. Bringezu (eds) Biofuels: Environmental Consequences and Interactions with Changing Land Use. Proceedings of the Scientific Committee on Problems of the Environment (SCOPE) International Biofuels Project Rapid Assessment, 22-25 September 2008, Gummersbach Germany. Cornell University, Ithaca NY, USA. (http://cip.cornell.edu/biofuels/)

[145] Sano, E.E.; et All (2008) "Mapeamento semidetalhado do uso da terra do Bioma Cerrado". Pesq. agropec. Bras 2008, vol.43, n.1, pp. 153-156.

Other examples of deforestation and loss of biodiversity have been experienced in Malaysia and Indonesia where the expansion of palm oil has been huge. It has been calculated by Koh L.P. and Wilcove D.S. (2008)[146] that "*during the period 1990-2005, 55%-59% of oil palm expansion in Malaysia and at least 56% of that in Indonesia occurred at the expenses of forests*". According to the authors of the same studies the conversion of primary forest and logged forests to palm oil caused a decrease in richness of forest butterflies by 83% and 79 respectively.

The areas where the feedstocks are introduced do cause quite diverse impacts in terms of loss of biodiversity. According to a study of Peh et All (2006)[147] on forest birds in degraded areas of Malaysia, while the conversion of primary and logged forests to oil palm decreases the species variety of forest birds by 77% and 73% respectively, the conversion of rubber plantation to palm oil affect 14% of the forest birds.

2.2 The Social Impact

The impact of biofuels on the social component of sustainable development, as well as on rural development is subject to different views.

One of the main impacts on population, especially in developing countries, is food affordability in terms of price.

The skyrocket increase in food commodities accounting for about 83%[148] in years 2006-2008 has animated a lively debate about the contribution of biofuels to this phenomenon.

The studies that have been conducted have provided different estimations. The International Monetary Fund (IMF) [149] estimated in 2006-2007 a 50% increase in the

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[146] Koh L.P, Wilcove D.S. (2008) "Is oil palm agriculture really destroying tropical biodiversity?", Conservation letters (2008), 2008 Blackwell Publishing

[147] Peh K.S. et All (2006) "Conservation value of degraded habitats for forest birds in Southern Peninsular Malaysia", in Diversity and Distribution, Volume 12 Issue 5,Pages572-581

[148] World Bank (2008) "Rising Food Prices: Policy Options and World Bank Responses", pag. 1, available at http://siteresources.worldbank.org/NEWS/Resources/risingfoodprices_backgroundnote_apr08.pdf on July 10, 2009

demand of food crop due to corn based biofuels, the OECD[150] accounted for a similar percentage for cereals and vegetable oils while US Council of Economic Advisors estimated a percentage of 3%[151].
Although, as different sources underlined, different factors have contributed to the increase in food commodities, as for example the price of oil based products, such as fertilizers, the weather conditions, speculation practices.

While the increase in food prices has affected especially the poorest rural households, who do spend most of their income of food, there could be also some positive externalities due to the rise of food prices. These beneficial effects could range from increase in the level workforce (sugarcane production is labour intensive), to the creation of transport facilities necessary for biofuels operations in rural areas.

Here are some examples related to the effects of biofuels production on employment on the basis of the available data.

According to the US Renewable Fuels Associations, the ethanol industry in US would create around 1 million new jobs by 2022 and in 2008 the ethanol industry helped to support more than 494,000 jobs[152].

The social impact of biofuels production in Brazil is reported quite differently from different sources.
Goldemberg et All (2008)[153] report that while in Brazil the mean rate of formal job is 40%, the one in the domestic sugarcane industry has reached 72.9% from 53.6%

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[149] IMF (2008) "World Economic Outlook 2008", pag. 60, available at http://www.imf.org/external/pubs/ft/weo/2008/01/pdf/c1.pdf on July 10 2009
[150] OECD (2008) "Rising Food Prices: causes and consequences", OECD 2008 available at http://www.oecd.org/dataoecd/54/42/40847088.pdf on July 10, 2009
[151] Lazear, Edward, (2008) "White House Disputes Role of Biofuels in Food Prices," Associated Press, May 15, 2008.
[152] LEGC, LLC (2009) "Contribution of the Ethanol Industry to the Economy of the United States" February 2009 http://www.ethanolrfa.org/objects/documents/2187/2008_ethanol_economic_contribution.pdf pag 10
[153] Goldemberg et All (2008) "The Sustainability of ethanol production from sugarcane" in Energy Policy 36 (2008) 2086-2097

in 1992. If we look only at San Paulo State this percentage is 93.8%, and in North-North East region 60.8%.
Regarding the contribution of the ethanol industry to the job creation, Goldemberg (2005) reports that for every 300 million tons produced, almost 700,000 jobs are created.
Wages are estimated to be on average 50% higher than in the service sector and 40% compared to the industry one[154].

The quality of work in the sugar cane sector raises concerns. The precarious conditions of cane harvesters have been highlighted, in terms of exposure to chemical substances (fertilizers), exhaustion that have caused even death or injuries, bad housing and transporting conditions[155].
Although Brazil has signed ILO's recommendations on children labour, there are still reported cases and the incidence should be about 3% in 2006[156]. Lack of enforcement and of reliable data makes this number quite uncertain.

2.3 The Economical Impact

Biofuels production can have different levels of economical impacts. The one related to the potential link with the increase in food prices has been already covered in the social impact section.

Another impact is related to the possibility of replacing oil import with domestic produced biofuels. It will have an impact on the trade balance of the country as ell as on energy security through the diversification of energy sources.

As it has been pointed out already in the first Chapter, according to the US Renewable Fuel Association, the production of 9 billion gallons of ethanol in

[154] Macedo, Isaías de Carvalho, (2005), "Sugar Cane's Energy: Twelve Studies on Brazilian Sugar Cane Agribusiness and Its Sustainability". São Paulo: UNICA. São Paulo: Sugarcane Agroindustry Union.
[155] Sawyer D. (2008) "Climate Change, biofuels and eco-social impacts in the Brazilian Amazon and Cerrado" in Philosophical Transactions of the Royal Society, 363, 1747-1752
[156] Smeets et All (2006) "Sustainability of Brazilian bio-ethanol". Report NWS-E-2006-110. Universiteit Utrecht Copernicus Institute, Department of Science, Technology and Society and University of Campinas Brazil

2008[157] has avoided 5% of the total US crude oil import. Furthermore, according to the same source, it has added to US GDP in 2008 more than 65$ billion in combination of spending per annual operations, ethanol transportation and capital spending for new plants under construction.[158]

As far as Brazil, the ethanol program has contributed to the self sufficiency of the country from foreign oil. Today, Brazil uses 85%[159] of its ethanol production at domestic level and the remaining part, which in 2008/2009 is forecasted to account to 4.8 billion liters, is exported to US (either directly or through the Caribbean Basin Initiative).[160]
According to Goldemberg (2007)[161] the overall subsidies to ethanol have been accounted to US$30Billion over 20 years and they were more than offset by a US$ 50 billion reduction in oil imports as far as 2006.

Also in a phase of economic recession, as the one of the first half of 2009, while the overall exports of Brazil have accounted to -0.8, both raw sugar and soybeans have experienced an increase in export[162].

Another field that might be taken into account in the economical dimension of the sustainability is the possibility for biofuels projects that have a net gain in terms of GHG to account as Clean Development Mechanism of the Kyoto Protocol. This will not only enhance technology transfer from developed countries to developing one, but will also give an economical value (through the Certified Emissions Reductions – CERs market).
Due to the difficulty in defining a liquid biofuels baseline and methodology from the Executive Board of the Convention on Climate Change, and also due to the complexity of developing and managing CDM projects, only in December 2009 the Executive Board of the United Nations Framework Convention on Climate Change

[157] LEGC, LLC (2009) "Contribution of the Ethanol Industry to the Economy of the United States"
[158] LEGC, LLC (2009) "Contribution of the Ethanol Industry to the Economy of the United States
[159] Goldemberg J (2007) "Ethanol for a Sustainable Energy Future", Science vol 315, February 9, 2007
[160] USDA (2009) Gain Report Brazil Biofuels Annual Ethanol 2008
[161] Goldemberg J (2007) "Ethanol for a Sustainable Energy Future", Science vol 315, February 9, 2007
[162] Economist Intelligence Unit (2009), Country Report Brazil, March 2009

has approved one consolidated baseline and monitoring methodology for the Production of biodiesel for use as fuel.

The methodology is applicable to project activities that "reduce emissions through the production, sale and consumption of blended biodiesel that is used as fuel, where the biodiesel is produced from: (a) Waste oil/fat; and/or (b) Vegetable oil that is produced with oil seeds from plants that are cultivated on dedicated plantations established on lands that are degraded or degrading at the start of the project activity" (ACM0017, pag 3)[163].

[163] UNFCCC CDM Executive Board Approved consolidated baseline and monitoring methodology ACM0017
Production of biodiesel for use as fuel, ACM0017 / Version 01 Sectoral Scope: 01 and 05 EB 50 available at
http://cdm.unfccc.int/UserManagement/FileStorage/CDM_ACMXXRJY0KM1HPYFDRDZF2R2BMQZ3TPJD downloaded on March 5th 2010

Chapter 3

Certification as an emerging tool to measure sustainability. Theory and Examples

3.1 Why an interest in Certification

In the last years a new model of governance has arisen, represented by the definition and implementation of standards, regulations and codes by the private sector, with in same cases the collaboration of Non Governmental Organization and, with different degrees of opened or shady participation, of Governments.

This new model of governance has been generically defined as "civil regulation"[164] and is characterized by "*a shift in global business regulation from state-centric forms toward new multilateral, non territorial modes of regulation*"[165], therefore based on soft law rather than on binding standards.
The phenomenon has also defined as "*transnational private regulation"*[166] in which alliance of non government actors "*codify, monitor and same cases certify firms' compliance with labor, environmental, human rights or other standards of accountability*"[167]

The new governance model, apart from the different definitions, is linked in its rationale and principles to the Corporate Social Responsibility (CSR) concept whose

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[164] Vogel D. (2009) "The Private Regulation of Global Corporate Conduct Achievements and Limitations" in Mattli W. and Woods N. "The Politics of Global Regulation", Princeton University Press, 2009.
[165] Scherer A, Palazzo G. and Baumann D. (2006) "Global rules and Private Actors: toward a new role for transnational corporations". Business Ethics Quarterly 16.4: 505-532, pag 506
[166] Bartley, Tim (2007), "Institutional Emergence in an Era of Globalization: The Rise of Transnational Private Regulation of Labor and Environmental Conditions". American Journal of Sociology 2007 113:2, 297-351.
[167] Bartley, Tim (2007), "Institutional Emergence in an Era of Globalization: The Rise of Transnational Private Regulation of Labor and Environmental Conditions". American Journal of Sociology 2007 113:2, 297-351

focus, according to Auld et All (2008)[168], is on internalizing the externalities produced by a firm's core business activities in contrast to hiding or diverting attention to environmental or social externalities derived from the firm's activity.

In this new model, the business sector becomes an "active" subject in auto-creating rules that drive, and in a way constraint, its business as usual practices.

Private actors decide in this way to put themselves at the forefront, auto-raising the bar of compliance with social and environmental standards, in some cases being an absence of governmental regulation, or in other just being more ambitious of what the law requires.

There are different reasons behind the business decision to adhere to self-private regulation.

Globalization is, most probably, one of the central one. Global companies operate in different (and distant) parts of the world and the transparency and predictability of the supply chain becomes a complex system to deal with. Companies want to be sure that all the parts of the supply chain comply with same (or comparable) levels of quality, from the point of view of the characteristics of products, but also from an environmental and social standpoint.
The implementation of a pre-defined set of standards, to be controlled and signaled through certification schemes and labels respectively, can help in reducing the complexity of the "globalized" production and lower the risk of potential asymmetries.
On top of that, the specification of a set of standards and procedures to be applied globally in the supply chain can lead to a reduction of performance and monitoring costs[169].

[168] Auld G., Bernstein S. and Cashore B. (2008), "The New Corporate Social Responsibility", Annual Review of Environment and Resources 33:413-435
[169] Dowell G., Hart S. and Yeung B. (2000), "Do Corporate Global Environmental Standards Create or Destroy Market Value?" Management Science 46, no. 8 (2000): 1059-1074.

Another element of influence for the complying with self-regulation is the reputation effect. Global brands are the most targeted from Non Governmental Organizations (NGOs) for their environmental and social practices, especially in developing countries. The accusation to Nike of abusive labour practices at some Indonesian suppliers in the 90s is an example in this regard.

NGOs monitoring systems and media influence sophistication has enhanced considerably in the last decade, thanks also to the improvements in communication speed and techniques. Furthermore, NGOs due also to the failure of institutional negotiation processes, have started to partner with the private sector for the negotiation and implementation of voluntary environmental and social standards. This NGO's "*shift from boycotts to global partnership*"[170] has both enhanced the effectiveness of NGOs to influence business sector's practices and helped corporate to build good reputation image.

Many large firms, generally risk adverse, have started to signal clearly their commitment in the environment agenda and in social rights, and certification and labeling can represent good tools to this end. Furthermore, the firm's joining of specific certification or assessment tools give the company access to "Good Clubs" and be identified under the same good reputation umbrella[171], making in this way a clear distinction between the good apples from the bad one[172]. An example in this regard can be the adherence to Forest Stewardship Council or ISO 14001.

From a strategic and economical point of view, according to Porter and Kramer (2006), complying with CSR strategically can generate "*opportunity, innovation and competitive advantage for corporations - while solving pressing social problems*"[173].

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[170] Domask, J. (2003) "From Boycotts to Global Partnership: NGOs, the Private Sector, and the Fight to Save the World's Forests" in Doh J.P. and Teegen H. (eds.) "Globalization and NGOs: Transforming Business, Governments and Society", Praeger Books: Westport, CT, pp: 157-186.

[171] Potoski M. and Prakash A. (2005) "Green Clubs and Voluntary Governance : ISO 14001 and Firms regulatory Compliance", American Journal of Political Science, Vol 49, N.2 April 2005, pp 235-248

[172] Bartley, Tim (2007), "Institutional Emergence in an Era of Globalization: The Rise of Transnational Private Regulation of Labor and Environmental Conditions". American Journal of Sociology 2007 113:2, 297-351.

[173] Porter M., Kramer M. (2006) "Strategy and Society – the Link between Competitive Advantage and Corporate Social Responsibility" in Harvard Business Review, December 2006

Being at the forefront of innovation, give companies the gains of the first mover[174] in a particular business area. Adhering to the same certification scheme, give a group of firms the setting of a "quasi-cartel" to secure competitive advantage and manage competition[175].

This is not only important because it can influence the design of a possible future binding regulation on the same issues or it can lobby in order to deflect it, but also for capturing a niche market for premium products.

On this last point there is a classical market dynamic where the companies go through the certification process and get the label because there is a percentage of consumers (usually high end consumers) that are willing to pay a higher price for "extra" quality (being environmental, organic, etc) products (Reinhardt 1999)[176]. In this way, companies will get a price premium that pays back for expenses related to the certification process and assure a profit or as Reinhardt e Al (2008) call it, "pays for itself", in case companies invest in product differentiation until the marginal returns decline to the overall market rate of return[177].

Finally, another element that have probably shaped the increase of civil regulation is the need of the private sector to have a framework of standards (environmental, social) in

which to operate. This is extremely important in order to plan investments in the medium-long term, and act strategically.

On the opposite side, the uncertainty in the outcome of institutional negotiations on climate for example, have a double effect: to procrastinate a serious commitment by the private sector in meeting strict GHG reduction standard, and at the same time to leave the market in a limbo where it is not clear the entity of future regulation and timetable.

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[174] Vogel D. (2008) "Private Global Business Regulation", The Annual Review of Political Science, 2008, 11:261-282.

[175] Vogel D. (2008) "Private Global Business Regulation", The Annual Review of Political Science, 2008, 11:261-282.

[176] Reinhardt F. L. (1999) Down to Earth: Applying Business Principles to Environmental Management. Cambridge MA: Harvard Business School Press

[177] Reinhardt F.L. et Al (2008) "Corporate Social Responsibility through an Economic Lens", Regulatory

Policy Program Working Paper RPP-2008-04. Cambridge, MA: Mossavar-Rahmani Center for Business and Government, John F. Kennedy School of Government, Harvard University.

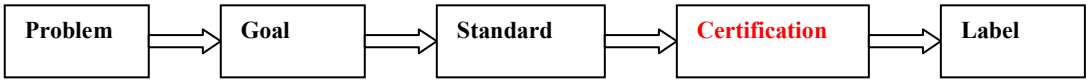
This drives us to another important point which is the certification as a second best policy outcome. An example in this regard is the failure of signing at the Rio Summit in 1992 a global forest convention[178], and the subsequent creation of the Forest Stewardship Council[179], a certification system that provides internationally recognized standard-setting, trademark assurance and accreditation services to companies, organizations, and communities interested in responsible forestry.

3.1.1 Characteristics of a certification scheme

First of all it is important to define terms, that in common language, are sometimes mixed up. Certification means "*the process of verifying that a product, process or service adheres to a given set of standards and/or criteria*"[180]. But in order to understand the purpose of certification it would be helpful to look at the process of which certification is a particular step.

Following a step to step approach, we start with the realization that a Problem exist, and in order to address the problem (and hopefully solve it), a goal is set up. To this end, standards are developed as tools that will be used to reach the goal. Certification is the verification action that measures that a product, process or service complies to the standards or criteria previously defined. The last step in the process is the labelling in order to provide visible information about a particular product or process in the supply chain has been proved to comply with the set of standard.

Figure 3.1: Simplified Process Diagram from Goal to Label[181]



Source: Matus K. JM. 2009, "*Standardization ,Certification and Labelling: Lessons from Theory and Practice*."

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[178] Cashore B. Auld G., Newsom D. 2004 "Governing Through Markets: Forest Certification and the Emergence of Non-State Authority". New Haven, CT: Yale University Press

[179] Forest Stewardship Council website: http://www.fsc.org/ visited on November 1st 2009

[180] Matus, Kira JM. 2009, "Standardization ,Certification and Labeling: Lessons from Theory and Practice." CID Graduate Student and Research Fellow Working Paper No. 37. Center for International Development at Harvard University, May 2009.

[181] Matus, Kira JM. 2009, "Standardization ,Certification and Labeling: Lessons from Theory and Practice." CID Graduate Student and Research Fellow Working Paper No. 37. Center for International Development at Harvard University, May 2009, pag. 2, Fig. 1.

If we apply the above scheme to the certification of biofuels only referring to GHG, as requested by the EU Directive 2009/28/EC, we could summarize as following:

- Problem: Global warming
- Goal: reduce GHG emissions by 2020 for a percentage of 20%, as well as increase energy security in the EU. At least a 20 % share of energy from renewable sources in the Community's gross final consumption of energy in 2020 has to be met.
- Standard: Each Member State shall ensure that the final consumption of energy in the transport sector will be met by "sustainable" biofuels for at least 10%, by the year 2020. The "sustainability" means that in order to account for the 10% target, biofuels have to be sustainable, meaning that they have to account for a net decrease of GHG of at least 35%[182] compared to fossil fuels (LCA assessment).
- Certification: in order to verify the sustainability of biofuels, it has to be certified (measured) by producers or third party that the biofuels used in EU are sustainable (net decrease of GHG emissions equal to 35% compared to fossil fuels).
- Label: information will be posted on the "tanks" or at the pump in order to signal the sustainability of biofuels both to consumers and producers in the supply chain.

In the last decade, due do different reasons highlighted in the previous paragraph, certification schemes have been used in different sectors, from energy , to chemicals, to organic food.

This phenomenon has overwhelmed consumers because the link between the standard and the certification is not always clear, and the information provided in the

[182] According to the EU Directive, with effect from 1 January 2017, the greenhouse gas emission saving from the use of biofuels and bioliquids taken shall be at least 50 %. From 1 January 2018 that greenhouse gas emission saving shall be at least 60 % for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017.

label is sometime misleading. An example in this regard is the wide range of vegetable quality that goes from "organic" to "natural" to "chemical free", etc.
This confusion in the final step of a standard and certification process, runs the risk of creating uncertainties and scepticism in consumers.

That means that the standard and certification process should generally comply with some basic characteristics in order to work.
The first one is credibility. The process of setting standards to meet a determined goal and of defining a certification procedure have to be seriously defined and managed. Standards have to be determined keeping science information at the front, and "*political un-rationality*" or opportunism have not to drive decisions. In setting a specific target for standards, we have to be sure that the it has been based on the best and robust available scientific knowledge and we have to be able to explain how, and on the basis of which scientific criteria, that number has been calculated. The way standards are defined in the real world can be very different from what we claim here. As we know, especially when the standard and certification process is Government driven, standards can be the results of complex negotiations at political level that can sometimes lose sight of objectivity.

Let's go back to our example related to the EU Directive, and in particular to the way biofuels target of 10% and the certification process and methodologies have been decided. According to interviews[183] made with Governments' experts participating in the EU negotiation process for the definition of the Directive's text, we can see the tension felt by the experts in being scrupulous and use the scientifically-sound criteria for defining a credible text (target, methodologies, etc) and the pressure of having an "agreed" text to be passed, sometime with a sense of political urgency, at the European Council. Compromising, especially in the negotiation of technical documents such as Directives not always goes hand in hand with scientific meticulousness.

[183] Interviews made on December 21, 2009 with experts negotiating at the Environment Expert Group the European Council on the text of EU Directive 2009/28/EC

The scientific based priority was therefore highlighted in the following mandate G8 Hokkaido Toyako Summit gave in 2008 to the Global Bioenergy Partnership (GBEP)[184]: "*to work with other relevant stakeholders to develop science-based benchmarks and indicators for biofuel production and use*". (G8 Summit Declaration - Hokkaido Toyako, 8 July 2008).

The new discipline of Sustainability Science, as we have already described in the Introduction of this paper, is trying to close the gaps between scientific research and policy makers decisions, and is make a concrete effort (Biofuels and Globalization program at Harvard is an example) in providing usable scientific evidence to be used in a pragmatic and quick way by policy makers.

Setting standards that are recognized as scientifically credible is not sufficient for determining the credibility of a process. Another step to build this credibility relies on the certification process. A credible certification system gives minimum room to cheat. One way to avoid cheating is to distinguish between those that get certification, from those that certify. Third party certification is perceived more objective than an internal one, both firm based or association based.

In order for the certification to be "serious", standards need to be verifiable and able to measure compliance with a determined set of standards. Especially in the case for example of social standards, it can be very difficult (and expensive) particularly for the multinationals to verify the compliance with labor rights when the market is globalized and highly fragmented and outsourced. The third party verifiers or the firm itself, should constantly inspect firm's suppliers and detect cheating and use of subterfuges. As Matus K. highlights, "*since constant monitoring is expensive, the challenge it to find the optimum level of monitoring to disincentive bad actors*"[185].

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[184] GBEP is a public-private partnership launched in 2005 by the Gleneagles Summit. In the G8 Plan of Action, the G8 +5 (Brazil, China, India, Mexico and South Africa) agreed to "... *promote the continued development and commercialisation of renewable energy by: [...] d) launching a Global Bioenergy Partnership to support wider, cost effective, biomass and biofuels deployment, particularly in developing countries where biomass use is prevalent*".

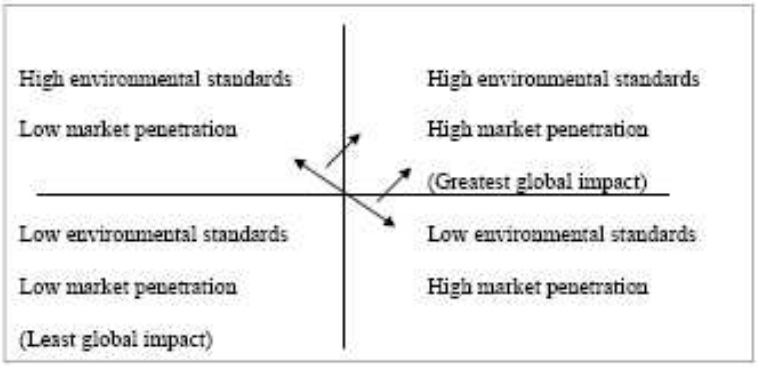
[185] Matus, Kira JM. 2009, "Standardization ,Certification and Labeling: Lessons from Theory and Practice." CID Graduate Student and Research Fellow Working Paper No. 37. Center for International Development at Harvard University, May 2009, pag 14

Furthermore, standard and certification process has to be perceived as attainable. This has to be traded off with the ambition in setting strict standards and complicated certification procedures. In order to be successful, the standard and certification specifics have not be felt as impossible otherwise it will be discouraging and the penetration into the market will very low. Once the products that standards that meet the standards specifications, new, stricter standards can be defined in an iterative way.

This rationale has been followed by Energy Star on product performance for energy efficiency.

Figure 3.2 shows graphically the trade off:

Figure 3.2: Balancing high environmental standards with market penetration



Source: Mathews Amos A. (2009), pag 11[186]

3.1.2. What are we certifying?

It is important to make some distinctions related to what the certification is referred to.

The first distinction is related to the type of certification that we are pursuing, is it process or product base, and the related implications.

In the case of process based certification, both standards and the related certifying process, occur through the supply chain.

[186] Mathews Amos A. (2009) "Effective Ecolabeling: Lessons from the Past and Questions for the Future in Fisheries", A white paper prepared by Amy Mathews Amos for Resources Legacy Fund and The David and Lucile Packard Foundation September 2009

It means that we will have different criteria and indicators to comply with for different aspects of the supply chain, from the cultivation phase of the feedstock in the case of biofuels, to the production and end use. An example is the standard and certification process of biofuels, where we have different standards that have to be met and be verifiable through the different steps of the creation of the products "from wheel to well", most of the time performing a life cycle assessment.
A similar system is followed in the Forest Stewardship Council certification scheme, where criteria and principle apply in different realms: environment, economical and social, and in different phases: generation, management, commercialization.
The positive aspect of this scheme is the comprehensiveness of the approach, where the compliance to different standard can be weighted and no (or not too many) aspects left behind.
The negative side is the complexity in dealing with a multiple and step by step approach, that implies higher transaction costs, need of traceability, higher complexity.
Furthermore, from a consumer point of view, the process based certification might be perceived less immediate in terms of performances, being more useful for the suppliers involved in the different phases of the supply chain.

The second type of certification approach is based on product performances. It means that a specification is established for a given "family" of products, in terms for example of energy efficiency. An example in this regard is Energy Star for products where the U.S. Environment Protection Agency, through a procedure that will be described in the following paragraphs, establishes a specification target for energy efficiency, and those products that meet the specifications can be labelled as Energy Star products.
The positive side is the immediate and clear signalling of product characteristics for consumers. Furthermore, the process to get the label is more straightforward.
The negative side is that the standard "coverage" can be narrow and too specific. What happen if a product meets the specifications standards related to energy efficiency and is eligible for Energy Star certification label, but it does contain a toxic element that make that particular product waste disposal troublesome for environment and health?

The case of the Energy Star bulbs containing mercury is a specific example[187]. In synthesis, how to deal with complexity when the focus of the certification is focused specifically on product performances?
How to ensure that focusing narrowly on a specific issue, such as energy efficiency, will not worse other environmental or social components? On the other side the effort to be comprehensive can affect the effectiveness of a certification program.

Let's focus now on the second issue related to certification: should certification occur at Firm or Country level[188]? Or, who should have the certification responsibility?
There are pros and cons in both cases. At the firm level, the advantage is that the private sector has more often, especially in the developing countries, the capacity to understand the business significance of getting certified and is more dynamic in following the procedures that a certification implies. This is quite clear when the certification represent an entry point for access to foreign markets that require certification (es biofuels in the EU market to account for the renewable target).
Another aspect that makes the proof of certification at firm level is the problems that some countries administration can incur in, due to the scarce administrative capacity. This can affect negatively also firms in not getting the certification in due time or getting some "fake" certification, due to cheating and corruption.

On the other side, having the certification at country level is preferred by some because it better avoids the leakage phenomenon especially when the certification is focused on global issues, such as GHG emissions. Furthermore, it gives the State a key role in national and global problems.

In conclusion, according to the precedent reasoning and also looking at current certification examples, such as the different types of ISO and Forest Stewardship

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[187] The Boston Globe, "Mercury leaks found as new bulbs break Energy benefits of fluorescents may outweigh risk*"* February 26, 2008 available at http://www.boston.com/news/local/articles/2008/02/26/mercury_leaks_found_as_new_bulbs_break/ found on December 29th 2009

[188] This part has been extensively discussed during a Workshop on Biofuels and Certification at Harvard University hold in May 2009. The sense of the debate is reflected in Devereaux, Charan and Lee, Henry, "Biofuels and Certification: A Workshop at Harvard Kennedy School" Discussion Paper 2009-07, Cambridge, Mass.: Belfer Center for Science and International Affairs, June 2009.

Council, we do think that certification can be better dealt with by firms. At the end firms are those that are willing to get certification because it increases their business opportunities when certification is voluntary, or is obliged way to have access to market, when is mandatory. Therefore firms have a business incentive in going through certification for competitiveness reasons. This implies time constraints, that not always states can respect due to administrative burdens, credibility and precision.

3.1.3. Interactions with other tools (regulation for example)

The interaction between civil regulation (private standard and certification) and institutional regulation can present different results.

Literature and research in this field is still not mature, and further elaboration is needed. We can summarize four possible types of interactions:

Table 3.1: Different types of interactions between civil and institutional regulation[189]

Complementarity	Two or more systems working for common goals
Rivalry	Two systems competing for dominance
Hybridity (or transformation)	Systems merge into new hybrid process

Let's start with the first category listed in Table 3.1: Complementarity.

In this interaction category we consider two systems, civil and institutional one, that have the same objective and are mutually reinforcing. This can happen both in an independent and/or coordinated way.

In some cases, civil regulation can also have the effect of upgrading existing law. This is the case for example of the Forest Stewardship Council (FSC), that has been endorsed by different governments through their public procurement policies to shape forestry laws.

An example of the first case is the decision of the United Kingdom, Germany, France, the Netherlands and Denmark and Japan to base their public procurement on

[189] Elaboration from Trubek, D. and Trubek L. (2007) "New Governance and Legal Regulation: Complementarity, Rivalry or Transformation", Columbia Journal of European Law 13:539–564

FSC certified wood products[190]. The use of specific certification schemes by governments, enhance the legitimacy and credibility of both specific certification schemes and institutional policies.

In other cases, especially in developing countries, standard and certification schemes have filled a vacuum in the legislation or have shaped national laws.
Using again the example of FSC, the government of Mexico has "transferred" FSC standards in the national forestry law[191] . Similar example is happening in South Africa and Bolivia where FSC was the only voluntary forestry standard system that met the law requirements for independent third party verification of the operations of forest concessions holders[192]. The result is that Bolivia is becoming a world leader in certified tropical sustainable forest management and has transformed considerably its forest sector.
Another key example in this regard is Guatemala, where the Guatemalan National Council on Protected Areas adopted FSC amongst its requirements from forest concessionaries in the Maya Biosphere Reserve. Also in this case the result has been remarkable: according to 2008 data, in the Maya Biosphere Reserve the average annual rate of deforestation in FSC certified areas between 2002-2007 was 20 times lower than that in other protected areas where the harvesting of wood and of non-timber forest products is prohibited[193].
Especially in developing countries the existence of FSC have been proved to shape the involvement of a large number of stakeholders that otherwise would not have been consulted, as well as to take in due account issues, such as indigenous people rights, that probably would not have been focused on[194].

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[190] Auld G., Gulbrandsen L.H. and McDermott C.L (2008) "Certification Schemes and the Impacts on Forest and Forestry", The Annual Review of Environment and Resources 2008, 33:187-211
[191] Pattberg P. (2006) "The Influence of Global Business Regulation: Beyond Good Corporate Conduct", Business and Society Review 2006, 111:3 241-268
[192] Bartley T. (2009) "How Certification Matters: Examining Mechanisms of Influence" presented as input material for the meeting on "Certification and Standards Assessment" hosted at the National Academy of Science, Washington, DC September 22-23, 2009
[193] ISEAL Alliance (2008) "Governmental Use of Voluntary Standards: Innovation in Sustainability Governance", September 2008 available at http://www.isealalliance.org/_data/n_0001/resources/live/R079_GUVS_Innovation_in_Sustainability_Governance.pdf visited on December 20th, 2009
[194] Trubek, D. and Trubek L. (2007) "New Governance and Legal Regulation: Complementarity, Rivalry or Transformation", Columbia Journal of European Law 13:539–564

At the same time the existence of regulation provides a "*regulatory floor*"[195] incentivizing firms and governments to adopt stringent measures in a proactive way
It is true that this regulatory floor can be justified as a way for governments to deliver on public policy objectives through the adoption of voluntary standards, as a guarantee of credibility and impartiality being established at international level.

Rivalry happen when civil regulation is an attempt to avoid further legally binding regulation.
An example in this regard cited by Vogel D. (2009)[196] is the program Responsible Care and the attempt of the chemical industry to prevent the formation of binding rules in response to the Bhopal disaster in 1994.
Another example is represented by the attempt of the European Manufacturers' Association (ACEA)[197] to avoid a legally binding regulation for the consumption (and carbon emission) from new vehicles. Through a strong lobby by the industry, a voluntary agreement[198] (clearly not binding) was agreed between the European Commission and the ACEA to release in the market by 2009 new passenger vehicles with a mean level of CO2 emissions of 140 grams per km.

It is true that due to the failure of the agreement, a Regulation (EC) No 443/2009[199] has been passed, that sets 130 g CO2/Km as average emissions for the new car fleet, and from 2020 onwards, the target will be of 95 g CO2/km as average emissions for the new car fleet.

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[195] Matus, Kira JM. 2009, "Standardization ,Certification and Labelling: Lessons from Theory and Practice." CID Graduate Student and Research Fellow Working Paper No. 37. Center for International Development at Harvard University, May 2009
[196] Vogel D. (2009) "The Private Regulation of Global Corporate Conduct Achievements and Limitations" in Mattli W. and Woods N. "The Politics of Global Regulation", Princeton University Press, 2009
[197] European car manufacturers in ACEA: BMW AG, Daimler Chrysler AG, Fiat S.p.A., Ford of Europe Inc., General Motors Europe AG, Dr. Ing. H.c.F. Porsche AG, PSA Peugeot Citroën, Renault SA, Volkswagen AG, AB Volvo
[198] Commission Recommendation of 5 February 1999 (1999/125/EC)on the reduction of CO2 emissions from passenger cars (notified under document number C(1999) 107) http://ec.europa.eu/environment/air/transport/co2/99125/en.pdf (visited on November 10, 2009)
[199] REGULATION (EC) No 443/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on "Setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles". http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0001:0015:EN:PDF visited on November 10 2009

Other dynamic, or complementary to the one just described, happens when the private sector fills a vacuum in the regulation through standards and certification and in this way remove attention of governments and NGOs to other "priorities".
Another rivalry effect is given also by the prevailing of big multinational and large international NGOs on more local circumstances and actors, following a distorted "colonization" of Northern practices and standards on more local and traditional one.
An example in this regard has been presented by Vandergeest P.(2007)[200], who argued how local regulation of shrimp aquaculture, which could have been base on more traditional practices and been involved a larger number of local stakeholders, has been displaced by Shrimp Aquaculture Certification.

Finally, hybrid or transformation, happens when there is not a clear border between civil regulation and law. It means that the two are tighten together and the failure of one can determine the failure of the other.
This is the case for example when the law creates the framework and civil regulation represents the tool to implement the goals determined in the framework. Trubek D. and Trubek L.(2007)[201] present the case of the EU Water Framework Directive where the European Commission establishes the framework and the goals, but leaves the Member States independent in adopting specific measures to meet the goals.

Another example can be represented by the Global Bioenergy Partnership work program on the definition of sustainability criteria and indicators for biofuels.
It is interesting to note that the participation in the GBEP work is mainly of representatives of public institution and international UN based organization, but in a voluntary not negotiating setting. The objective of this work is to inform (and drive) national policies for the development of sustainable biofuels. In this case, a public/private voluntary dialogue has clear intersections and impact on the strategy and possible content of institutional policies.

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[200] Vandergeest P. (2007) "Certification and Communities: Alternatives for Regulating the Environmental and Social Impacts of Shrimps Farming". World Development Vol. 35, No. 7, pp. 1152–1171, 2007
[201] Trubek, D. and Trubek L. (2007) "New Governance and Legal Regulation: Complementarity, Rivalry or Transformation", Columbia Journal of European Law 13:539–564

3.1.4 Experience so far in general terms (focus on SMEs and developing countries)

To have a first evaluation of the experience gained so far in the implementation of civil regulation related to sustainability is not an easy task.

Many elements can concur to the effectiveness or failure of the implementation of a certification scheme, as we have already seen in the case both of the characteristics of the scheme itself and "environmental" factors.

A criteria to "measure" the experience can be the numbers of firms certified, the diversity in terms of geographical distribution of firms, the costs related to joining a certification.

An interesting study developed by Espach R. (2006)[202] illustrate in Table 3.2, has divided the factors that influence the effectiveness of private environmental regulation regimes in two main groups: Demand side and Supply side factors, both from a market and non market angle. It is interesting to look at the institutional requirements that the author assigns to each factor.

Table 3.2: Factors that influence the effectiveness of private environmental regulatory regimes

Factors that Influence the Effectiveness of Private Environmental Regulatory Regimes

			Institutional requirement
Demand-side factors	Market	Consumer preference	Competitive markets with environmentally conscious consumers (domestic or foreign)
		Client preference or pressure (supply chain pressure)	Asset specificity and/or coordination among clients (easiest under conditions of high industry concentration)
		Enhanced company image	Company or brand differentiation
	Nonmarket	Threat of further state regulation	Competent state regulation
		Threat of negative public campaigns	Presence of activist groups and media for public dissemination
		Threat of litigation	Judiciary open to public claims against firms alleging environmental malpractice
			Institutional requirement
Supply-side factors	Market	Availability of verification instruments across the entire commodity chain	Organization and oversight of program across commodity chain through network or central administration
	Nonmarket	Organization and administration	Industry concentration, leadership by major firms, and capable administrative agency
		Availability of external support	Capable NGOs or other independent organizations willing to collaborate
		Government position relative to program	State legitimacy as a voice for public interest, credibility of government initiatives

Source: Espach R. (2006), Table 1, pag. 61

[202] Espach R. (2006), "When is Sustainable Forestry Sustainable? The Forest Stewardship Council in Argentina and Brazil", Global Environmental Politics 6:2, May 2006, © 2006 by the Massachusetts Institute of Technology

As we have stated previously, the interest of private companies on to civil regulation has increased considerably. Let's examine some numbers.

According to Vogel (2009),[203] at global level there are more than 300 industry or product codes. Looking at specific examples of joining civil regulation schemes we see a quite enthusiastic engagement.

UN Global Compact[204] accounts for 6700 participants, including over 5200 businesses in 130 countries around the world[205].

ISO 9001:2000[206] and ISO 14001: 2004[207] are implemented by over a million organizations in 175 countries[208].

As far as the FCS concerns, globally, over 118 million hectares of forests are certified with FSC standards, and FSC forest management and chain of custody certificates are issued in over 100 countries worldwide. The distribution of areas FCS certified still present a predominant participation of North countries, with the European Union accounting for a percentage of 46.31%, the United States 34%, South America 9.81%, Asia 2.47% and Oceania 1.40% (Figure 3.3). Overall, FSC

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[203] Vogel D. (2009) "The Private Regulation of Global Corporate Conduct Achievements and Limitations" in Mattli W. and Woods N. "The Politics of Global Regulation", Princeton University Press, 2009.

[204] Launched in 2000, The UN Global Compact is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with ten universally accepted principles in the areas of human rights, labor, environment and anti-corruption. Companies that intend to join the initiative need to endorse UN Global Compact at CEO level through a letter of commitment, and report on an annual base the progress made in achieving the ten principles. http://www.unglobalcompact.org/

[205] Information on the UN Global Compact website visited on November 11, 2009 http://www.unglobalcompact.org/ParticipantsAndStakeholders/index.html

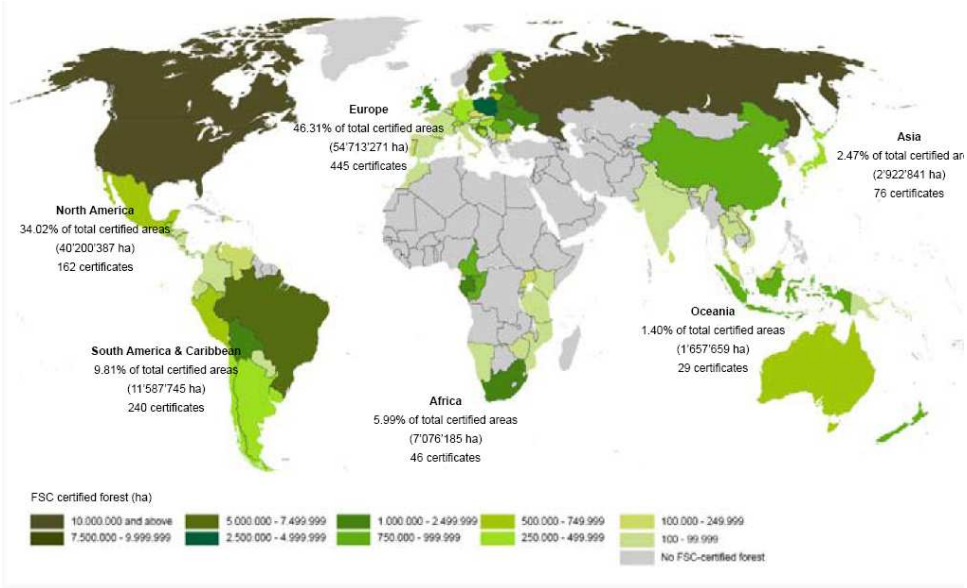
[206] The ISO 9000 family consists of standards and guidelines relating to quality management systems and related supporting standards. ISO 9001:2008 is the standard that provides a set of standardized requirements for a quality management system, regardless of what the user organization does, its size, or whether it is in the private, or public sector. Information based on ISO website: http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000/iso_9000_essentials.htm
visited on November 12, 2009

[207] The ISO 14000 family addresses various aspects of environmental management. ISO 14001:2004 provides the requirements for an environmental management systems (EMS). http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000/iso_14000_essentials.htm visited on November 12, 2009

[208] http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000.htm visited on November 12, 2009

certifies around 2.4%[209] of the world's forest, while its more direct "competitor" scheme, the Pan European Forest Certification (PEFC)[210], covers globally 5.2%.

Figure 3.3: FSC Certified Forest Areas[211]



Source: Map source: January 2009 © FSC Denmark Regional figures source: October 2009 © FSC

The numbers presented for the adoption of ISO and of FSC drives us to a second set of questions related to both the size/industrial organization of companies that decide to comply with civil regulation and public policy[212].

The size and the industrial organization matters in the sense that complying with certification schemes implies front, initial costs, that are easier to be absorbed by large firms in a shorter time. Furthermore big companies, that have outsourced production in developing countries but still have primary consumers in the developed world, are more likely to be subject to scrutiny by their own consumers in the form of buyers associations or NGO.

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[209] FSC News and Note, Vol.7, Issue 10, Nov. 2009 available at http://www.fsc.org/fileadmin/web-data/public/document_center/publications/newsletter/newsletter_2009/FSC-PUB-20-07-10-2009-11-01.pdf found on December 9th, 2009.

[210] In the late 90s European forest owners association created the PEFC scheme to facilitate common recognition of national schemes and to provide a common ecolabel. http://www.pefc.org/internet/html/ visited on November 12, 2009

[211] FSC News and Note, Vol.7, Issue 10, Nov. 2009

[212] Auld G. et All (2007) "The Spread of the Certification Model: Understanding the Evolution of Non-State Driven Governance", Presented at Annual Conv. Int. Stud. Assoc., 48th, Chicago, Feb. 28-Mar 3.

The public policy question refers to the fact that firms that show interest in civil regulation, are more often located in countries where there is already a stringent environmental regulation in place. The paradox might be that the spread of civil regulation takes place in regions (the ones that have already regulation in place) where it is needed less.

Small-medium size firms are therefore penalized in their compliance with certification schemes as they often need external expertise help, often in the form of consultants, for both of both equipment and operational upgrades. This can represent a financial hurdle, especially for small-medium enterprises that cannot rely on scale economies to have a quicker investment return.

The picture looks even more critical in developing countries, where the inability to comply with environmental and social standard can restrict their access to OECD markets. This is due to different factors, that goes beyond their willingness to comply,
such as the non capacity to either identify key requirements, implement the necessary institutional and procedural changes, or demonstrate compliance in a credible way[213].
At the same time, developing countries have often argued the "unfairness" in imposing *de facto* environmental and social standards to have access to export as a way of restricting access to foreign market. In practice they did not have a voice in the process of defining the standard themselves, as many companies in the western side of the globe had the possibility to do.

As we will argue in the following chapters, the certification of biofuels according to sustainability criteria and indicators, can represent a strong disadvantage for developing countries firms in building a business especially if the purpose is to participate in the global market.

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[213] Rotherham T (2003) "Implementing Environmental, Health and Safety Standards, and Technical Regulations – The Experience of Developing Countries" International Institute for Sustainable Development

3.2 Some examples of certification schemes in the energy, food and forestry sectors

The purpose of this section is to prepare the ground for the matrix on the effectiveness of sustainability certification schemes.

As we have pointed out in the introduction, some "more experienced" certification schemes other than the ones on biofuels will be evaluated in terms of effective and practicable governance, design, capacity building and reliability.

The purpose is to build an analytical framework that will assign a value, in terms of effectiveness and practicability, to the different dimensions that a certification scheme implies.

We have chosen the Energy Star certification on energy efficiency, the Forest Stewardship Council on forest protection, and the Organic Food certification as three examples that can inform our analysis. These examples have been chosen not only on the basis of their consolidated experience, but also according a geographical representativeness.

3.2.1. Energy Star for products in US

The Environment Protection Agency (EPA) launched in 1992 Energy Star, a voluntary labeling program, focused on the promotion of energy efficient products through the application of the Energy Star label.

The first products to be labelled were computers and monitors than, over the years, following also the joining of the US Department of Energy (DOE), Energy Star has been extended also to buildings and industrial plants, home performances and new homes.

We will focus our attention here only on the part related to product specification.

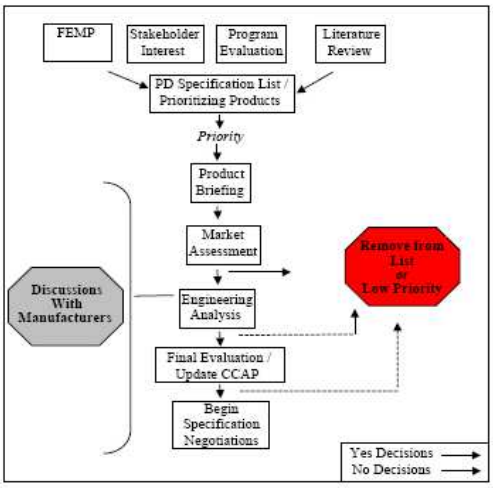
In order to join the Energy Star program and be granted to use the Energy Star label, products manufacturers sign a partnership agreement with EPA that commit them to comply with the program specification target for energy efficiency.

After more than 15 years of experience, it is fair to say that Energy Star for products has achieved good results. According to Sanchez M.C. et All (2008)[214] through the year 2006 Energy Star labelled products saved 4.8EJ of primary energy, $47 billion in energy bills and avoided 82 TgCeq. Energy Star covered 40 types of products, but only 6 of them (in ranking order of impact monitors, printers, residential light fixtures, TVs, furnaces and computers). If we look at projection estimates, according to the same source, over the period 2007-2015 the primary energy save should account to 12.8 EJ, $90 billion in energy bills save and 203 TgCeq[215].

The way EPA has created and consolidated in the years the "market power" of Energy Star is framed by a clear business strategy that goes through the following steps[216]:

1. Creation of an initial list of potential products to be eligible of ENERGY Star label;
2. Prioritization of the list on the basis of a carbon saving model developed by the Climate Change Action Plan of Lawrence Berkeley National Laboratory;
3. Analysis of technical and market potentiality of high priority products;
4. Discussion with manufacturers on the development of product specification.

Figure 3.4:Product Specification Development Framework



Source: McWhinney M. And All (2005), pag 1618

[214] Sanchez M.C. and All (2008) "Savings Estimates for the United States Environmental protection Agency's ENERGY STAR voluntary product labelling program", Energy Policy 36 (2008) 2098-2108

[215] Rotherham T (2003) "Implementing Environmental, Health and Safety Standards, and Technical Regulations – The Experience of Developing Countries" International Institute for Sustainable Development

[216] McWhinney M. And All (2005) "ENERGY STAR product Specification development framework: using data and analysis to make program decision", Energy Policy 33 (2005) 1613-1625, pag 1618.

In practice, as it has been shared also during interviews with the experts of the EPA Office of Partnership Programs, National Center for Environmental Innovation[217], standard specifications represent a trade off between the ambition for setting up a strict energy efficiency specification, with the pragmatic goal of making this specification achievable for a substantial amount of products in a adequate time frame.

In simple terms, the standard has not to be perceived as "impossible" to achieve. For this reason, EPA does set up a standard that is already achievable by approximately 10% of the products in the market. What happens is that most probably the manufacturers leader in that specific product have already reached the specification standard requested by Energy Star and will get the label. For a "follower" effect, driven by competitiveness reasons, other producers will be "forced" to reach the specifications standards defined by EPA in order to get the Energy Star label and be part of the good "Energy Star club". This will create a positive, virtuous cycle effect. Or as it has underlined by Howarth R.B. et All (2000):[218] "*The decision by individual firms to participate (in Energy Star) has the collective effect of dramatically decreasing the supply of less energy efficient products*" (pag 484).

As it has been reiterated many times during the interviews with EPA officers, standard specifications are not static, but iterative. Once the standard specification has been achieved by a good percentage of the market, with a penetration of approximately 40%, EPA raises the bar determining a new, more ambitious specification target, following the business strategy described above.

As far as concern the certification process, as described above, this is governed through a formal agreement signed by the manufacturer and EPA, where the manufacturers commit to comply with the standard specification. The monitoring of this compliance is based on a conformity assessment carried out *by the same manufacturer*.

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[217] Interview with experts of EPA Office of Partnership Programs, National Center for Environmental Innovation made on December 4th, 2009, Washington DC.

[218] Howarth R.B. et All (2000), "The Economics of Energy Efficiency: Insights from Voluntary participation programs" in Energy Policy 28 (2000) 477-486

There is, in simple word, a "trust agreement" between EPA and the producers, with no involvement of third party certifiers. This system will avoid third parties transaction costs, as well as will speed the process. On the other side a potential "risk for cheating" makes the system suspicious, but, in the words of EPA experts we have interviewed, the experience tells us that private companies have an adverse attitude in cheating first with a Federal Agency and second with their own consumers.

Furthermore, the business strategy has not to be focused only on the producers side, but instead equal attention has to be paid on the demand side. "*You have to buy the demand*" has been highlighted by EPA officers, in the sense that procurement policies can help[219], but most of all you have to create the market power of the brand that needs to be recognizable instantly and being credible[220].

3.2.2 Forest Stewardship Council

We have already touched upon briefly on the Forest Stewardship Council (FSC) certification scheme in previous section related to the effectiveness and the status of implementation of different certification schemes.

In this paragraph, we will describe a little more in deep FSC, highlighting its main characteristics and standard procedures in order to be able, in the next chapter, to come up with a matrix where we will compares and weight the effectiveness and practicability of different certification schemes linked to environmental/sustainability effects.

[219] An example in this regard related to Energy Star for buildings has been the Federal purchasing guidelines and federal Executive Order 13123 "Greening the Government through Efficient Energy Management" signed by President Clinton in December 2000, available at http://www1.eere.energy.gov/femp/pdfs/eoguidancedoc.pdf found on December 5th, 2009

[220] US EPA (2007) "Building a Powerful and Enduring Brand: The Past, Present and Future of the ENERGY STAR Brand" prepared by the Interbrand for the US EPA available at http://www.energystar.gov/ia/partners/downloads/ENERGY_STARBndManf508.pdf , found on December 5th 2009.

Following the failure of negotiating a binding global forest agreement in the preparatory process for the 1992 UN Conference on Environment and development, FSC was founded in 1993 by the World Wide Found for Nature (WWF), other NGOs, indigenous people groups, forest workers organizations to promote responsible management of the world's forests[221].

FSC today (data related to Oct. 2009) certify globally, over 118 million hectares of forests, and FSC forest management and chain of custody certificates are issued in over 82 countries worldwide, with a total forest management certificates worldwide amounting to 998 and chain of custody certificates equal to 15,094[222].

As far as geographical distribution matters, the European region accounts for about 53.240. 908 ha of forest certified, the American region accounts for about 50.848.187 ha (US only 11, 616.666 ha, Brazil 5.464.126 ha), Oceania for 1.659.330 ha, Asia 2.761.603 ha and Africa 7.095.531 ha[223].

The above data are a first snapshot at the penetration and success of the FSC certification model, but assessing what does it mean in terms of effectiveness is not very easy to say, as also qualitative rationale apply. In fact as Auld et All (2008) declare: "*a hectare certified in one country may not have the same ameliorative effects as a hectare certified in another*"[224].

But let's see how FSC works and which are its peculiarities.

FSC mission is to promote "environmentally appropriate, socially beneficial, and economically viable management of the world's forests"[225] and in order to translate

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[221] Auld G. et All (2008) "Certification Schemes and the Impacts on Forests and Forestry", The Annual Review of Environment and Resources 2008.33:187-211

[222] FSC (2009) "Global FSC certificates: type and distribution", September 2009 available at http://www.fsc.org/fileadmin/web-data/public/document_center/powerpoints_graphs/facts_figures/09-09-15_Global_FSC_certificates_-_type_and_distribution_-_FINAL.pdf, found on December 9th, 2009

[223] FSC (2009) "Global FSC certificates: type and distribution", September 2009.

[224] Auld G. et All (2008) "Certification Schemes and the Impacts on Forests and Forestry", The Annual Review of Environment and Resources 2008.33:187-211

[225] FSC mission is than described in more detail as following: Environmentally appropriate forest management ensures that the harvest of timber and non-timber products maintains the forest's biodiversity, productivity, and ecological processes; Socially beneficial forest management helps both local people and society at large to enjoy long term benefits and also provides strong incentives to local people to sustain the forest resources and adhere to long-term management plans; Economically viable forest management means that forest operations are structured and managed so as to be sufficiently profitable, without generating financial profit at the expense of the forest resource, the ecosystem, or affected communities.

its mission in reality, an international standard for the definition of responsible management of forest has been defined. The international standard[226] comprises 10 principles and 56 criteria, that include, among others, tenure and use right and responsibilities, indigenous peoples' rights, community relations and workers' rights, environmental impact, management plans.

One particularity of FSC scheme, is that the above principles and criteria can be made more specific and tailored to national and regional circumstances through a negotiation process that has to be developed at national level with the consensus of local and national economic, social and environmental councils. In this way specific standards are defined for each type of forest at national level, pending the approval of the FSC Board that has to verify the consistency with the global/generic principles and criteria.[227]

In order to get the FSC label, the certification of compliance to the FSC standards has to go through the entire chain of custody, and it is carried out by third parties certifiers accredited by FSC.

In synthesis the FSC certification includes the following steps[228] that apply both for the management of forests and the Chain of Custody.

- preliminary assessment;
- on the ground field inspection;
- consultation with local communities;
- preparation of a preliminary assessment report by the certifier and peer review of the report;
- discussion with the applicant;
- final certification determination and issuance of a renewable, five years certificate;
- annual follow up audits to ensure continued compliance to FSC standards.

Available at http://www.fsc.org/vision_mission.html found on December 8th, 2009.

[226] Forest Stewardship Council "FSC International Standard - FSC Principles and Criteria for Forest Stewardship" FSC-STD-01-001 (version 4-0) EN available at http://www.fsc.org/fileadmin/web-data/public/document_center/international_FSC_policies/standards/FSC_STD_01_001_V4_0_EN_FSC_Principles_and_Criteria.pdf found on December 8th, 2009.

[227] Forest Stewardship Council "FSC International Standard - FSC Principles and Criteria for Forest Stewardship" FSC-STD-01-001 (version 4-0)

[228] Forest Stewardship Council "FSC International Standard - FSC Principles and Criteria for Forest Stewardship"

A way to look at the effectiveness of FSC, is to analyze the Corrective Action Requests (CARs) that certifiers ask for in order to release the certifications. It is interesting to note that, according to a study carried out by SmartWood, in developed countries CARs were mostly related to the improvement of management plans, monitoring performance and inventories, in developing countries, such as Brazil Bolivia and Mexico, CARs were more related to compliance with worker's rights, workers safety, communications and conflicts with stakeholders, communities[229]. Maybe this difference will not surprise, as it might be expected that in a country like US workers already have their own rights in place and respected, but it is important to underline the impact that FSC can have especially in developing countries in enhancing social conditions. This can be due to both a direct effects, with the action requested by CARs, but also as an indirect one in terms of communities and workers awareness raising and empowerment on their own rights[230].

An example in this respects has been given by FSC Brazil that reported that because FSC requires transparency in land tenure, a FSC certified company was "forced" to get the FSC certification, to make an agreement with the Government of Amazonas to issue land titles to 142 families in agrarian communities and to make available a also compensation for timber use[231]. As Leight Taylor P. (2005)[232], pag 138, has stated "… *FSC's explicit emphasis on stakeholder involvement in evaluation and standard setting has created new spaces for community and indigenous group participation in policy debates*".

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[229] Auld G. et All (2008) "Certification Schemes and the Impacts on Forests and Forestry", The Annual Review of Environment and Resources 2008.33:187-211

[230] FSC (2009) "FSC impacts and outcomes-Extracts from FSC literature review 2009" available at http://www.fsc.org/fileadmin/web-data/public/document_center/publications/FSC_Policy_Series/Impacts_lit_review_summary_EN.PDF found on December 9th 2009

[231] FSC (2009) "FSC user-friendly guide to FSC certification for smallholders", FSC Technical Series N. 2009-T003 available at http://www.fsc.org/fileadmin/web-data/public/document_center/publications/FSC_Technical_Series/Smallholder_guide_EN_no_logo.pdf found on December 9th, 2009

[232] Leigh Taylor P. (2005) "In the Market But Not of It: Fair Trade Coffee and Forest Stewardship Council Certification as Market-Based Social Change", World Development Vol. 33, N.1, pp 129-147, 2005

Figure 3.5 gives a brief snapshot on the top ten issues addressed during certification assessments, on the basis of a study delivered by Newsom D. and Hewitt D. (2005)[233] who analyzed 129 certification reports from 21 countries: 20 operations in Latin America, 10 in Asia/Australia and 89 in North America, covering natural, semi-natural forests and plantation. It shows us that the impacts of certification are very diverse and not predominant in a single direction.

Figure 3.5: Top ten issues addressed during CARs (Newsom D. 2005)

Source: Newsom D. and Hewitt D. (2005), Figure 2, pag. 15

Another peculiarity of FSC Certification scheme is the attention paid towards smallholders. Given that they own and manage 55% of forests in Europe and almost 25% in the global South, and almost 18% of globally FSC certified forest area id managed by smallholders[234], a Special program has been set up called Small and low Intensity Managed Forests (SLIMFs). The main purpose of the program is to make more accessible FSC to small or low intensity managed forests, through the reduction of certification costs and the streamline of administrative procedures. Examples in this regards are "Group Certification" where the group entity holds the certificate on behalf of the single participants to the group and is responsible for the compliance with FSC standards from all the members of the group.

[233] Newsom D., Hewitt D. (2005) "The global impact of SmartWood certification". Rep. TREES Program, Rainforest Alliance, New York
[234] FSC (2009) "FSC user-friendly guide to FSC certification for smallholders", FSC Technical Series N. 2009-T003

Another way to lower the costs for small holders is the certification of "forestry contractors" as they comply with FCS standards in their forestry operations. It will in this way decrease the number of single standards smallholders have to demonstrate they comply with.

3.2.3 Leadership in Energy and Environment Design (LEED)

LEED has been launched by the US Green Building Council (USGBC) in 1998.

It provides standards and a certification process for defining environmentally sustainable constructions, including new constructions and major renovations, existing buildings, commercial interiors, homes, neighbourhood development, schools and retails.

LEED project was promoted at the beginning of the 90's by Natural Resources Defense Council, a US NGO that built consensus about the idea of certified sustainable buildings through the participation in the launch process of the different stakeholders involved in buildings construction such as developers, architects, engineers, government agencies and other NGOs.
This effort of broad involvement of interested parties has been kept in the years, as the technical criteria that are proposed by the LEED committees are examined and reviewed by more than 10,000 membership organization that are part of the USGBC.

LEED has been penetrated in the building construction market quite massively from 1998 to now, and, the overall green building market (both non-residential and residential) is expected to increase twofold, from today's $36-49 billion to $96-140 billion by 2013.[235]

[235] McGraw Hill Construction (2009). "Green Outlook 2009: Trends Driving Change"

Its spread has also been incentivised by some US Municipalities or States through tax exemptions (such as the City of Cincinnati in Ohio), tax based incentives (State of Michigan), etc.

Let's see how does it work.

The building rating system covers the following areas:

1. Sustainable sites
2. Water efficiency
3. Energy and atmosphere
4. Material and Resources
5. Indoor environmental quality
6. Innovation in design process
7. Regional priority.

LEED is a certification based on points, higher is the number of points earned, better the certification label that the building will be certified with.

Therefore, each of the six areas listed above entail a set of prerequisites, that are necessary for certification but that do not yield points, and a set of specific measures whose compliance give access to points.

According to the latest version of LEED 2009, the area that allows the maximum gaining of points if all the measures are met is Energy and Atmosphere, with 35 possible points. Examples of measures in this area that give access to points are: i) minimum energy performance; ii) on-site renewable energy; enhanced refrigerant management; green power.

Examples of measures included in the area of Sustainable Sites (26 possible points) include: i) Public transportation access; ii) bicycle storage and changing rooms; iii) light pollution reduction.

The 6th area, Innovation in Design provides bonus points for projects that use innovative technologies that are not required in other LEED credits.

Finally, regional priority area comes from the efforts of USGBC's regional councils, chapters and affiliates identification of environmental concerns that are important especially at local level and regional level. Additional points are earned in case the project complies with local/regional specifications.

The points gained in each areas are than summed up and the certification level is given on the basis of where the total of points fits in the following different ranges:

- Certified: 40-49 points
- Silver: 50-59 points
- Gold: 60-79 points
- Platinum: 80 points and above.

LEED is a third party certification and the professional accreditation is administered by the Green Building Certification Institute.

While the implementation of LEED certification is gaining a degree of success, some concerns have been raised on its comparability and effectiveness.

On comparability, it has been underlined that the comparison among LEED projects with similar ratings is difficult and not completely representative, as different economic and regulatory preconditions alter the baselines of the projects and therefore the cost effectiveness of the projects[236].

Another issue that has been underlined is the cost related to LEED design and construction compliance. It comes in the form of consultants, higher quality materials, etc. On the other side of the coin, in the medium term these higher costs are offset by the savings in terms of electricity consumption, water consumption, but also better working environment in terms of indoor pollution, natural light, all issues that concur to create a healthier and nicer place to live and work. According to Kats (2003)[237], "…a*n upfront investment of 2% in green building design, on average, results in life cycle savings of 20% of the total construction costs – more than ten times the initial investment"*. Furthermore, according to Miller at Al[238] estimates that building sale prices for energy efficient buildings are as much as 10% higher per square foot than conventional buildings.

Finally, a concern we have raised also for other certification product performance based, is the focus on specific elements that cannot be omni comprehensive of environmental concerns. This is the case for example of leather use, which does

[236] Tso B. at Al (2004) "The Costs and benefits of Achieving Silver LEED for Two Seattle Municipal Buildings"

[237] Kats, G. (2003). "The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force", CapitalE

[238] Miller, N., Spivey, J., & Florance, A. (2008), "Does Green pay off?" Studie, Burnham Moore Centre for Real Estate, from Burnham Moore Centre for Real Estate

avoid Volatile Organic Compound (VOC), but that can contain other chemical substances damaging the environment.

3.2.4 Certification of Organic Products in Europe

The EU regulation on organic agricultural products was introduced in 1992[239], but already in the 80's many European countries already launched their own national schemes for certifying organic products. The 1992 regulation was part of the wider reform of the Common Agricultural Policy of the EU that started to focus more on the impacts of agriculture on environment and biodiversity, as well as on its contribution in meeting the preference of some consumers for products produced in a more "*natural*" way.

It represented also a successful attempt to create common minimum standards for organic products for all the EU countries, enhancing both clarity and confidence among consumers.

In order to understand the magnitude of the organic farming, according to the data provided by Willer, H. and Kilcher (2009)[240] 32.2 million hectares of agricultural land are managed organically (end 2007). More than one third of the world's organic land is in Oceania, followed by Europe (24%) and Latin America (20%).

Organic Monitor estimates that international sales of organic product have reached 46.1 billion US dollars in 2007, threefold levels since 1999. North America and Europe consumers account 97 percent of global revenues from organic product consumption[241].

Asia, Latin America and Australia are important producers and exporters of organic foods.

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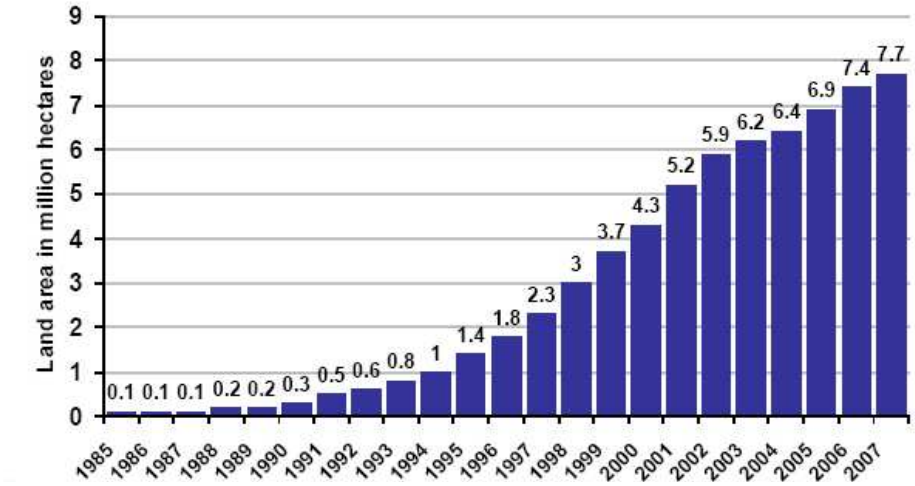
[239] Council Regulation (EEC) N 2092/91 of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs available at http://eur-lex.europa.eu/LexUriServ/site/en/onsleg/1991/R/01991R2092-20070101-en.pdf downloaded on January 6th 2010

[240] Willer, H. and Kilcher, L. (Eds.) (2009) "The World of Organic Agriculture. Statistics and Emerging
Trends 2009". IFOAM, Bonn; FiBL, Frick; ITC, Geneva

[241] Amarjit Sahota (2009) "The Global Market for Organic Food & Drink. The World of Organic Agriculture 2009", IFOAM, FIBL, ITC

As far as concern EU 25, at the end of 2007, 7.7 million hectares were managed organically by more than 200,000 holdings. 1.9 percent of the European agricultural area and 4 percent of the agricultural area in the European Union is organic.

Figure 3.6: Development of the Organic Agricultural Land in Europe



Source: Willer, H. and Kilcher, L. (Eds.) (2009)[242]

After 15 years a new regulation, EC n. 834/2007[243] came into effect on January 1, 2009, replacing the one of 1992.

Let's examine the main points related to the new regulation.

First of all the definition: products can be labelled as "organic" when at least 95% of their agricultural ingredients are organic[244].

The following list of products, originating both from agriculture ad aquaculture, are covered by EU regulation:[245]

- live or unprocessed agricultural products;
- processed agricultural products for use as food;
- feed;
- vegetative propagating material and seeds for cultivation.

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[242] Willer, H. and Kilcher, L. (Eds.) (2009) "The World of Organic Agriculture. Statistics and Emerging
Trends 2009". IFOAM, Bonn; FiBL, Frick; ITC, Geneva

[243] Council Regulation (EC) N. 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) N. 2092/91, available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:189:0001:0023:EN:PDF downloaded on January 5th, 2010

[244] Art. 23, para 4, comma (a) (ii) Council Regulation (EC) N. 834/2007

[245] Art 1, para 2, Council Regulation (EC) N. 834/2007

Products coming from hunting and fishing of wild animals are not included in to the scope of regulation as organic products.

The EU Regulation is quite prescriptive in defining the meaning of organic. Main principles to be followed in a organic production are[246]:

- closed cycles with the use of internal resources are preferred to those using external resources. In the last case, they should be limited to inputs from organic production, naturally or naturally-derived substances and low mineral soluble materials.
- chemically synthesized inputs are allowed only in exceptional cases;
- prohibited use of GMO in organic production. A tolerance threshold of GMO proportion in the ingredients of products is allowed when is less than 0.9% or when GMO entered the products unintentionally.

In addition to the overall principles, described above, the EU Regulation list specific principles to be respected for farming, for the processing of organic food and organic feed, for plant and seaweed production as well as for livestock and aquaculture animals.

In this way all the steps related to both the life cycle of organic products such as production, preparation and distribution of organic products and their control, and the use of organic labelling and advertising,[247] are covered.

The new import regime prescribed in the EU Regulation, foresees the presence of control bodies in third countries that are authorized and monitored by the EU Commission and the Member States. It means that the prerequisite to have a bilateral recognition on organic production between a EU country and a third one is not anymore a precondition for imports in the EU market, even if it is still an option to follow. This should facilitate the external market of organic products, lowering the burden of administrative procedures and monitoring compliance.

Furthermore, while in the past the compliance of organic products fro third countries was checked on a product by product basis, with evident difficulties due to differences in the production practices in third countries, with the new regulation the

[246] Art.4, Council Regulation (EC) N. 834/2007

[247] Art 1, para 1, Council Regulation (EC) N. 834/2007

system has been simplified, allowing similar rules elated to production and control in third countries that are comparable to the ones applied in the EU.
While the use of EU logo to label organic products was voluntary, starting from July 2010 it will become mandatory for all organic pre-packaged food produced within the EU Community. It will facilitate in this way the recognition of organic products among consumers.
At the same time, the EU regulation allow to have, in addition to the EU logo, also national or private logo, which, in our opinion, can create overwhelming reactions among consumers in their choices and recognition of organic products. This is also due to the fact that EU allows Member States to have stricter specifications for organic products at domestic level, compared to the common denominator established in the EU Regulation.
In order to get the logo and being recognized as "organic", all the activities related to the different steps of production, preparation and distribution of organic products have to be submitted to a control system that verifies the compliance with the organic rules.

The certification process is based on third party verification and its set up is left to EU Member States that have to define a system of controls and designate one or more competent authorities responsible for control of compliance with EU Regulation. The control system is quite strict, apart some exceptions, all operators shall be subject to verification of compliance at least once a year. Control bodies (certifiers) have to be accredited in a "register" of the EU that verify the competences and expertise of certifiers and are identified with a code number.

Producers that sell directly to final consumers are exempted from the notification and control requirements in order not to overburden small operators with administrative procedures. As in the case of the Forest Stewardship Council, also in the case of organic farming certification it has been recognized the need to pay special attention to small scale producers, that due to limit capacities in dealing with extra costs deriving from third party certification.
Another interesting point is the one related to the existence in this case, as well as in the one of biofuels, of a process certification instead of a product based one. This

implies the need of traceability and control and monitoring along all the chain of custody, instead of a performance based control only on the product.

Chapter 4

Biofuels Sustainability Certification schemes: Characteristics and Implications

4.1 Principal certification schemes in the biofuels sector

In this chapter we will illustrate and analyze main sustainability certification schemes that are in place, or are under negotiating, for biofuels.

We will describe the main requirements related to standards and certification, as well as the issues that present the biggest uncertainty in terms of implementation for the three pillars of sustainable development.

In this way we will start to bound the main elements that will allow us to create the analytical framework for evaluating the effectiveness and practicability of sustainability certification schemes.

We will start with the "mandatory ones" such as the one prescribed by the European Union and the one of the US Environment Protection Agency and than we will move to the voluntary one such as the Global Bioenergy Partnership and the Roundtable on Sustainable Biofuels.

Being the sustainability certification of biofuels a new field of implementation, we will make some comparison to other sectors certification schemes we have examined in the previous chapter as far as regard practicability and possible challenges from the producers side.

As it is becoming clear, the implementability of sustainability certification schemes for biofuels is a key issue for having access to the EU market. This is becoming clear to third countries producers, who, especially those representing small and medium size realities, find themselves confused in the crowded and dynamic world of mandatory certification. It is not by coincidence that almost all the biofuels project that apply for financial co-support at the Inter -American Development Bank Sustainable Energy and Climate Change Initiative[248], always include a feasibility

[248] Sustainable Energy and Climate Change Initiative (SECCI) is an Initiative, than transformed in Unit, of the Inter-American Development Bank (IADB) whose objective is to streamline climate change policies and low carbon projects inside IADB and in the Latin America and Caribbean Region (LAC). One of the pillar of SECCI activities is the development of sustainable biofuels through the co-financing, both to the private and public sector, of feasibility studies and pilot projects.

study component to check if the biofuels of feedstock product complies with the specifications required by the European Union.

4.1.1 The European Directive 2009/28/EC on the promotion of the use of energy from renewable sources

The Spring European Council in March 2007[249] affirmed the commitment of the European Union to reduce (independently) GHG emissions by 20%compared to 1990 levels. This percentage will be raised to 30% in case "…. *other developed countries undertake to achieve comparable emission reductions and that the economically more advanced developing countries make a contribution commensurate with their respective responsibilities and capabilities"*[250].

In the Council conclusion of 2007, the European Action Plan (2007-2009) "Energy Policy for Europe" was also endorsed. It included the following main elements:

- "*a binding target of a 20 % share of renewable energies in overall EU energy consumption by 2020;*
- *a 10 % binding minimum target to be achieved by all Member States for the share of*

biofuels in overall EU transport petrol and diesel consumption by 2020, to be introduced

in a cost-efficient way. The binding character of this target is appropriate subject to production being sustainable, second-generation biofuels becoming commercially available and the Fuel Quality Directive being amended accordingly to allow for adequate levels of blending"[251]

- a 20% energy efficiency improvement.

The Directive 2009/28/EC on the promotion of the use of energy from renewable sources (EU-RES-D) is part of the 20-20-20 Package adopted in the 2008 December European Council, for the achievement of the overarching EU goal of GHG

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[249] Council of the European Union, Presidency Conclusions 8/9 March 2007, 7224/1/07 REV 1 available at http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf found on December 12th 2009

[250] Council of the European Union, Presidency Conclusions 11-12 December 2008, 17271/1/08 REV 1, available at http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/104692.pdf found on December 12, 2009.

[251] European Action Plan (2007-2009) "Energy Policy for Europe", pag 21

reduction. This Directive represent an important milestone in the EU strategy towards the development of biofuels and European Member States have to comply with it starting from January 1st, 2011.

The main point is that, unlike the previous Directive 2003/30/EC[252], where the target value for biofuels consumption were indicative, in the new regulation the target is mandatory.

The Directive 2009/28/EC presents also other elements of innovation related to the sustainability of biofuels. It is, in fact, prescriptive in the requirements that biofuels need to have to be considered "sustainable" and therefore account in the 10% mandatory target. The following sustainability requirements are listed in Art. 17 of the Directive:

- GHG Saving: a minimum requirement for GHG saving, compared to fossil fuels, of at least 35%. This percentage raises to 50% starting from January 1st, 2017 and to 60% from January 1st 2018 for biofuels and bioliquids produced in installations in which production started or on after January 1st, 2017[253].

  Annex V of the Directive, indicates the following formula to calculate the GHG emissions from the production and use of transport fuels, biofuels and bioliquids:

E = eec + e l + e p + e td + e u - e sca - e ccs - e ccr - e ee

Where[254]:

E	= total emissions from the use of the fuel;
eec	=emissions from the extraction or cultivation of raw materials;
el	=annualised emissions from carbon stock changes caused by land-use change;
ep	=emissions from processing;
etd	=emissions from transport and distribution;
eu	=emissions from the fuel in use;
esca	=emission saving from soil carbon accumulation via improved agricultural management;
eccs	=emission saving from carbon capture and geological storage;
eccr	=emission saving from carbon capture and replacement; and
eee	=emission saving from excess electricity from cogeneration.

[252] Directive 2003/30/EC on the promotion of the use of bio fuels or other renewable fuels for transport. It established a reference vale of minimum proportion of biofuels equal to 2% by December 31, 2005, and 5.75% by 31 December 2010. Available at http://ec.europa.eu/energy/res/legislation/doc/biofuels/en_final.pdf, found on December 12, 2009.

[253] Directive 2009/28/CE, art. 17 para 2.

[254] Directive 2009/28/CE Annex V "Rules for calculating the GHG impact of biofuels, bioliquids and their fossil fuels comparators", part C on Methodology.

Given the above formula to calculate the GHG emissions, the energy saving will be equal to: Saving= $(E_f - E_b)/ E_f$ where E_f = total emissions from the fossil fuel and E_b = total emissions from the biofuel or bioliquid.

In order to facilitate the calculation of the savings, the Directive provides also:

- *default* values for GHG emissions for biofuels[255] (if produces with no net carbon emission from land use change). An example in this regards is the default GHG emission saving from sugar cane ethanol defined as 71% or soybean biodiesel indicated as equal to 31%;
- *default* values for the GHG emissions of the single phases of the life cycle of biofuels[256]. An example in this regards is the default value for cultivation (e_{ec}) of sugar cane ethanol listed in the Directive as equal to 14, or the one for soybean biodiesel equal to 19.

However, the *default* values, can be used only in particular circumstances, when raw materials are[257]: i) produced outside the Community; ii) cultivated in the Community in areas where it is demonstrable that GHG emissions from the cultivation phase are expected to be lower than or equal to the default value listed in Annex V part D on Disaggregated default values for cultivation" and iii) waste or residues other than agricultural, aquaculture and fisheries residues.

An issue that has not been defined yet in the EU Directive is a concrete methodology for calculating emissions from carbon stock changes caused by indirect land use changes. The Commission should submit a report, and a concrete methodology to address this issue, by the end of December 2010[258]. The Commission should also adopt, by December 2009, guidelines for the calculation of land carbon stocks[259].

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[255] Directive 2009/28/EC Annex V, Part A "Typical and Default value for biofuels if produced with no net carbon emissions from land use change".
[256] Directive 2009/28/EC Annex V, part D "Disaggregated default values for biofuels and bioliquids"
[257] Directive 2009/28/EC, art 19, para 3.
[258] Directive 2009/28/EC, art. 19, para 6
[259] Directive 2009/28/EC, Annex V, Part C on Methodology, para 10.

- Biodiversity protection: biofuels should not be made from raw materials obtained from land with high biodiversity value[260]. It means: i) primary forest and wooded land of native species not significantly disturbed by human activity; ii) natural protected areas designated by law or areas designated for the protection of threatened or endangered ecosystems or species (list by international organizations or IUCN); iii) highly biodiverse grassland (both natural and non-natural).

- Land with high carbon stock: biofuels should not be made from raw materials obtained from lands with high carbon stocks[261] to avoid risk of causing big GHG losses through the release of carbon stored in the soil and in the plants. According to the Directive, lands with such characteristics are wetlands,, continuously forested areas, undrained peatlands.

- Social pillar of the Sustainability of biofuels: there are no specific criteria to be respected for social purposes, but only monitoring or informative rules. The Commission shall, every two years, report on the impact on social sustainability both in the Community and in third countries. The report should address: availability of food at affordable price, respect of land use rights. It should also state for third countries and Member States providing high quantity of raw materials, if the main International Labour Organization (ILO) Conventions,[262] the Cartagena Protocol on Biosafety and the Convention on International Trade in Endangered Species of Wild Fauna and Flora have been ratified and implemented.

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[260] Directive 2009/28/EC, Art. 17, para 3, comma a), b) and c).
[261] Directive 2009/28/EC, Art. 17, 4 comma a), b) and c)
[262] The Directive refers to the following International Labour Organization Conventions: Convention concerning Forced or Compulsory Labour (No 29), Convention concerning Freedom of Association and Protection of the Right to Organise (No 87), Convention concerning the Application of the Principles of the Right to Organise and to Bargain Collectively (No 98), Convention concerning Equal Remuneration of Men and Women Workers for Work of Equal Value (No 100), Convention concerning the Abolition of Forced Labour (No 105), Convention concerning Discrimination in Respect of Employment and Occupation (No 111), Convention concerning Minimum Age for Admission to Employment (No 138), Convention concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour (No 182).

It is interesting to point out that the Directive does not call for the compliance to specific requirements for air, soil or water protection, but it might do so following a report that the Commission has to prepare for the European parliament and the Council by December 31, 2012.
On the certification of the sustainability criteria, Member States shall require that economic operators demonstrate that the sustainability criteria have been fulfilled and ask that a "mass balance system" is used which "i) allows consignments of raw materials or biofuels with different sustainability characteristics to be mixed and ii) requires information about the sustainability characteristics and size of the consignments to remain assigned to the mixture"[263].

In order to have an independent and reliable monitoring process, economic operators should be audited by independent certifiers. Moreover, the Commission can conclude bilateral/multilateral agreements with voluntary national or international schemes working on the sustainability of biofuels and in case they fulfil with the Directive's requirements consider them as "certifiers" for the Directive.
It means for example that if an economic operator gets a sustainability certification for biofuels from the Roundtable on Sustainable Biofuels Directive (RSB), and RSB has demonstrated to be comparable to the criteria of the EU Directive, the economic operator has not to go through the administrative procedures to prove its "sustainability". The one of RSB will be sufficient evidence of compliance.

This system of comparability would be very helpful in both lowering the administrative burden on economic operators in complying with different certification schemes around the world, and de facto will put some order in the jungle of the number of certification.

Being the EU Directive in an implementation phase, the EU Commission shall report to the EU Parliament and the Council in 2010 and in 2012 on the operations of mass balance verification method and on the possibilities to use other methods. The Commission should also establish a list of all the information required in the

[263] Directive 2009/28/EC, Art 18 Verification of compliance with the sustainability criteria for biofuels and bioliquids. Para 1 comma a) and b).

mass balance system, ensuring that the process will not represent an overwhelming administrative burden for operators, particularly the small and medium one and cooperatives[264].

While, the EU Commission seems to be aware of the problems that the compliance with sustainability standards implies, still many "grey zones" remain in the Directive that have to be solved before the end of 2010, when the EU scheme will become mandatory.

The main ones, identified by the Italian Biofuels Platform[265], have been the following[266]:

- GHG Saving: The default value indicated in Annex V could not be comprehensive
- The Ebio formula is not exhaustive. Specific methodologies for single production phases are lacking. Some examples:
  - The calculation of the emissions for the cultivation phase (e ec) presents problems, because the Directive does not specify a methodology that takes into account NO2 and CH4 emissions coming out as fertilizers.
  - The calculation of the Transport and Distribution phase (e td) the Directive does not specify which emissions to include. An example of inaccuracy is that once the trucks or other transport means have unload the fuel or raw materials, the trip back with empty trunk are not considered. The emissions from land use change are not easy to be calculated, until the Commission will adopt a guide for the calculation of the carbon stock in the land.

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[264] Directive 2009/28/EC Art 18, para 3.

[265] The Italian Biofuels Platform, coordinated by the Alma Mater University of Bologna, is composed by all the major biofuels stakeholders coming from the private, public and academic sectors of Italy. Its main objective is to highlight and address challenges related to the implementation of EU and international regulations related to biofuels in the national law. The Platform also provides contribution and updated scientific knowledge both to institutions and public on biofuels. http://www.unibo.it/Portale/Ricerca/Servizi+Docenti+Ricercatori/finanzeuropei/biofuelsitalia.htm downloaded on January 10th, 2010

[266] Adapted from Carratù L., Visconti G. (2009)"Attuazione della recente normativa comunitaria nel campo dei combustibili e successivi sviluppi: elementi di criticità sulla sostenibilità", Piattaforma Italia Biofuels.

- A bonus factor of 29 gCO2/MJ for the use of degraded lands has been included, but indirect land use change even if in degraded lands are not computable until the Commission comes up with a method to calculate it.
- In the GHG emissions attribution of co-products, the energy allocation method has been chosen. It could present inaccuracies for example in the case of co-products used as animal feeds. The Commission should examine the possibility to use also the substitution method, other than the energy allocation one.

4.1.2 Environment Protection Agency Renewable Fuel Standard (RFS)

As we have already described in Chapter 1, the U.S. 2007 Energy Bill, called Energy Independence and Security Act of 2007 (EISA), committed U.S. to increase the volume of renewable fuels used each year, beginning with 9 billion gallons in 2008, leading to 36 billion gallons by 2022.[267].

Table 4.1: New Renewable Fuel Volume Requirements (Billion Gallons)

	Cellulosic biofuel requirement	Biomass-based diesel requirement	Advanced biofuel requirement	Total renewable fuel requirement
2009	n/a	0.5	0.6	11.1
2010	0.1	0.65	0.95	12.95
2011	0.25	0.80	1.35	13.95
2012	0.5	1.0	2.0	15.2
2013	1.0	a	2.75	16.55
2014	1.75	a	3.75	18.15
2015	3.0	a	5.5	20.5
2016	4.25	a	7.25	22.25
2017	5.5	a	9.0	24.0
2018	7.0	a	11.0	26.0
2019	8.5	a	13.0	28.0
2020	10.5	a	15.0	30.0
2021	13.5	a	18.0	33.0
2022	16.0	a	21.0	36.0
2023+	b	b	b	b

Source: EPA Office of Transportation and Air Quality EPA-420-F-10-007 Feb. 2010[268]

EISA established specific GHG emissions thresholds for the various categories of fuels, mandating specific percentage improvements compared to the emissions of a 2005 baseline for gasoline and diesel. In calculating the GHG emissions, a life cycle assessment has to be performed, including production and transport of the feedstock, land use change (both direct and indirect), production, distribution and blending of the renewable fuel, and end use of the renewable fuel.

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[267] Energy Independence and Security Act of 2007 http://www.govtrack.us/congress/billtext.xpd?bill=h110-6

[268] EPA (2010) Office of Transportation and Air Quality EPA-420-F-10-007 Feb. 2010 available at http://www.epa.gov/OMS/renewablefuels/420f10007.htm downloaded on February 14th, 2010

Table 4.2: Lifecycle GHG Thresholds Specified in EISA (% reduction from 2005 baseline)

Renewable Fuel[269]	20%
Advanced biofuels	50%
Biomass-based diesel	50%
Cellulosic biofuels	60%

Source: EPA, Office of Transportation and Air Quality, 420-F-10-007 February 2010 [270]

According a rationale already followed by the EU Directive on renewable, in order to be accounted for the renewable mandated set by EISA, renewable fuels have to demonstrate a reduction of GHG according to the above table 4.2.

According to the standards finalized in 2010, the RFS program has been expanded to all transportation fuels. It means that further to gasoline and diesel to be used in road vehicles, it now covers also non-road, locomotive and marine engines.

The standards apply to refiners, blenders, and importers of transportation fuel (with some flexibilities for small refiners), and their percentage standards apply to the total amount of gasoline and diesel they produce for such use[271].

According to EPA estimations, the increased use of renewable fuels needed to reach the 36 billion gallons mandated by 2022 is estimated to reduce dependence of foreign oil by 41.5 billions, and reduce greenhouse gas emissions by138 million metric tons by 2022 (equivalent to remove 27 million vehicles from the road). By 2022, the increased use of renewable fuels is expected to decrease gasoline costs by 2.4 cents per gallon and to decrease diesel costs by 12.1 cents per gallon[272].

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[269] The 20% criterion applies to renewable fuel from new facilities that commenced construction after December 19, 2007

[270] EPA (2010), Regulatory Announcement, EPA finalizes Regulations for the National Renewable Fuel Standard program for 2010 and Beyond, Office of Transportation and Air Quality EPA-420-F-10-007 February 2010

[271] EPA (2010), Regulatory Announcement, EPA finalizes Regulations for the National Renewable Fuel Standard program for 2010 and Beyond, Office of Transportation and Air Quality EPA-420-F-10-007 February 2010

[272] EPA (2010) Office of Transportation and Air Quality "Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis", EPA-420-R-10-006 February 2010

Differently from the EU Directive, EPA has included already a methodology to calculate direct and indirect land use change and their impacts in terms of GHG. The EU Commission has still to deliver a methodology to calculate them.

EPA's draft results demonstrate that indirect land use change can determine considerable emissions of GHG especially in the near terms, but this will be paid back by the displacement of oil by biofuels in the medium term.

Some scenarios related to lifecycle GHG emissions reductions for different time horizon and discount rate approaches have been produced. Using a model with two options, 30 years time period for assessing future GHG emissions impact and values equally all emissions impacts regardless of time of emissions impact (0% discount rate) and a 100 year time period and discount rate of emissions equal to 2%. In the draft regulation, published in 2009, corn ethanol (natural gas dry mill) in the 30 year scenario presented GHG 5% more than those of oil, and in a 100 years time horizon they account fro a -16%. According to the new rules it reaches the 20% reductions and therefore accounts as a renewable fuel.

The scenarios and assumptions developed by EPA in the draft regulation of 2009 have been extensively argued. They range from not having considered innovation and technology breakthroughs in the agricultural productiveness, to the static policy framework with no consideration of a possible new legislation more strict on the GHG emissions or with the introduction of a cap and trade system[273].

The finalized rules published in 2010 have been modified quite consistently in this regard.

Here are the main elements:

> "Ethanol produced from corn starch at a new natural gas, biomass, or biogas fired facility (or expanded capacity from such a facility) using advanced efficient technologies (ones that we expect will be most typical of new production facilities) will meet the 20% GHG emission reduction threshold compared to the 2005 gasoline baseline;

[273] Lee, Henry and Charan Devereaux. "Biofuels and Certification: A Workshop at the Harvard Kennedy School of Government" Discussion Paper 2009-07, Environment and Natural Resources Program, Belfer Center for Science and International Affairs and Sustainability Science Program, Center for International Development, Harvard University, June 2009. Available at http://belfercenter.ksg.harvard.edu/files/Biofuels%20and%20Certification%20Harvard%20Workshop%20Report%2009%20web.pdf found on December 14th, 2009.

Biobutanol from corn starch also meets the 20% threshold;

Biodiesel and renewable diesel from soy oil or waste oils, fats, and greases will meet the 50% GHG threshold for biomass-based diesel compared to the 2005 petroleum diesel baseline.;

Biodiesel and renewable diesel produced from algal oils will also comply with the 50% threshold should they reach commercial production;

Ethanol from sugarcane complies with the applicable 50% reduction threshold for advanced biofuels;

For cellulosic ethanol and cellulosic diesel, the pathways modeled (for feedstock and production technology) would comply with the 60% GHG reduction threshold for cellulosic biofuel"[274]

An additional issue raised by the Ethanol industry and related to the new mandated targets for biofuels, is the waiver application to EPA concerning the possibility to allow conventional blends of gasoline to include up to 15% ethanol by volume (E15), expanding in this way the potential ethanol market by nearly 50%. The current limit is 10% ethanol (E10) for conventional blends of gasoline.

Finally, the scheme allows some exceptions for small producers, defined as Parties who produce or import less than 10,000 gallons of renewable fuels per year. They are not required to generate RINs for that volume, and are not required to register with EPA if they do not take ownership of RINs generated by other parties. In addition, EPA is also finalizing a temporary exemption for renewable fuels producers who produce less than 125,000 gallons per year from new production facilities. They should not required to generate and assign RINs to batches for a period up to 3 years[275]

[274] EPA (2010) "Lifecycle Analysis of Greenhouse Gas Emissions from Renewable Fuels", EPA-420-F-10-006, February 2010, pag 2 available at http://www.epa.gov/otaq/renewablefuels/420f10006.htm#3 downloaded on March 5th 2010

[275] EPA (2010) 40 CFR Part 80 [EPA-HQ-OAR-2005-0161; FRL-XXXX-X] RIN 2060-A081 Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, February 2010 available at http://www.epa.gov/otaq/renewablefuels/rfs2-preamble.pdf pag. 141, downloaded on February 14, 2010

4.1.3 California Low Carbon Fuel Standard

California's Low Carbon Fuel Standard (LCFS) approved by the California State in January 2010[276] requires a 10% reduction in the average greenhouse gas (GHG) emission intensity of the state's transportation fuels by 2020. The LCFS uses a market-based emission trading mechanism for compliance, allowing regulated parties to develop their own strategy for compliance, including buying credits from other regulated parties. The LCFS applies to all potential transport fuels, including electricity, hydrogen, compressed natural gas, and biofuels among others. Given current technology constraints, biofuels will probably supply the majority of the target[277].

The LCFS includes emissions from indirect land use change (iLUC) in its greenhouse gas accounting methodology. It currently assigns an iLUC factor depending on the type of feedstock and the location of the feedstock. Producers and blenders will be assigned this iLUC factor, regardless of the specificities of their production. However, if producers want to provide documentation, data, and analysis showing that their iLUC emissions are lower than the default value for their region and factor they are able to do so by applying to CARB.

It does not include any sustainability criteria other than a requirement for a reduction in greenhouse gas emissions. However, California Air Resource Board (CARB) and the California Energy Commission are in the process of reviewing sustainability criteria adopted by other voluntary and regulatory institutions and will most likely adopt the sustainability criteria of the Roundtable on Sustainable Biofuels in early 2010[278].

The chain of custody requirements for the LCFS is to show documentation of the Physical Pathway of the fuel. The Physical Pathway should include all methods of transport and delivery of the final product from the source.

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[276] State of California, Final regulation Order on Low Carbon Fuel Standard available at http://www.arb.ca.gov/regact/2009/lcfs09/finalfro.pdf downloaded on March 4th 2010

[277] California Environmental Protection Agency (2009) "Proposed Regulation to Implement the Low Carbon Fuel Standard", March 2009 available at http://www.arb.ca.gov/fuels/lcfs/030409lcfs_isor_vol1.pdf downloaded on February 28th, 2010

[278] Interview with a representative of California Energy Commission on January 26th, 2010 on the occasion of the Meeting on sustainability certification schemes organized by Packard Foundation on January 25-26th, 2010

Finally, on the occasion of presentation given by a representative of the California Energy Commission, on the expectations from sustainability programs, the declaration given was very much in line with the purpose of this research: "*to focus program principles and criteria on the tangible and realistic: no soft and fuzzy and don't try and save the world via sustainability!*".

4.1.4 United Kingdom's Renewable Transport Fuel Obligation

The Renewable Transport Fuel Obligation (RTFO)[279], beginning in April 2008, placed an obligation on refiners and importers of fossil fuels supplying at least 450,000.00 litres per year, to ensure that a certain percentage of their aggregate sales were made up of biofuels. The goal of this obligation is to requiring 3.25% by volume of all fuel sold in the UK to come from a renewable source by 2010. The targets than increase year by year, reaching 5.26% by 2013-2014[280].

In order to show demonstration with RTFO, suppliers have to redeem Renewable Transport Fuel Certificates (RTFCs) from the Renewable Fuels Agency (RFA) at the end of each year.

Each litre of biofuels reported to RFA, is awarded with one RTFCs. The way to get RTFCs is through supplying directly biofuels, or buying them from other biofuels suppliers, creating in this way a real market where to trade certificates.

Biofuels suppliers have to report the volume and carbon and sustainability characteristics of their fuels through an online reporting system managed by the RFA. The RFA than publishes reports on a regular basis on the biofuels supplied in the UK (monthly), on the performance of individual suppliers (quarterly) and on the overall impact of RTFO (yearly).

The information requested for the monthly reporting includes carbon and sustainability reporting.

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[279] The Renewable Fuel Transport Obligation Order (2009) available at http://www.renewablefuelsagency.gov.uk/_db/_documents/RTFO_Order_as_amended_April_2009.pdf downloaded on March 4th 2010

[280] The Renewable Fuel Transport Obligation Order (2009), Part 2, chapter 4, para 4

The first one is based on lifecycle emissions from direct land use change, cultivation, processing and transport of biofuels. Suppliers can utilize their own actual emissions calculating real data, or using default values based on fuel type, feedstock and country of origin.
Sustainability reporting includes environmental principles such as potential loss of carbon stock and biodiversity, impact on air, water and soil quality. It also includes social sustainability principles such as respect of land and workers rights.
The RTFO does not currently include iLUC, but is likely to have to do so with integration with the EU RED.

The RTFO relies on "Qualifying Standards" which are feedstock specific as a way for producers to prove their compliance with the minimum requirements. Qualifying standards include voluntary certification schemes like the Roundtable on Sustainable Palm Oil and other feedstock specific certification schemes. This method of using qualifying standards or a "meta-standard" approach is similar to what the EU will adopt, is how the RSB has been designed, and is what the LCFS is considering.
The RTFO accepts all methods of chain of custody, but in the absence of a chain of custody system under the qualifying standard, the RTFO operates under a "mass balance approach".
On January 28th 2010, RFA has presented to the UK Parliament the first Annual Report on RTFO for the period April 208-April 2009[281].
What has emerged from the report is that several suppliers did not demonstrate the sustainability of their biofuels, or failed to have their data verified to the RFA's satisfaction.
Table 4.3 shows the targets that RFA set for Carbon and Sustainability reporting. These targets are not mandatory, but only (at least at this stage) indicative of the level of performances of suppliers.
As we can see, while the GHG saving and the data reporting targets have met the Government's expectations, this is not the case for the Environmental Standards.

[281] UK Renewable Fuel Agency (2010), "Year One of the RTFO" available at http://www.renewablefuelsagency.gov.uk/_db/_documents/year_one_of_the_rtfo_a4.pdf downloaded on March 7th, 2010

Table 4.3: UK Government targets versus suppliers performances

	Government target for 2008/09	Performance 2008/09
Percentage of feedstock meeting a Qualifying Environmental Standard	30%	20%
Annual GHG saving of fuel supplied	40%	46%
Data reporting of renewable fuel characteristics	50%	64%

Source: RFA (2010) "Year One of the RTFO[282]

According to interviews[283] with biofuels suppliers that had to comply with RTFO certification scheme, the biggest struggle was the quality of data along a global supply chain especially in the case of multinationals that operate simultaneously in different markets around the world.

In addition, some rules were not easily understandable relating to how to store and classify mixed feedstocks. In comparison the supply chain for oil industry has been demonstrated to be very efficient, because differently from biofuels, it is based on a homogenous product.

On the other hand producers admitted that having the reports issued by RFA public, is a strong incentive for reputational effects to perform well and to demonstrate a high commitment for sustainability.

4.1.5 Global Bioenergy Partnership (GBEP)

GBEP was launched on the occasion of the G8+5 (Brazil, China, India, Mexico and South Africa) Gleneagles Summit in the year 2005.

GBEP
Global Bioenergy Partnership

[282] UK Renewable Fuel Agency (2010), "Year One of the RTFO"
[283] Interviews made on January 25th on the occasion of the IDB workshop on Challenges to comply with sustainability certification schemes for biofuels.

The mandate that was given to GBEP in the Gleneagles Plan of Action was "*to support wider, cost effective, biomass and biofuels deployment, particularly in developing countries where biomass use is prevalent*".
The mandate of GBEP in the following years was tailored in a more specific way by the G8 Summits in the years that followed, directing the Partnership more to the sustainability dimension of biofuels and to the definition of a methodology for GHG measurement[284].

The membership of GBEP[285] is mainly composed by Governments and UN family organizations with few exceptions, and a Term of Reference has to be signed in order to become official Partner, defining the Partnership's goals and functioning.
GBEP is governed by a Steering Committee that, on a consensus basis, decide about Partnership's strategy and program of work, a Technical Working Group assist the Steering Committee on the practical work and facilitate the decision process through technical expertise, and finally a Secretariat housed at FAO Headquarters in Rome facilitate the communications among the Partners and is in charge of administrative matters.
Following the yearly mandates given by the G8 Summit, the Partnership is focusing its activities mainly on two main tracks:

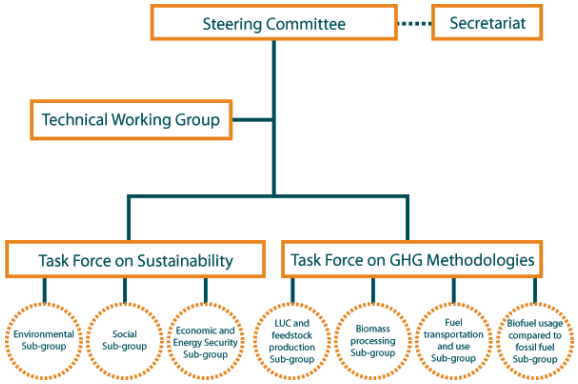
- **Task Force on Sustainability,** whose mandate is to "develop a set of relevant, practical, science-based, voluntary criteria and indicators as well as examples of best practice regarding the sustainability of bioenergy. The

[284] In 2007 it was given a renewed mandate by the G8 Heiligendamm Summit to "*continue its work on biofuel best practices and take forward the successful and sustainable development of bioenergy*" (G8 Summit Declaration - Heiligendamm, 7 June 2007). In 2008, the G8 Hokkaido Toyako Summit invited GBEP to "*work with other relevant stakeholders to develop science-based benchmarks and indicators for biofuel production and use*". (G8 Summit Declaration - Hokkaido Toyako, 8 July 2008). In 2009, GBEP received a new mandate by the G8 Summit of L'Aquila: "*We welcome the work of the Global Bioenergy Partnership (GBEP) in developing a common methodological framework to measure greenhouse gas emissions from biofuels and invite GBEP to accelerate its work in developing science-based benchmarks and indicators for sustainable biofuel production and to boost technological cooperation and innovation in bioenergy*". (G8 Summit Declaration – L'Aquila, 8 July 2009)
[285] Current Partners are: Brazil, Canada, China, Fiji Islands, France, Germany, Italy, Japan, Mexico, Netherlands, Paraguay, Russian Federation, Spain, Sudan, Sweden, Switzerland, Tanzania, United Kingdom, United States of America, Food and Agriculture Organization of the United Nations (FAO), International Energy Agency (IEA), United Nations Conference on Trade and Development (UNCTAD), United Nations Department of Economic and Social Affairs (UN/DESA), United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), United Nations Foundation, World Council for Renewable Energy (WCRE) and European Biomass Industry Association (EUBIA).

criteria and indicators are intended to guide any analysis undertaken of bioenergy at the domestic level with a view to informing decision making and facilitating the sustainable development of bioenergy in a manner consistent with multilateral trade obligations"[286]

- **Task Force on the definition of a common methodological framework on GHG emission reduction measurement from the use of biofuels for transportation and from the use of solid biomass.** The Task Force has released in June 2009 a report containing a common methodological framework for the use of policy makers and stakeholders when assessing GHG impacts by which the results of GHG lifecycle assessments could be compared on an equivalent and consistent basis.

Figure 4.1: GBEP Structure



Source: GBEP website

We will focus here on the work of the Task Force on Sustainability that is de facto working on criteria and indicators for the sustainability of biofuels.

The Task Force, as it is shown in Figure 1, has divided its work into 3 Sub-Groups, each of them focusing on a different pillar of Sustainability: Environmental, Social and Economical.

While the Criteria have been almost defined (but the agreement is conditional to the definition of the related specific indicators), the Task Force is trying to identify specific indicators in order to measure the compliance with the above criteria.

[286] GBEP Task force on Sustainability Scope and Program of work available at http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/2008_events/5th_SC/GBEP_sustainability_18_June_2008_final_approved.pdf, found on December 16, 2009

It is expected to present a completed work at the G8+ Summit in Canada, in the Summer of 2010.

Even if at draft level, it would be interesting to look at the list of provisional criteria defined by GBEP

Table 4.4: Draft list of GBEP Sustainability Criteria

Environmental Basket Criteria
GHG Emissions
Productive Capacity of land and ecosystems
Air quality
Water availability, use efficiency and quality
Biological diversity
Economic Basket Criteria
Resource Availability
Resource use efficiencies in bioenergy production, conversion, distribution and end-use
Economic Development
Economic viability and competitiveness of bioenergy
Access to technology and technological capability
Social Basket Criteria
Food security
Access to land, water and other natural resources
Labour Conditions
Rural and Social Development
Access to Energy
Human Health and Safety

A discussion is on going on the definition of particular indicators, and both the issues of co-products as well as indirect land use change are generating debate on how to measure them in a scientific way, due to the uncertainties that are still in place at scientific level.

The criteria a principle for selecting the indicators GBEP has put at the front of the work are:

- **Relevance** in terms of importance in measuring that particular criteria;
- **Practicality**: using, if existent and qualitatively relevant, existing methodologies. At the same time quantitative indicators, where possible, are preferred to qualitative ones;
- **Geographical Scale**: capturing both national and international effects of national-level bioenergy production and use.
- **Comparison with fossil fuels**: allowing comparison between bioenergy and fossil fuel equivalent, where possible.

The way sustainability certification criteria and indicators will work in practice, is still not clear. The goal as we described earlier is to inform and guide policy makers in the analysis of bioenergy policies at domestic level.
GBEP, as an assessment tool is still perceived in a hybrid phase not seeming to end up with a real certification approach with a GBEP label, as the RSB nor being mandatory in defining policies at domestic level for Governments.
Even if the GBEP is a voluntary partnership, whose outcomes/decisions are not mandatory binding, due to the highly sensitiveness of the work content of the Partnership (sustainability criteria and indicators are a clear example in this regard), Partners/Governments do act almost as they are in a formal negotiation context.

The clear added value of having sustainability criteria and indicators for biofuels agreed at international level by all key players such as USA, Brazil, some EU countries, with the significant support of UN organizations, is the political weight of such an agreement.
This political weighted agreement can represent a key element for example in the trade arena, where according to art 3.1 of the Doha round environmental good and

services can be subject to a "reduction, or, as appropriate, elimination of tariff and non tariff barriers".

Being biofuels possibly be part of environmental goods, an "agreed way" for defining biofuels sustainable would be needed. This "way" might be the sustainability criteria and indicators for biofuels agreed at GBEP level.

4.1.6 The Roundtable on Sustainable Biofuels (RSB)

The Roundtable on Sustainable Biofuels (RSB)[287], established in November 2006, is an international initiative that engages in a multi- stakeholder process different biofuels stakeholders such as farmers, private companies, non-governmental organizations, international agencies and foundations and some governments[288].

The main activity of the RSB is to carry out a set of agreed principle and criteria fro certifying the sustainability of biofuels at project base.

To this end the RSB defined a first draft of principle and criteria, called Version 0, that after a public consultation revision, became a Version 1.0 (November 2009) standards and criteria for biofuel production.

In the first half of the year 2010 RSB, will test the practicability of these standards through a pilot testing activity. This represent a very positive decision, that demonstrate a pragmatic approach focused on the practicability and doability other that in a wishing list of nice criteria that can be very far from reality.

This work has found a great interest from the IADB, given the interest of Latin American and Caribbean producers in having access to European markets for biofuels and not be taken away from the business. To this end, the IADB has encourage its LAC clients to candidate themselves as pilot case study. This, on one hand could make clients "uncomfortable" in disclosing all the specifications related to their environmental and social performance, on the other hand it will give them a "first mover" advantage in getting RSB certification and in tailoring on them

[287] Roundtable on Sustainable Biofuels website http://cgse.epfl.ch/page65660.html downloaded on January 10, 2010

[288] Full list of RSB partners available at http://cgse.epfl.ch/page77270.html downloaded on January 10, 2010

eventual modification that Version 1.0 will have to be subject to for (un)practicability reasons.

This is even more important, due to the clever strategy of RSB to adopt a meta-standard approach which benchmarks other certification efforts based on the RSB's principles and criteria[289].

In this regard, the most promising and interesting discussion is in place between the RSB and the European Commission, for having RSB able to be comparable to the specifications mandated by EU on the sustainability side of biofuels. In this way, producers can get a an RSB certificate that complies with the EU certification requirement for biofuels having access in this way to the EU market[290].

Let's examine the governance/structure of the RSB as well as the principle and criteria set up in Version 1.

On the governance aspects, RSB has an open membership that is divided into Chambers representing the different actors along the biofuels supply chain, as well as different types of civil society and government groups.

The Chambers each elect two members to the RSB Steering Board that, according to the Terms of reference that govern its functioning, is in charge of all of the decisions regarding the RSB strategy, the standards, and approve, on a consensus basis, the different options for certification.

The Secretariat, who is responsible for all the administrative issues, the communications flows, meetings convening, is bases at Ecole Politechnique Federale de Lausanne (EPFL).

Finally, experts groups for addressing specific topics can be convened as a support for the decisions to be taken by the Steering Committee.

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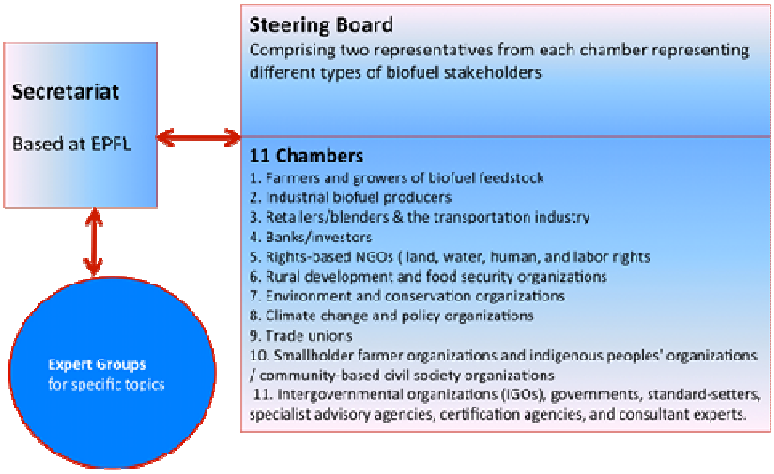
[289] E4tech (2009) "The RSB GHG accounting scheme – Feasibility of a meta-methodology and way forward", report prepared for the RSB Version 4.1, October 8, 2009 available at http://cgse.epfl.ch/webdav/site/cgse/shared/Biofuels/Documents%20and%20Resources/09-10-08_E4Tech%20Report%20GHG%20Accounting_V4%201_08October09.pdf downloaded on January 14, 2010

[290] RSB (2009), RSB Standard for EU market access, Technical draft, Version 0.1, RSB Reference code RSB-STD-20-002available at http://cgse.epfl.ch/webdav/site/cgse/shared/Biofuels/RSB%20Certification/09-11-06%20RSB-STD-20-002-vers%200.1-EU%20access%20standard.pdf downloaded on January 13, 2010

Figure 4.2: RSB Governance Structure



Source: RSB website

Let's examine in brief the principle and criteria included in the Version 1.0[291].

They provide specific requirements along the entire supply chain of biofuels and are addressed to four types of operators – feedstock producers, feedstock processors, biofuels producers and blenders – for whom specific standards are applied.

Version 1.0 include the following 12 Principles:

- Principle 1: Legality
- Principle 2: Planning, Monitoring and Continuous Improvement
- Principle 3: Greenhouse Gases Emissions
- Principle 4: Human and Labor Rights
- Principle 5: Rural and Social development
- Principle 6: Local Food Security
- Principle 7: Conservation
- Principle 8: Soil
- Principle 9: Water
- Principle 10: Air
- Principle 11: Use of Technology, Inputs, and Management of Waste
- Principle 12: Human Rights

[291] RSB (2009) Principles and Criteria for Sustainable Biofuels Production, RSB Reference Code TSB-STD-20-001 – Version 1.0, November 12, 2009 available at http://cgse.epfl.ch/webdav/site/cgse/shared/Biofuels/Version%20One/Version%201.0/09-11-12%20RSB%20PCs%20Version%201.pdf downloaded on January 12, 2010

Each Principle include a criterion and minimum specific requirements have to be met.
The GHG accounting methodology is still under development, and will include a threshold after results from pilot testing are submitted. The RSB is currently considering a minimum reduction below the applicable fossil fuel baseline (minimum GHG emission reduction threshold) of either 10%, 40%, or 70%. Once the initial threshold will be defined, it shall increase over time in a dynamic and ambitious way.

For the moment RSB does not provide specific criteria and requirements related to indirect land use change (iLUC), criteria listed above do only address the direct activities that farmers and producers can undertake to prevent unintended consequences from biofuels production. In any case, being the iLUC a "sensitive" issue in the determination of the sustainability of biofuels, specific studies will carried out in 2010 to evaluate if and how this aspect can be included in the RSB criteria.

It is interesting to note that RSB for particular principles, the one on Soil and the one on Water, specific, simplified, minimum requirements are requested for "small scale operators".
As we have seen in the criteria set out by the Forest Stewardship Council and by the EU regulation on Organic Food, there is the recognition that certification requirements can be of difficult implementation for small scale producers for lack of data, know how, problems in dealing with transaction costs.
Ad hoc requirements seem to be a fair way to keep small scale producers in the loop of sustainability certification, taking in this way the market advantages to be labeled with a "tailored" way for them to comply

As we have described above, RSB, such as also other Roundtable related to biofuels production (es. Better Sugarcane Initiative) are transitioning from the status of forum for stakeholders to discuss and hopefully agree on sustainability standards, to a more business oriented one of "certifiers".
The rationale behind acting as meta-standards providers is a wise one, especially when especially in a first stage the sustainability requirements that will lead the

market will be the mandatory one of the EU and of the US one. As we have seen in the first Chapters of this research, the target mandates of E and USA have in a way spurred the market of biofuels and they will in this way dominate with their own rules (EU Directive 2009/28/EU and EPA requirements) to have access to their markets.

Therefore RSB, such as BSI, will be in the position to provide, through the meta-standard approach, a certification for operators on the basis of the market they want to have access to.

In this way operators can have a single interlocutor to work with and in case of request of multi certification, for example access to different markets let's say EU and US, a simplified process and, maybe, a cost reduction for certification.

Finally, RSB Principle and Criteria Version 0 has already had some practical application in the realm of "green banking". IADB for example has created the IADB Sustainability Biofuels Scorecard[292], based on RSB criteria and principles, as a tool to pre-screening biofuels projects that ask for financial support from the Bank. The Scorecard assign colours – red, yellow and green – to the different performances of the project according to different criteria.

In case the project ranks, according to the RSB criteria red from a sustainability standpoint, it will not be considered further by the Bank for support. In case it ranks in yellow, the Bank asks for sustainability improvements before proceeding for evaluation in case it ranks green it can be suitable for further evaluation in the decision process for financing.

4.1.7 Other voluntary schemes: Roundtable on Sustainable Palm Oil, Better Sugarcane Initiative, Roundtable on Responsible Soy and Council on Sustainable Biomass

In this paragraph we will examine briefly the sustainability criteria defined by other more specific roundtables/organizations dealing with biofuels.

As it is already clear by the number of schemes described in this chapter, there is a "crowded" situation in dealing with biofuels sustainability.

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[292] IADB Sustainability Biofuels Scorecard available at http://www.iadb.org/biofuelsscorecard/ downloaded on January 13th, 2010

The Roundtable on Sustainable Palm Oil

was formed in 2004 in response to the global concern regarding unsustainable palm oil plantations and rising demand due to biofuels and oils without transfats.

The RSPO's objective is to "promote the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders"[293]. The RSPO is a non-profit organization made up of stakeholders from oil palm producers, palm oil processors, consumer goods manufacturers, retailers, banks and investors, environmental and nature conservation NGOs and social or development NGOs, to develop and implement global standards for sustainable palm oil.

The RSPO Principles and Criteria (P&C) were adopted in November 2005 for an initial pilot implementation period of two years and to be reviewed at the end of this period (2007). The objective of the pilot implementation period was to enable field-testing of the principles and criteria and associated guidance, and thereby allow the indicators and guidance to be improved, including guidance for application by smallholders. During this initial period, national interpretations and trial implementations were also progressed.

The Principles and Criteria of the RSPO include many of the same or similar components of the other biofuels sustainability voluntary and mandatory efforts including biodiversity protection, labour rights, restrictions on land conversion, and transparency and consultation, among others. Some key differences of the RSPO are that it does not currently include any GHG criteria, although there is a working group in place; and the date for which conversion of forests and HCVs are prohibited. The RSPO established November 2005 as the baseline year as that was when the Principles and Criteria were being defined. The RSPO accepts fully segregated, mass balance, and book and claim chain of custody certification methods.

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[293] RSPO mission and objective available at http://www.rspo.org/?q=page/16 downloaded on March 7th, 2010

The Better Sugarcane Initiative (BSI) is a voluntary non-profit multi-stakeholder organization aiming to improve the social, environmental, and economic sustainability of sugar cane production.

BSI was put on a permanent footing in June 2007 and includes farmers, processors, intermediary and end users and NGO's. BSI released Version 1 of their standard in February 2009 followed by a public comment period. BSI recently released Version 2 in November 2009[294], which includes five general principles related to human rights, production and processing, biodiversity and ecosystems, continuous improvement, and obeying the law. The BSI standard does include a criterion under Production and Processing pertaining to GHG emissions, which sets a maximum threshold for grams per ton of sugar or grams per Mega Joule of ethanol produced depending on the type of production of the facility. BSI uses January 2008 as a baseline year for considering emissions from land use change, consistent with the EU Directive. The BSI also allows the use of default values for selected countries, consistent with the UK's RTFO (PAS 2050, BSI 2008). BSI's preferred chain of custody systems are mass balance (for EU compliance) and book and claim.

The Roundtable on Responsible Soy (RTRS) was formed in 2004 as a multi-stakeholder dialogue intended to promote the use of a responsible standard of soy production, processing, and trade[295].

The RTRS includes producers, industry, trade, finance, and civil society organizations. In May 2009, the RTRS approved Principles and Criteria for Field Tests. The RTRS is currently conducting field tests for one year, in order to revise the P&C based on practical experience, upon which they will be able to begin certifying. The RTRS does not currently include a GHG threshold, but does include a criterion to reduce emissions. The RTRS uses a cut-off date for native habitat

[294] BSI (2009) Standards Version 2.0 http://www.bettersugarcane.org/bsi_standard_2.html
[295] Round Table on Responsible Soy http://www.responsiblesoy.org/index.php?option=com_jevents&task=icalrepeat.detail&evid=24&Itemid=56&year=2010&month=02&day=17&uid=93d9bdea0a2b690b70598412940e1546&lang=en

conversion of May 2009, unless evidence can be provided showing the absence of primary forest, High Carbon Value (HCV), and local peoples' lands.

The Council on Sustainable Biomass Production (CSBP) is a multi-stakeholder organization established in 2007 to develop comprehensive voluntary sustainability standards and certification program for the production of biomass and its conversion to bioenergy in the US. The CSBP includes participation from growers, environmental and social interest groups, and all sectors of industry. The US Departments of Agriculture and Energy, as well as the US Environmental Protection Agency, provide technical support to CSBP. CSBP certification will only be applicable to non-food crops, including dedicated fuel crops, crop residues, purpose-grown wood, forestry residues, and native vegetation. CSBP released for public comment and expert review a draft standard for biomass production in September 2009, with plans to release a Provisional Standard in April, 2010. CSBP will then conduct field-testing over the next two years to review and revise the standard based on practical experience. CSBP will begin development of a biomass users standard (for refineries and electricity power facilities) in the second quarter of 2010. Both standards will be completed by 2012.

The CSBP will have a scaled certification system enabling participants to achieve silver or gold certification depending on the level of sustainability achieved. The CSBP biomass standard addresses a full range of environmental, economic, and social issues. With respect to greenhouse gas emissions, "*CSBP is likely to set the silver standard at a level equivalent to the minimum reduction that is set by the U.S. Renewable Fuels Standard 2 (in current law a 60 percent reduction compared to gasoline blended in 2005). For the gold standard, CSBP is likely to require a substantially greater reduction in emissions than is required for RFS biofuels*"[296] (CSBP 2009). CSBP is still considering how to address emissions from indirect land use change.

[296] CSBP (2009) Draft Standard September 11, 2009 available at http://www.csbp.org/files/survey/CSBP_Draft_Standard.pdf downloaded on February 10th 2010

4.2 What does a certification scheme implies. Specification and analysis of its main dimensions

Last paragraph has shown the multiplicity of sustainability certification schemes that are in place or under negotiation, both at mandatory and voluntary level.
Some of them are comparable, other are about to become meta-standards. In any case the world of sustainability certifications schemes for biofuels is dynamic and they will accommodate themselves according to implementation challenges and opportunities.

Mandatory schemes will oblige producers at all level to be certified like for example in the case of European producers. At the same time also the producers that intend to export into markets that have a certification in place will be de facto "obliged" to comply with the same standards and to be certified.
It will implies a series of issues such as the increase in transaction costs, governance issues both at national institutional level and for the private sector, at level of trade rules, especially in the framework of WTO.
The availability of data, and especially their comparability to standard values in place in developed countries will represent also a challenge, especially in developing countries and for small scale producers.

This paragraph will examine the above challenges especially in a developing country perspective,
trying to underline at the same time the real possibility of implementation and verification.

4.2.1 Transaction costs

The compliance to the sustainability certification of biofuels will imply additional costs to the production of biofuels.
These costs will depend on multiple factors such as the strictness of standards to be met, the number of requirements to be met, their specificity, inclusiveness, the size and complexity of the operation.
In order to simplify the picture they can be categorized in direct and indirect costs. The first ones are related to the cost that producers have to pay for the auditing. As it

has been noted, availability of good quality auditing can be at least in these first year a hard task. Biofuels auditing requires a broad spectrum of competences that go from water to air quality to GHG and social standards. The second one, the indirect costs, are related to the implementation of higher standards – environmental, social- that are associated with the certification requirements. According to interview with international auditors, the indirect cost represent the higher part.

Many factor concur to a disproportionately higher cost for developing countries, especially for small scale producers to get certification and comply with sustainability standards.

Reasons are multiple. They range from the need to hire international certifiers, due to the lack of accredited local certifiers in some developing countries, to the lack of national regulation that in a way create the basis to comply with from an environmental and social point of view. For this reason, some producers have to begin from the scratch in dealing with these policies, and of course, the so called indirect effects of certification- the compliance with standards (not higher ones, as maybe they are not requested by domestic law) implies a complete updated of industrial processes.

According to UNCTAD (2008)[297], this cost can be also 50% higher compared to the one of developed countries.

Moreover, small scale producers due to the lack of dedicated personnel for dealing with auditors requests in terms of data, questionnaires, etc have to budget also the amount of time to be dedicated to the certification audit. This is not a secondary element, in a situation where few people run the enterprise performing different tasks at the same time.

Let's look at some costs defined under the different certifications schemes.

According to the consultations on RTFO carbon and sustainability reporting[298], UK estimate of the annual cost to be faced by each suppliers in gathering carbon and

[297] UNCTAD (2008) Making Certification Work for Sustainable Development: the Case of Biofuels, UNCTAD/DITC/TED/2008/1 available at http://www.unctad.org/en/docs/ditcted20081_en.pdf downloaded on January 16, 2010

[298] RTFO (2009) Summary of responses to consultation on RTFO's carbon and sustainability reporting requirements available at

sustainability information along the supply chain, as well as in preparing annual carbon and sustainability reports is about $71,000.00. The breakdown of this amount is split as following: 24% for monthly collection and submission of carbon an sustainability data, 31% improvement and collection and data and 45% for validation and certification by external consultants.
Clearly, the above one is just an example that cannot be generalized to other situations.

According to van Dam J. et Al (2008)[299], the cost for compliance with sustainability criteria can be in a range of 8-65%. The cost for the certification process and the chain of custody are, for large operations, in a range of 0.1-1.2%. This range is for small operations much higher, for all the reasons described above and in same case prohibitive to dealt with.

According to the presentation made by SGS[300] in a workshop at IADB on the Implementation of Sustainability Certification schemes, from the experience made in the forestry field "*direct costs are generally between $0.5 and $1.0/ha. The cost of monitoring the chain of custody varies from 0.6 per cent to 1.0 per cent of the product value*".

For this reason, capacity building and assistance should be devoted both for developing countries and small producers, in order to provide them tools and financial capacity to be able to get certification.
In this regard, the Inter-American Development Bank is providing financial support to its private clients, co-financing auditing for checking the compliance with the Roundtable on Sustainable Development sustainability principles and criteria. These represent "pilot case" activities, both for LAC enterprises to be certified at minor cost and for RSB in order to test on real cases, that range from big to small dimension, from Latin and Central America its certification requirements.

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http/www.dft.gov.uk/pgr/roads/environment/rtfo/sumresponrtfo?page9 downloaded on January 17, 2010
[299] van Dam et Al (2008) "Overview of recent developments in sustainable biomass certification" Biomass and Bioenergy 32 (2008) 749-780
[300] Theresa Almonte, SGS presentation on Chain of Custody, January 25, 2010.

Otherwise we can end up in a situation where only the large size producers will have access to markets that require, in a mandatory or voluntary way, a sustainability certification.

Or, complementary to this, some dedicated procedures should be put in palace especially for small scale, such as the possibility to have "group certification", as we have seen for the Forest Stewardship Council.
Other proposals that were listed by practitioners during the workshop were:

- buyers might support access to the market for smallholders by stipulating as a condition that a certain part of the biomass should originate from smallholders. The same approach is followed by Brazil in its social programme for biodiesel as we have seen in Chapter 2. .
- sustainability requirements be simplified for smallholders, where necessary.
- The additional costs producers have to face to participate in the certification system could be spread along the chain, including traders and retailers. This solution would avoid putting all the cost burdens on farmers, especially smallholders, who tend to be the weakest segment along the production chain.

On the other hand, criteria and indicators need to be adopted/designed according to the requirement of a region. This is true especially for the design phase, where most of the time developing countries do not actively participate in the discussion related to the definition of criteria and indicators in for a such as the various roundtable we have listed in the above paragraphs. This is not only due to the lack of funds for participating in international meetings, but also for the absence of specific expertises in dealing with specific aspects of the sustainability of biofuels. Again, an effort in enhancing capacity building programs to deal with this problem is highly needed.

4.2.2 Traceability and data elaboration

Being biofuels certification schemes focused on a process based approach, all the phases of cultivation, process and production have to be examined and measured.

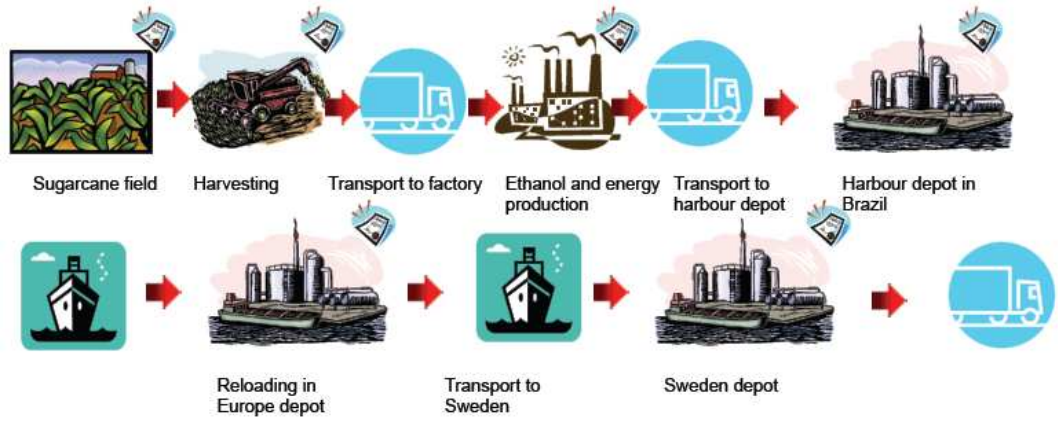
This is the so- called chain of custody that tracks fuels from feedstock production to delivery of biofuels.

The definition of chain of custody given by RSB[301] is "*path taken by raw materials, processed materials, finished products, and co-products from the crop harvesting site to the user through each stage of processing, transformation, manufacturing, storage and transport along the supply chain*".

It implies the availability of data, that have to be of a certain quality for comparison reasons, such as a complex system of traceability as the chain can be quite long and managed by different actors in different parts of the worlds.

This is because, biofuels can have multiple and multidimensional impacts, as we have seen in the first two chapters.

Figure 4.3: Chain of Custody - Traceability from Field to Wheel



Source: Theresa Almonte, SGS, January 25, 2010

301 RSB (2009) "Generic Custody of Chain Standard" RSB reference code: RSB-COC-10-001, September 2009, available at http://cgse.epfl.ch/webdav/site/cgse/shared/Biofuels/RSB%20Certification/09.09.26-RSB-COC-10-001-vers.0.2-Generic%20chain%20of%20custody%20standard.pdf downloaded on January 18th 2010

There is not a single way to carry out a chain of custody as they range from strictest to more flexible one. Here is a brief description of the four main chain of custody systems:

- Identity preserved: it implies full traceability to individual farms and certified feedstock have to be completely separated from the non certified one. Documentation and certificates tracing back to the original biomass are attached to a physical batch of raw material, intermediate and finished biofuel.
- Segregation: all companies in the supply chain need to get certified. The certified material do not need to be always and completely segregated from the not certified one.
- Mass Balance: documentation and certificates are attached to the batch of biomass, that may be mixed with other non-certified materials and is only partially traceable. The finished product is often labeled with its average percentage content of certified product.
- Book and Claim: feedstock/biofuels is not traceable to the source. Documentation and certificates must be obtained to prove that the same quantity of biofuel has been produced in a sustainable way somewhere in the world. There is no link between certificates and physical batches.

US RFS2 utilize an additional system which is the Renewable Identification Number (RIN) that thrack back biofuels. The RIN is a 38 digit code that is born with the producer or importer of renewable fuels. It only trace biofuels at the facility level, without providing information on feedstock origin, production, or processing characteristics[302].

There are of course pros and cons in choosing one or another of the systems listed above. While the first two, identity preserved and segregation, are more rigorous in the traceability of the entire supply chain, they have very high cost of compliance with, as well as problem is implementation but in very sophisticated farm and producers realities where quality of data does not represent a problem.

[302] Yeh S.et Al (2009) "Implementing Performance-Based Sustainability Requirements for the Low Carbon Fuel Standard – Key Design Elements and Policy Considerations" Research Report UCD-ITS-RR-009-05 Institute of Transportation Studies, University of California, Davis October 28, 2009

On the other hand, book claim and mass of balance, are less respondent for the purpose of GHG (or other sustainability criteria) accounting, but have better flexibility and "easiness" of implementation[303].

While the EU Directive requires a mass balance system for sustainability reporting, EPA one requires the RIN, for RFTO and RSB all are at the moment possible.
For comparability reason, and especially for simplification purposes for farmers/producers that export in different parts of the world, it would be more logic to have one internationally agreed chain of custody system.
This will not solve all the issues related to it, as the implementation of an operational, credible and transparent system is in any case hardly to be set up for administrative complexity, quality of data and logistical infrastructure[304].
Chain of Custody can therefore represent an impossible burden for small operators, especially for developing countries.
In a Track & Trace (Segregation) chain of custody system, a biomass processing company that wants to obtain a sustainability certificate, would have to exclude those smallholders that cannot fulfil the sustainability requirements.
In a Mass Balance chain of custody system, smallholders can be included. In this system, smallholders, who are not able to produce in a sustainable manner, can continue selling their harvest to a certified company. The certified company can declare its final product sustainable according to the percentage of sustainable raw material used, but does it make sense if its primary market, for example EU, prefers (in order to account for the 10% target) certified biofuels???
According to an international auditor interviewed[305] "*the result, of even the well-intentioned choice of a chain of custody system could lead to smallholders disappearance in emerging markets*". As the auditor was proposing in the basis of first hand experience, "*chain of custody systems should be adapted to the circumstances. In the case of few, but relatively professionally administrated farms, storable products, low complexity in the value chain etc. the implementation of chain of custody systems like track & trace and mass balance seems to be straight*

[303] CONCAWE (2009), presentation of J.F. Larivé "Certification schemes and chain of custody"
[304] Scarlat N and Dallemand J.F. (2008) "Biofuels Certification Scheme as a Tool to Address Sustainability Concerns: Status of Ongoing Initiatives" Proceedings Venice 2008, Second International Symposium on Energy from Biomass and Waste, Venice, Italy, 17-20 November 2008.
[305] Interview realized on January 25, 2010 on the occasion of the workshop at IADB.

forward. In other areas, alternative or hybrid systems should also be taken into consideration".

According to two representatives of Better Sugar Cane and Round Table on Sustainable Palm Oil[306] the Segregation system is impossible to make in practice, as the costs are prohibitive and the majority of producers, sometimes small farmers, do not have the store capacity to guarantee this segregation.

The problems related to this method, have also the risk to create an incentive to cheat from producers in order to remain in the business, being in some cases no other alternatives.

Targeted measures should be devoted to them increasing accessibility, following the example of FSC that allow small enterprises to form or join a group of operations and apply for group chain of custody certification[307].

As it has been recalled many times during the IDB workshop, especially from developing countries producers, linking certification with capacity-building in the areas of compliance and conformity assessment would facilitate producers' engagement in sustainable production, especially in developing countries. Compliance could also be linked to incentives such as enhanced access to financing, linkages to other support services such as health and education, and the establishment of local and regional networks to increase productivity.

Another major issue that creates difficulties for the accounting of GHG and other environmental impacts is the question of co-products.

With different agricultural feedstock, there is more than one "product" produced through the cultivation and production cycles. These dual or additional products are commonly referred to as co-products.

Typical co-products from biofuels production include energy from bagasse (sugarcane); glycerine (biodiesel processing); animal feed (soy and sugarcane); organic fertilizer (any crop residue, but most commonly referred to with vinasse); and many others. In other cases, the biofuels production is seen as the co-product or by-product of production, for instance with soy or bioenergy from wood chips or

[306] Interview made on January 26th, in Washington DC, IADB Headquarters

logging residues. There is widespread agreement and understanding of the various co-products from biofuels production, but what there is not consensus on is how to deal with, or account for the co-products, both in terms of greenhouse gas methodologies and in terms of looking at what percentage of the total production or what aspects have to meet certain sustainability criteria.

Experts are debating on the following options[308]:

- System expansion (also called substitution): this option is normally used in consequential LCA. All the environmental emissions of the biofuel system are owed to the main product, and the avoided emissions are withdrawn from these environmental emissions.

  Whereas this system is the most rigorous from a scientific point of view, its implementation can be problematic both for the exacted determination of which product does substitute which one and for the calculation of how much GHG emissions can be exactly saved with the avoided production of the substitute product.
- Allocation by market value: GHG emissions are allocated to the main product and co-products through different rationales based on physical or economical properties of the products, such as market value, mass, energy content;
- Allocation by energy content: GHG emissions are allocated to products proportionally according to their energy content;
- Allocation by mass: GHG emissions are allocated to products proportionally to their mass.

According to interviews made with auditors and producers[309] involved in the field, it would be beneficial to simplify, and possible converge, on a given methodology. Designers of certification schemes need to set up a methodology that has to be understandable and data has to be reproducible for economic operators; provide detailed guidance on methodology and provide underlying values for transparency; Define specific default values that increase accurateness and stimulate supply chain information.

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[308] Theresa Almonte, SGS presentation on Chain of Custody, January 25, 2010.
[309] Interviews made in Washington DC, on January 25-26, 2010 at IADB Headquarters.

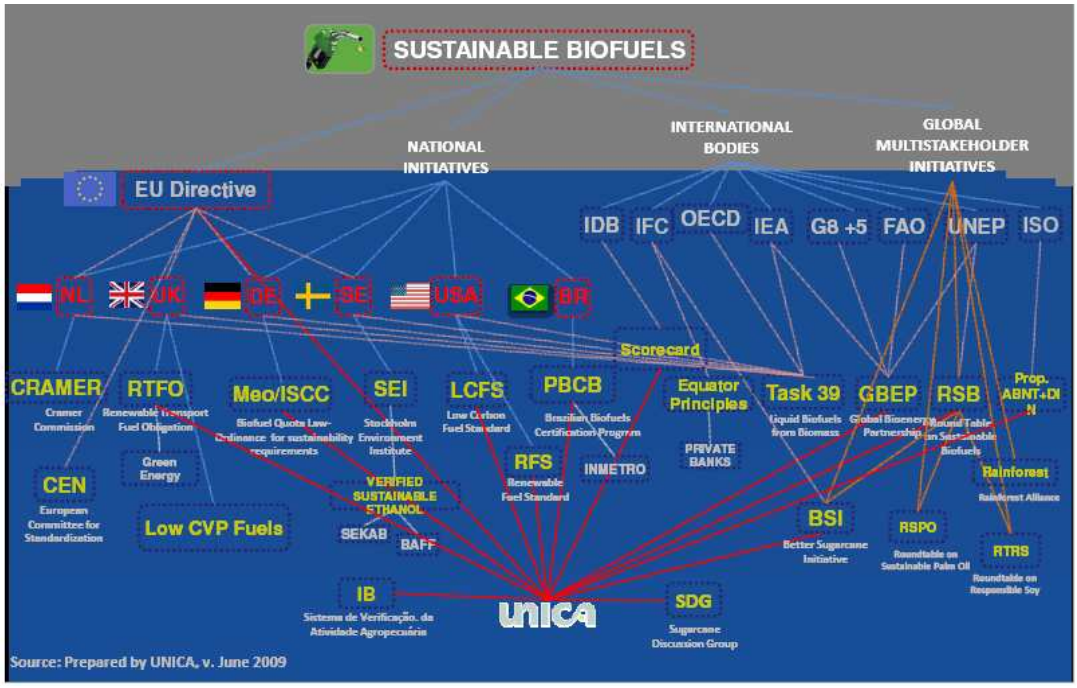
On the top of that, the practicality of a GHG methodology and reporting. As it has been underlined repeatedly "*so far, the debate was focused on setting the criteria. The key challenges now lies with how companies can practically demonstrate compliance with these criteria*".

4.2.3 Governance

There are different aspects related to the governance of the sustainability certification for biofuels, some of them we have already touched upon in previous chapters. One of the main issue that strikes producers is the plethora of sustainability certification schemes for biofuels that are in place, or under negotiations. They can be based on the type of feedstock used (BSI, RSPO, RTRS), they can be "nationality" (EU Directive 2009/28/CE, US EPA, UK, Colombia, Netherlands), or international (RSB, GBEP).

Figure 4.4 gives a snapshot of current situation as illustrated by UNICA[310] in a workshop convened by the IDB and UNEP on "Assessing Challenges for Implementation of Biofuels Sustainability Criteria" on January 25-26, 2010.

Figure 4.4: Plethora of sustainability certification schemes for biofuels



Source: do Amaral Luiz Fernando, presentation made at IDB on January 26th, 2010.

[310] UNICA is the Brazilian Sugar Cane Association http://english.unica.com.br

If UNICA, one of the most structured (and powerful) association show some concern related to the chaos in the number of certifications in place, what about a small-medium producer? There is definitively an overcrowded situation in terms of criteria and standards to comply with at national and international level and many duplications exist. This multiplicity of certifications schemes are one of the principal concerns of producers.

In fact, according to a producers[311] interviewed "the hardest challenge is not to be compliant, but to prove compliance". Too many grey zone do exist in the different methodologies to calculate for example indirect land use change, but also GHG attribution to co-products along the supply chain. A better convergence of different methodologies is highly needed, as well as clarification on "how to measure".

Issues like biodiversity, protection of child labor, good agricultural practices, air emission, are part of sustainability criteria that belongs to different existing certification schemes. The following table gives an overview of the criteria that are covered both by certifications other than the ones on biofuels and the one focused on biofuels.

Table 4.5: Criteria relevant for biofuels in certification schemes[312]

	Fair trade	SAN	Eurepgap	Ifoam	RSPO	RTRS	FSC	PEFC	RTFO	NL	BSO	RSB	EC
Biodiversity	-	+	-	+	+	+	+	+	+	+	+	+	+
Soil protection	+	+/-	+/-	+	+	+	+/-	+	+	+	+	+	+
Water protection	+/-	+	+/-	+/-	+	+	+/-	+	+	+	+	+	+
Air emissions	+	-	+/-	+	+	+	+/-	-	+	+	+	+	+
GMO	no		+	no	-	-	+	-	-	-	-	+	-
Social well being	+	+	-	-	+/-	+/-	+	-		+	-	+	-
Working conditions	+	+	+	+/-	+/-	+	+/-	+	+	+	-	+	-
Human & land rights	+/-	+/-	-	+/-	+	+	+/-	+/-	+	+	-	+	-
Direct land change	-	-	-	-	-	-	+	+	+	+	+	+	+
Competition with food	-	-	-	-	-	-	-	-	-	+	-	+	+
Indirect effects	-	-	-	-	-	-	-	-	-	+	-	?	+
Carbon conservation	-	+/-	-	+/-	-	-	+/-	-	+	+	+	+	+
GHG reduction	-	-	-	-	-	-	-	-	+	+	+	+	+
CoC - separation	+	+	+	+	+	+/-	+	+	+	-		+	-
- mass-balance		-	-	-	+	+/-	+	+	+	-		+	+
- book and claim		-	-	-	+	+/-	-	-	+	+		+	-
Implementation	v	v	v	v	v	v	v	v	o	o	o	v	o
Benchmarking			+	+			+	+	+	+	-	+	-

(+ included; - not included; v: voluntary; o: obligatory)

Source: Scarlat N. Dallemand J.F.[313]., table 1

[311] This concern has been defined as number one by all the producers present at IADB-UNEP workshop on Implementation of Sustainability Certification schemes in DC January 2010.

[312] Fairtrade is a certification system applied to traded goods whose aim is to guarantee a fair payment of agricultural products, meliorate producers life and improve their market access. The crops, that include rice, sugar, coffee, must be grown and harvested on the basis of international standards defined by Fairtrade Labelling Organizations (FLO). http://www.fairtrade.net/

Moreover, when standards and certification schemes do cover both environmental and social criteria, producers can find themselves in a situation where the two dimensions of sustainability create opposite results.

UNICA for example presented the case of the increase in the mechanization of agricultural to displace the sugar cane burning that has a high impact in the deterioration of air quality. The increase in the practice of mechanization in fact has provoked the deployment of many people whose job was linked to burning. It is therefore important to include "corrective" actions when these trade offs emerge, such as efforts for reintegration of the unemployed people in the job market through re-qualification programs and education activities.

In the specific case the State of San Paolo, UNICA, with the financial support of the IADB, started a re-qualification process for people left without a job.

There is an ongoing debate at international level on how to deal with this chaotic situation from a governance point of view, and some options are on the table:

- Meta-standard approach;
- Creation of a new generic global standard approach
- Maintain the situation as it is, the market forces will prioritize among different certification standards.

Let's start from the first one, the meta-standard approach that we have seen has been considered by the Roundtable on Sustainable Development.

SAN – Sustainable Agriculture Network Rainforest Alliance is a group of organization that try to enhance social and environmental sustainability of agricultural production, for many products such as coffee, cacao flowers. Info available at http://www.rainforest-alliance.org/agriculture.cfm?id=san

EurepGAP is a private certification scheme of agricultural products whose aim is food quality and safety. It is also focused on the minimization of environmental impacts of farming operations and on the optimization of the use of inputs to ensure a responsible approach to worker health and safety. http://www.eurepgap.org/Languages/English/about.html

Ifoam - International Federation of Organic Agriculture Movements is aimed at the global adoption of environmental, social and economical systems that are based on the principles of Organic Agriculture. http://www.ifoam.org/about_ifoam/inside_ifoam/mission.html

NL: Netherlands Sustainability Certification of Biomass based on the Cramer Committee BSO: Germany Biofuels Sustainability Ordinance http://www.oeko.de/service/bio/dateien/en/pres_germanbso_delbrueck.pdf

[313] Scarlat N and Dallemand J.F. (2008) "Biofuels Certification Scheme as a Tool to Address Sustainability Concerns: Status of Ongoing Initiatives" Proceedings Venice 2008, Second International Symposium on Energy from Biomass and Waste, Venice, Italy, 17-20 November 2008

A meta –standard approach act as a benchmark standard: it means that the meta-standard, for example RSB, recognize other certification schemes that cover already some sustainability standards, therefore RSB will create standards only for those issues that are not covered by other certifications that are already in place (such as FCS, FairTrade)[314].

The main positive aspects of this approach is the avoidance of duplication in case a qualifying standard for a particular issue already exist and the increase in the harmonization among existing certification schemes. It will in practice apply a kind of rationale logic to the existing proliferation situation.

Other positive aspects of the meta-standard approaches relate to a better acceptance by producers, who in most cases have participated in the definition of some qualifying standards and also acceptance in terms of avoiding a double certification process that has to take into account not only the cost in terms of money(auditors, experts) but also of time. It should also imply a shorter term in implementation.

Negative aspects are related to the fact that eventual changes in standards cannot happen directly, but through the qualifying standards system, decreasing the possibilities to have a more direct control on the dynamic evolvement of standards in terms of strictness/enhancement[315].

The meta-standard approach should also be tested as a benchmark not only in reference to other regulatory or voluntary certification schemes, but also towards national regulations.

In fact, as it happens in many cases, domestic law already covers issues linked to environmental or social protection and in that case, as it has been many times highlighted during the IADB workshop it is highly inefficient to re-invent the wheel!

The creation of a new generic global standard approach, implies the agreement of all the organizations that have designed natural resources certification standards to get together under the same umbrella, and agree "*to revise their standards to achieve*

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[314] Kaphengst T. et Al (2009) "At a tipping point? How the debate on biofuels standards sparks innovative ideas for the general future of standardization and certification schemes", Journal of Cleaner Production 17 (2009) S99-S101

[315] Schlegel S, Kaphengst T, Cavallieri S. (2008) "Options to develop a Global Standard-Setting Scheme for products derived from Natural Resources (NRS)". WWF, ecologic discussion paper, commissioned by FSC International, WWF Germany;.

full alignment with the new generic standard, and eventually merging into the new standard" (Schlegel S., pag. 18) [316].

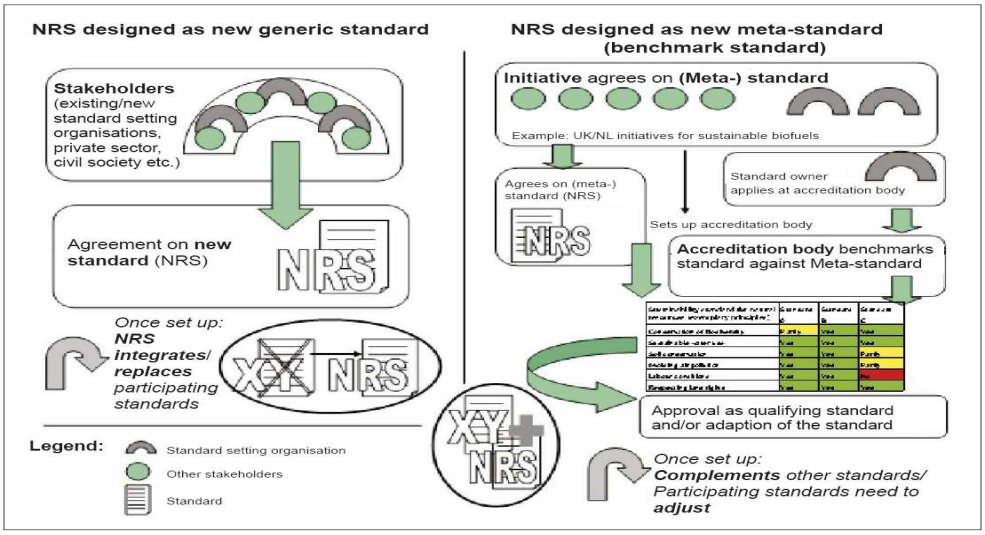
From a theoretical point of view, this approach will assure full harmonization and "order" among the different sustainability standards and certification schemes that apply to biofuels. It will simplify the complex procedures and bureaucracy that the multiplicity of schemes imply, guarantying a "*one stop shop*" for standards compliance and certification.

On the other hand, its feasibility appears to be very scarce, as it will be utmost improbable that organizations that have a huge experience in sectors like sustainable forestry, energy efficiency, organic food, will be willing to lose their "market power" (remember the Energy Star one) with all the work and investments underlined.

Moreover, this approach does not take into account the difficulties, from a legal and procedural point of view, in pooling under the same umbrella NGOs, Roundtables and Institutions such as the EPA and the EU with their mandatory targets.

Moreover, being formal or informal negotiations, experience tell us that agreements of such a nature and complexity are hard to be made, and request a lot of time.

Figure 4.5: New Generic Standard versus Meta-standard approach[317]



Source: Schlegel S. (2008), Figure 2, pag 14

[316] Schlegel S, Kaphengst T, Cavallieri S. (2008) "Options to develop a Global Standard-Setting Scheme for products derived from Natural Resources (NRS)". WWF, ecologic discussion paper, commissioned by FSC International, WWF

[317] Schlegel S, Kaphengst T, Cavallieri S. (2008) "Options to develop a Global Standard-Setting Scheme for products derived from Natural Resources (NRS)". WWF, ecologic discussion paper, commissioned by FSC International, WWF

Finally, the third option: leave the situation as it is a let the market work.

Most probably the standards and certification schemes that will lead the market will be the one set by Institutions such as the EU and EPA and that will have a mandatory status. This is because they will represent the entry door for the market in both the EU and the US. Putting my shoes in the ones of a producer, especially the one interested in exporting both feedstock and or biofuels, I would like to be sure that the certification I will get will have a clear and tangible additional value that will overcome the costs to get the label.

There will be, most probably a natural convergence of the myriad of sustainability standards and certification schemes versus the ones that are mandatory, creating in this way a more clear and less troublesome picture.

This phenomenon, already "smell" by some Roundtables, like for example RSB, will also encourage the creation of meta-standards that will "endorse" as a priority the mandatory standards of national Institutions.

We cannot make a comparison in this respect with for example the forest sector, as we have already underlined how the "spread" of the FSC certification has been also motivated by the fact that no legal agreement on forest protection has been passed at international level.

And in many cases, national laws have been accommodated their standards to the one of FSC.

Current situation, however, pose some questions in terms of equity, transparency and inclusiveness, especially in the design phase of standards and criteria and applicability of certification.

It means that not all the stakeholders, especially small scale farmers, indigenous people, as well as more broadly developing countries representatives have been able to take part to these processes. This is because there has been a clear leadership of developed countries, such as the EU and USA for reasons that range from climate change and energy security, and a clear lobbying influence of bigger companies.

As Bastos Lima M. G. (2010)[318] argues, "(partnership) *are clearly more focused on promoting biofuels than on regulating their production or addressing their wider*

[318] Bastos Lima M. G (2009) "Biofuels Governance and International Legal Principles: Is It Equitable and Sustainable?" Melbourne Journal of International Law, Volume 10, October 2009, Issue 2

impacts. These initiatives have been to a large extent in addition to the biofuels promotion done by governments individually and through bilateral negotiations".
Even if there is a partial *veritas* in this, there are current efforts of a better involvement of developing countries in the design of standards for the sustainability of biofuels, and GBEP is a good example in this regard.
What the Author claims is the not consideration of the Rio principles[319] and the principles of good governance[320], in the actual biofuels governance.
The first ones, range from priority attention should be given among others to equity and poverty, biophysical sustainability as well as transparency and consensus based negotiations. The second one, inclusiveness, accountability, rule of law.

4.2.4 Compatibility with WTO rules

The global market of biofuels is likely to increase in the next years, due especially to the establishment of mandatory targets for biofuels consumption in the EU (10 % binding minimum target to be achieved by all Member States by 2020) and US (36 billion gallons by 2022) regulations. Especially in the EU case, it will not be possible to meet these targets exclusively through domestic supply.
Thanks to climatic conditions, availability of land and feedstocks, and particularly in the Brazilian case, the presence of experience and expertise in the biofuels industry, it is expected that in the next years the import/export of both raw materials and finished products will increase in a consistent way.
However, the trade picture is quite complicated due especially to the interlinkages between biofuels and agriculture protectionist policies.
Let's examine the potential obstacles to the development of a biofuels global market, and especially a market where biofuels are certified for their sustainability.

Symposium — Climate Justice and International Environmental Law: Rethinking the North–South Divide available at http://www.mjil.law.unimelb.edu.au/issues/archive/2009(2)/04Bastos_Lima.pdf downloaded on January 23, 2010
[319] The Rio Principles are part of the Rio Declaration, agreed at the UN Conference on Environment and Development in 1992 in Rio, and consist of 27 principles. Available at http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=78&ArticleID=1163 downloaded on January 24, 2010
[320] UNDP (1997) "Governance for sustainable human development - A UNDP policy document", January 1997 available at http://mirror.undp.org/magnet/policy downloaded on January 25, 2010

1. Classification

First of all there are problems related to the classification of bioenergy – as an agricultural, industrial or environmental good- both in the World Trade Organization (WTO) and in the World

Custom Organization[321] (Harmonized Commodity Description and Coding system – HS) frameworks.

The classification of products is key for defining a system of bound tariffs and this classification is competence of the World Custom Organization (WCO), also called as the Harmonized Commodity Description and Coding system – HS[322].

WTO negotiates tariffs based on that classification system. However, being HS classification limited to the so called six digit level, WTO Members can introduce more detailed sub-classifications that are not included in the HS.

The additional complication is that, according to Article II of the GATT[323], the consequence of such sub-classification cannot be to increase the rate of tariff applied to that sub set of goods beyond the bound rate for the more general HS category to which it belongs.

Moreover, the sub-classification cannot violate the Most Favored Nation (MFN)[324] rule, according to which countries cannot normally discriminate between their trading partners: a lower customs duty rate for one of their products for one country should apply also to all other WTO members. We will see in the continuation of this paragraph that some exceptions apply. Finally, some obligations are in place with respect to the treatment of "like products", whose definition has not defined neither

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[321] The World Customs Organization (WCO) is the only intergovernmental organization exclusively focused on Customs matters, covering inter alia the development of global standards, the simplification and harmonization of Customs procedures, trade supply chain security, the enhancement of Customs enforcement and compliance activities, and sustainable global Customs capacity building programs. Information available at http://www.wcoomd.org/home_about_us.htm downloaded on January 29, 2010.

[322] The HS includes about 5,000 commodity groups; each identified by a six digit code, arranged in a legal and logical structure and is supported by well-defined rules to achieve uniform classification. The system is used by more than 200 countries and economies as a basis for their Customs tariffs and for the collection of international trade statistics. Over 98 % of the merchandise in international trade is classified in terms of the HS.
http://www.wcoomd.org/home_wco_topics_hsoverviewboxes_hsoverview_hsharmonizedsystem.htm

[323] The General Agreement on Tariffs and Trade – GATT – was negotiate in the year 1974 during the UN Conference on Trade and Employment. It lasted until 1994, when the World Trade Organization was formed in 1995. The text of GATT is still into effect under the WTO framework, with some modifications. Article II of GATT is related to "Schedules of Concessions". Text available at http://www.wto.org/english/docs_e/legal_e/gatt47_01_e.htm#articleII downloaded on January 29, 2010.

[324] Most Favored Nations – MFN – is stated in Art 1 of GATT

by GATT nor by WTO, instead it has been evolved during the years through the different cases submitted to panels of the appellate body. With some "approximation", the likeliness of a product is based on the products properties, end uses and consumers taste and habit[325].

Let's see in practice how the classification uncertainty affects biofuels market.

Ethanol is classified on the basis of its chemical composition as undenatured (220710) and denatured (220720) alcohol in the Harmonized System. Therefore these classifications go uniquely to its chemical composition, and there is no classification or sub-classification specific to fuel ethanol as opposed to ethanol used for other purposes.

Since classifications are the starting point for tariff bandings in WTO's Members schedules, "*the lack of HS classifications makes it difficult to get precise biofuel trade statistics, but may impede also efforts to liberalize tariffs on biofuels*"(IPC 2006)[326].

HS classification also define if a product is an agricultural product under WTO rules. Annex 1 of the WTO Agreement on Agriculture (AoA) states that the provisions of the Agreement apply to HS chapters 1 to 24 as well as to a specified list of products with other HS headings.
While ethanol, in HS chapter 22 (HS code 2207), falls under agricultural good, biodiesel is under Chapter 38 (HS code 382490) and is therefore considered as industrial good. This means that tariffs rates and subsidies are different for ethanol and biodiesel.

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[325] UNCTAD (2008) "Making Certification Work for Sustainable Development: the Case for Biofuels", UNCTAD/DITC/TED/2008/1
[326] International Food and Agricultural Trade Policy Council (2006) "WTO Disciplines and Biofuels: Opportunities and Constraints in the Creation of a Global Marketplace" by IPC and REIL available at http://www.agritrade.org/Publications/DiscussionPapers/WTO_Disciplines_Biofuels.pdf downloaded on January 30, 2010

Finally, paragraph 31 (iii) of the Doha Development Agenda calls for "*the reduction, or, as appropriate, elimination of tariff and non tariff barriers to environmental goods and services*" .

Even if Doha negotiations are far from finding an agreement, the environmental goods negotiations focused on how to define "environmental goods" and criteria.

The following approaches have been discussed in coming up with a definition[327]:

- a list approach aiming all countries would agree on a single list of EGS for liberalization. This approach has created complicated discussions related for example to the distinction in the treatment of dual-use products. Brazil tried hard to include biofuels in the list;
- end-use approach limit the number of goods identified for liberalization, linking them to pre-approved environmental projects (India's proposal) or to products used in activities that implement multilateral environmental agreements (Uruguay proposal's).

  This approach was opposed by different countries, including US, for the administrative burdens it could originate.
- bilateral request-offer following a traditional WTO approach when countries ask for specific liberalization commitments at bilateral level, than this liberalization is going to be extended to all other nations according to the MFN principle (Brazilian proposal).

2. Sustainability certification schemes for biofuels according to WTO rules

In addition to the complications related to the classification of biofuels according to the HS schemes, a further level of "trouble" is given by the presence of sustainability standards and certifications schemes in the global market of biofuels.

The concern is that environmental and social standards that are part of the certification system can act as a barrier to trade, especially for developing countries where there is lower capacity of compliance and expertise.

Let's examine the principal rules under WTO that can be linked to biofuels trade.

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[327] IISD (2009) "Environmental Good and Services Negotiations at WTO: Lessons from Multilateral Environmental Agreements and Eco-labelling for Breaking the Impasse", Draft for Discussion – August 2009, available at http://www.iisd.org/pdf/2009/bali_2_copenhagen_egs_lessons.pdf downloaded on January 30, 2010

One of the main rule, is the Technical Barrier to Trade Agreement (TBT)[328]that "tries to ensure that regulations, standards, testing and certification procedures do not create unnecessary obstacles to trade". It encourages countries to utilize international standards for harmonization purposes, but at the same time it allows countries to take measures for the protection of human, animal or plant life, health or environment.

A "grey zone" of the TBT agreement is its coverage of labelling programmes that refer to the way products have been manufactured, even if these differences do not appear in the final products properties (non product related process and production methods – npr PPMs).

As we have seen in the coverage of different certification schemes, a common approach is the life cycle assessment in order to evaluate the overall GHG emissions. Especially in the biofuels case, this is a key element for any certification scheme we have analyzed.

This has been and is a critical aspect especially in a developing country perspective, for whom the use of PPM is equated with richer countries attempting to impose their environmental and socials standards on the rest of the world given the lack of innovative low carbon technologies that can help them reduce GHG impacts. For this purpose many countries maintain a position that PPMs should not be covered by TBT agreement.

In case they are not covered by TBT, the coverage is under the general GATT ruling.

Another issue concern the case of certification schemes developed by subjects, such as NGOs, that have not accepted (or have not the legal power to enforce in a mandatory way) the "Code of Good Practice for the Preparation, Adoption and Application of Standard"[329].

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[328] Technical Barrier to Trade Agreement text available at http://www.wto.org/english/docs_e/legal_e/17-tbt.pdf downloaded on January 30th, 2010

[329] Code's main points are: i) standards should not discriminate "like products" of national origin and not restrict trade; ii)international harmonization as well as public consultation, involving in particular developing countries, should be ensured; iii) standards should not create obstacles to the expansion and diversification of exports from developing countries.

There is a grey zone area for Public Private Initiatives, such as the Roundtable on Sustainable Biofuels, and their not coverage, if regarded as private schemes, in the scope of TBT. In this case they should not follow rules such as transparency, non discrimination, etc – even if, in practice they should play a key role in the global market flows of biofuels.
However, these hybrid organizations should be covered by GATT as "governmental measures" in case for example a Government decides to grant some incentives to certified biofuels and for doing so it relies on certification schemes developed by private bodies (UNCTAD, 2008)[330], most likely the situation of RSB for EU directive.

Another issue is related to the treatment of "like product", we have already referred to above, and in our specific case whether certified biofuels and not certified biofuels can be considered like products. This is because, regulations should not discriminate between products that compete in a given market. At the same time, article XX of GATT 1994 allows the following exceptions relevant for environmental purposes:
i) necessary to protect human, animal or plant life or health; (ii) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption.

Biofuels certified as sustainable could fall under these exceptions given their role in mitigating environmental and health effects of climate change. At the same time we know that some sustainability certification schemes include in addition to environmental standards also social one. This is a very sensitive issue, where WTO member countries have repeatedly expressed their contrary to accept trade discrimination on the basis of criteria such for example labour conditions[331], increasing the degree of complexity in the sustainability certification picture.

[330] UNCTAD (2008) "Making Certification Work for Sustainable Development: the Case for Biofuels", UNCTAD/DITC/TED/2008/1
[331] In the WTO Ministerial meeting in Singapore in 1996 it was explicitly agreed that market access should not be linked to social criteria.

In case certified and not certified biofuels are at the end addressed as "like" products, it has to be verified if imported biofuels are given a "less favourable" treatment than domestic biofuels. It happens when i) the imported and domestic like products are treated dissimilarly and ii) the dissimilarity is applied so to afford protection to domestic production[332].

The question, to our understanding, is even if the same sustainability criteria and certification schemes are applied to both domestic and foreigner producers the key question to consider is the affordability of sustainability standard compliance and certification for developing country. We have seen in the session related to transaction cost that, on average, a audit costs in a developing country two times as much one in a developed country. Does the less favourable treatment take into account this very pragmatic aspect? Moreover, are developing countries part of the process related to the definition of criteria and standards?

[332] Japan-Taxes on Alcoholic Beverages. Report of the Appellate Body, adopted on November 1st, 1996. WT/DS8/AB/R, WT/DS10/AB/R, WT/DS11/AB/R, p.24

Chapter 5

What our analysis tell us about effective approaches for certifying the sustainability of biofuels? Recommendations for policy makers

5. Designing an analytical framework to assess the feasibility of a certification scheme in measuring objectives compliance, with a special attention to developing countries

In the previous chapters we have examined the main elements that characterize different certification schemes as far as concern the three pillars of sustainability: environmental, social and economical.

What emerged from the previous analysis and from the interviews with major biofuels stakeholders is that too little attention has been paid so far to the actual "operationalization" of sustainability standards. The efforts made so far by certification designers has been focused mainly on the theoretical "comprehensiveness" of the standards listed in the schemes that operators have to comply with.

Issues like the actual calculation for demonstrating compliance with these standards is, in some cases, still to be determined and agreement among scientists still has to be found.

As producers have point out many times during interviews, a clear framework is needed as the profitability of an investment can differ a lot on the basis of different rules. Issues such as methodologies for calculating indirect land use change, as well as different schemes for co-products, if requested in a strict way, can affect considerable investment choices.

As a producer quite effectively described, "*building the race car while running the race*" [333] is an impossible task and it does not make much sense.

[333] This statement was by made a producer during the IADB Workshop on Implementation of Sustainability Certification Schemes on January 25th.

There is no logic in the fact that, while targets for biofuels use and sustainability criteria have been established, we are still debating about "how and what to measure".

A we know, what has caused the present situation is that, as John Ashton[334] declared, "*the policy on biofuels is currently running ahead of science*".

What is highly needed is to make an effort towards a rationalization of the entire system of certification schemes for biofuels, looking at an increased integration among i) the different voluntary schemes, ii) between voluntary and mandatory one also through the meta-standard approach, and iii) between certification schemes and sovereign domestic regulations.

Equally important is the need to evaluate the "operationalization" of both standards and certification tools, issue that producers invoke strongly.
This need of "operationalization" and effectiveness, applied to the different pillars of sustainable development, will be weighted on the basis of the following elements: costs of certification, feasibility and challenges encountered in data elaboration and different methodologies to be applied along the supply chain, governance and trade impacts.

We will try to provide a scheme to make this evaluation, synthesizing all the information in a matrix format (Table 5.4) where we will take into consideration for comparative purposes not only biofuels sustainability certifications schemes but also certification schemes that we have considered in other sectors.

We will therefore put in the row line the sustainability pillars we want to measure the practicability and effectiveness toward their compliance:

- GHG and environmental: as we have seen in the analysis of sustainability biofuels schemes, the net benefit in terms of reduction of GHG is a key

[334] Interview of John Ashton, UK Government climate change envoy, to BBC news on June 29, 2007 available at http://news.bbc.co.uk/2/hi/science/nature/6252594.stm downloaded on January 31, 2010

factor. Some schemes only refer to GHG, others also to other environmental impact such as air quality. The dimension of this pillar is global/national

- Social: we look here at issues such as labour conditions, job opportunities, food versus fuel issue. The dimension of this pillar is mainly national.
- Economical: we look at the economical pillar from the perspective of the firm, so the dimension we are going to evaluate is firm based. It means that we will evaluate it on the basis of elements such as profitability (price premium minus cost of getting the certification), trade barriers to product not certified (certification as entry point to have access to markets as in practice in the EU).

In the final (synthesis) column matrix we will examine:

- EU Directive 2009/28/CE as the key policy instrument that makes certification mandatory for biofuels that will account for the mandatory 10% of use target of biofuels in the EU by 2020.
- US EPA National Renewable Fuel Standards, recently issued (February 2010)[335] after a long period of internal consultation with stakeholders. The particularity of this standard is that it includes indirect land use impact assessment calculations. It provides a mandatory scheme for certification, and as well as the EU Directive for the European market, will represent the de facto rule for both domestic and international producers that want to export in the US.
- UK Renewable Transport Fuel Obligation: mandatory scheme with already 1 year experience. Interesting example of meta-standard trying to build synergies and benchmarking with certification schemes working in other sectors. Recently (January 2010) the firs assessment yearly report has been published[336].
- Round Table on Sustainable Biofuels: voluntary scheme whose principle and criteria are now tested in a pilot testing phase. It is an interesting example of

[335] EPA Renewable Fuel Standard Finalized rules available on http://www.epa.gov/oms/renewablefuels/rfs2-regs.pdf downloaded on February 25th, 2010

[336] Renewable Fuel Agency Report on the Renewable Transport Fuel Obligation 2008/2009, published on January 28th, 2010 available on http://www.renewablefuelsagency.gov.uk/_db/_documents/year_one_of_the_rtfo_a4.pdf downloaded on February 25, 2010

partnership between NGOs and private sector for the definition of sustainability standards. It is exploring the possibility to become a "recognized voluntary certification" for the EU Commission and possibly EPA, according to a meta-standard/benchmarking approach.

Other certification schemes that can have some impacts on biofuels certification for synergies purposes, or just fro comparison reasons that have been included in the matrix are:

- Forest Stewardship Council: some indicators of this voluntary certifications scheme can be used for the sustainability of biofuels. There are in fact many synergies and common elements such as biodiversity protection, social well being.
- Energy Star: it represent an interesting example of certification that follows a different evaluation approach, the one product performance based. Even if the similarities with the one of biofuels are few, for comparison purposes it is interesting to look at other approaches that might be considered in the future also for biofuels.
- Leadership in Energy and Environment Design (LEED): as Energy Star this is a certification scheme product performance based, but with different labels that correspond to different levels of quality in terms of impacts on energy efficiency and environment.
- Organic certification in Europe: as for LEED, it is an interesting example for comparison purposes with some analogy with the biofuels one in terms o supply chain and process based approach. Common indicators can be found with GMOs as well as biodiversity.

In order to clarify the rational behind the definition of the final/synthesizing matrix, we have broken down the evaluation of different certification schemes (Table 1, Table 2 and Table 3), according to our indicators, for the three pillars of Sustainable Development.

For clarity purpose let's define the indicators:

- Transaction costs: include direct and indirect cost that a certification implies. Direct cost are for example auditing costs, indirect ones are related to the implementation of higher standards associated with certification requirements (corrective actions in FSC).

- Traceability and data elaboration: mean the compliance with methodologies that a certification system requires in order to assess a performance (es. GHG) along the supply chain. We will consider here also the clarity and flexibility degrees that a certification requires in order to comply with an existent, clear and, in case, optional methodology.
- Governance: existence of synergies (or conflicts) among different certification schemes, through reciprocal recognition or use of benchmarking/meta-standard approach.
- Trade: potential incompatibility with WTO rules and/or possibilities of playing a key role in case the art 31 of Doha agenda will be moved on.

We will use the following signs for evaluations:

☺	not particular challenging
😐:	medium challenging/stand by
☹	Challenging
☺/😐	partially challenging
😐/☺	medium challenging with scope for improvement
NA	not Applicable

5.1.1. GHG and Environmental Assessment

Let's start with the evaluation of the practicability of the different certification schemes for the GHG measurement, in terms of transaction costs, traceability and data elaboration, governance and trade.

Table 5.1: Assessment of GHG and environmental certification with the lens of practicality

	EU/RES	EPA	RTFO	RSB	FSC	Energy Star	LEED	Organic
Transaction Cost	☹	☹	☹	☹	☹	☺	☹	😐
Traceability and Data Elaboration	☹	😐/☺	☺	☺	😐/☺	☺	☺	😐
Governance	☺	☺	☺	☺	☺	☺	☺	☺
Trade aspects	😐	😐	😐	☺	😐	😐	NA	😐

We will explain the reasons behind our evaluation for the GHG assessment. This evaluation has been made on the basis of the analysis of the main requirements of the different certification schemes and through personal judgment derived from the elaboration of the bulk of data gathered.

1. **European Directive 2009/28/CE or EU/RES:**

- Transaction Cost: ☹. Especially from a developing country point of view, measuring GHG emissions as requested by the EU RES is particularly challenging from a transaction cost point of view. This is because it will imply the use of international auditors, especially in the short – medium term, and we have seen that experience tells us that in developing countries this "indirect" cost could be 50% higher than in developed country. In the long term, both following targeted capacity building support measures for developing countries and to "scale economies" in the market of sustainability auditors, this cost can decrease.
- Traceability and data elaboration: ☹ The EU RES presents, as we have seen in Chapter 4, still grey areas as far as concern methodologies to use for calculating GHG along the supply chain. This is the case for example of the not comprehensiveness in the list of default value for the GHG saving, the not exhaustiveness of the Eb (total emissions from biofuels) as specific methodologies for single phases are lacking, such as in the cultivation phase the NO2 and CH4 effects, or in the transportation phase.

  Another major element is the postponement of the definition of a methodology to calculate indirect land use change (iLUC) to the end of December 2010, with a high level of uncertainty for producers in planning their investments, as the inclusion of iLUC can change the GHG and profitability considerably.

  Moreover, the EU Directive allow operators to apply only the mass balance verification method for the chain of custody, at least until other indications will be given by the report the Commission have to present to EU Parliament and Council in 2010 and 2012.

  For co-products at the moment only the allocation method is allowed, and also in this case the Commission could examine in the future the possibility to allow also the use of the energy allocation one.

For all the reasons above we have evaluated the task of traceability and data elaboration challenging, at least until the Commission will not clarify these so called "*grey areas*".

- Governance: ☺**.** From a governance point of view, we like the provision in the EU Directive to make use of others certification systems as "recognized voluntary certification schemes" by the European Commission. This approach will create some clarity on the interlinkages among different sustainability certification schemes, mandatory and voluntary. Moreover, it should concretely rationalize the actual picture.
- Trade: 😐 the impact of GHG certification and measurement on trade aspects present mixed possibilities, that is why we have evaluated as yellow. As we have seen in Chapter 4, it is allowed by WTO, according to the TBT Agreement, to take measures for the protection of human, health or environment purposes.

  On the other hand, as we will elaborate further in the next sections of this chapter, the setting of standards present a serious threat for developing countries in taking part to the global market of biofuels commodities.

2. EPA standards (RFS2 Program)

- Transaction Cost: ☹: as for the EU Directive we have evaluated as particularly challenging the compliance towards GHG emissions especially for developing countries, as far as concern the costs born in the need to hire international auditors.
- Traceability and data elaboration 😐/☺: here we have a mixed evaluation. This is because EPA standards allow for the chain of custody a peculiar system, called Renewable Identification Number (RIN). This system on one hand is simpler to adopt, as it only traces biofuels at the facility level, on the other hand EPA does not show flexibility (that is why the yellow) for producers that operate in other markets, to use one single system other than RIN,

  On the positive side (green one), EPA has already come up with an updated methodology to include the ILUC effects, giving in this way a clear

regulatory framework to producers and being also more comprehensive for the accounting of GHG impacts.

- Governance ☺: as for the EU Directive, EPA rules include the possibility to have "recognized voluntary certification schemes" for meeting their standards. As for the EU DIrective this is a positive point. Moreover targeted facilitations are foreseen for small producers. According to the exemption parties who produce or import less than 10,000 gallons of renewable fuels per year are not required to generate RINs for that volume, and are not required to register with EPA if they do not take ownership of RINs generated by other parties. In addition, EPA is also finalizing a temporary exemption for renewable fuels producers who produce less than 125,000 gallons per year from new production facilities. They should not required to generate and assign RINs to batches for a period up to 3 years.

  This exemption is justified not only for the limited impacts that such dimensions can have on the overall GHG picture, but also it is an effort to facilitate start up producers testing and piloting advancing technologies for biofuels.

- Trade: 😐 Same explanation as for the EU Directive.

3. RTFO:

- Transaction Cost: ☹ same rationale **as** for the EU Directive and EPA, at least in the short term.
- Traceability and data elaboration: ☺ It is evaluated as not challenging because it allows all the chain of custody at the moment on the market (IP, segregation, mass balance and book and claim). It gives flexibility and allows saves for the producers that operate in different markets around the world.
- Governance: ☺ It applies the concept of meta standards, enhancing in this way rationalization and harmonization.
- Trade: 😐 Same explanation as for the EU Directive and EPA standards.

4. Round Table on Sustainable Development

- Transaction Cost: ☹ same rationale for the EU Directive and EPA, at least in the short term.
- Traceability and data elaboration: ☺ As for RTFO, RSB is flexible on the chain of custody system to use.
- Governance: ☺ It is seeking recognition as "verified voluntary certification standard" from the EU Commission, as well as from the EPA. In this way it will provide a kind of service for producers benchmarking them towards the different sustainability certification they are looking for. One shop stop approach.
- Trade: ☺ In case the Doha negotiations will be reopened, and in particular**,** art 31 on environmental goods and services exemption or reduction from tariff with the inclusion of biofuels as "environmental", RSB could provide through its principle and criteria a practical approach for biofuels to be categorized as environmental good. As voluntary initiative, *super partes* and not representing specifically any particular country, RSB will have, as well as GBEP, a chance to play a key role in this regard.

5. Forest Stewardship Council (FSC)

- Transaction Cost: ☹ Same rationale as EU Directive, RTFO and RSB for auditors. At the same time, as we will see in the Governance part, it allows group certification which easy the participation of developing countries small producers. It will be accounted in the Governance aspects.
- Traceability and data elaboration: 😐/ ☺Traceability along the supply chain has to be ensured also as FSC is a process based certification scheme. At the same time possibilities for group certification are foreseen for small producers.
- Governance: ☺ FSC pays particular attention to smallholders, especially from developing countries through " group certifications" and "forestry contractors".

  Another peculiarity of FSC, which is positive from a governance implementation point of view, is that principle and criteria can be tailored (maintaining at the same time a level playing field with other national and

regional systems) to national and regional circumstances, addressing in this way the peculiarities of the places they operate in.

- Trade 😐: Same rationale as for the EU Directive

6. Energy Star

- Transaction Cost: ☺ No third party certification required, therefore transaction costs related to certification are those related to the enhancing of performance of the product from a GHG (energy efficiency) point of view.
- Traceability and data elaboration: ☺ More straight forward approach product performance based, so no "traceability" process has to be reported. What has a value is the performance of the product, therefore it is easier to certify. On the negative side of it, the performance product based approach does not take into consideration trade offs with other externalities that are nor taken into account in the measurement of energy efficiency product.
- Governance: ☺easy, it has to be reported to EPA who is the only manager of it. Efforts are in place in order to make energy Star targets comparable to the ones in use in EU , Japan, Mexico and Canada in order to facilitate producers that operate in different markets.

  Another important factor of governance is the flexibility of the certification that can be upgraded after a determined period of time, once there is a technology improvement and the current standard has already reached a sufficient market spread.

- Trade: 😐 Same rationale as EU Directive

7. Leadership in Energy and Environmental Design (LEED)

- Transaction Cost: ☹ LEED is a third party certification and for the reasons explained above, the cost of transactions can be quite high.
- Traceability and data elaboration: ☺ As Energy Star it is a product based performance, even if multidimensional covering the rating system about 7 areas.
- Governance: ☺ It is managed by the US Green Building Council (USGBC) an the process is relatively straightforward. A particular merit, as we have

already illustrated in Chapter 4, is to identify the environmental concerns that are important especially at local and regional level. (7th area Regional priority identified by LEED).

- Trade: It does not apply.

8. Organic Food in Europe

- Transaction Cost: 😐 It is based on a third party certification process, but an effort has been made by EU Regulation 834/2007 tries to valorize and make it easier the certification by local auditors that, in any case, have to be recognized by the EU Commission.
- Traceability and data elaboration: 😐 It is a process based approach, it means that traceability along the entire life cycle assessment has to be guaranteed.
  In the new Regulation a particular attention has been dedicated to developing countries capacities allowing local practices (that have to demonstrate to be comparable to the ones applied in the EU) for checking the compliance of organic products.
- Governance: 🙂 Particular procedures are allowed for small producers. Furthermore, as explained also in the other parameters, there is an on gong and proved efforts to simplify overall procedures for developing countries.
- Trade: 😐 As for the EU RES, the organic certification is compatible with TBT Agreement, as it can be related to human, health or environment protection. .

Social Assessment

Let's start with the evaluation of the practicability of the different certification schemes for the Social Assessment, with the same indicators used for GHG.

Table 5.2: Social Assessment/national dimension

	EU/RES	EPA	RTFO	RSB	FSC	Energy Star	LEED	Organic
Transaction Cost	😐	Not apply	🙂	🙂	🙂	Not apply	Not apply	😐/
Traceability and Data Elaboration	😐	Not apply	😐	😐/🙂	😐/🙂	Not apply	Not apply	😐
Governance	😐	Not apply	🙂	🙂	🙂	Not apply	Not apply	🙂
Trade aspects	😐	Not apply	😐	☹	☹	Not apply	Not apply	☹

1. European Directive 2009/28/CE (EU/RES):

- Transactional Cost: 😐 The EU Directive does not ask at the moment producers to comply with principles and criteria for the social dimension of the sustainability of biofuels. The European Commission has to report to the European Parliament on the social effects of the Directive. At the same time there is the possibility that the EU Commission will request producers to report on social issues for "monitoring" purposes. The same applies to air quality.

  At the same time, for the reasons we have explained in Chapter 4, it can be costly and difficult to check the social dimension at a producers point. This is because auditing should be made with no notice and on a multiple basis to avoid the possibility of cheating.

  For all the reasons expressed above, we are in a situation of stand by, depending on the decision that will be taken by EU.

- Traceability and Data elaboration: 😐 Similar reason as expressed in the precedent point related to transactional costs. The verifiability of eventual criteria and principle for the social dimension requires a very strict auditing

that in some developing countries, especially for small producers that operate along the supply chain is difficult to achieve. At the moment it is not requested by the EU Directive, but we know that a final decision on this certification requirement has not been taken yet.

- Governance: 😐 Also for this indicator we are in a stand by evaluation. In case some more detailed reporting will be asked to producers, or even criteria and principles to be met, the meta-standard approach with "recognized voluntary schemes" can be extended also to the social dimension, making easier the process.
- Trade: 😐 At the moment there are no major issues related to the social dimension from a trade point of view. However, in case there will be in the future any requirement to comply in the EU Directive with social criteria we will have a problem of compatibility with trade rules. As we have already described in Chapter 4, many countries have repeatedly expressed their refusal to accept trade discrimination according to social criteria, such as for example labor conditions.

2. EPA

The social dimension is not included in any form in the certification standards of EPA. They do apply only to GHG emissions. Some calculations have been made as regard the effects on other pollutants, such as Particulate Matter, Ozone Nitrogen Oxide as well as on economical and health issues.

3. RTFO

1. Transactional Cost 😊: RTFO requires a report from producers on social issues such as labor conditions, land ownership. It uses the meta-standard approach which simplify a lot compliance..
2. Traceability and Data elaboration: 😐 Same rationale as above
3. Governance: 😊 RTFO takes on board fully the concept of meta-standard, partnering with the different voluntary roundtable and recognizing them as a benchmark. It improves in this way rationalization and harmonization.
4. Trade: 😐 As it is only a reporting, RTFO does not go into conflict with WTO requirements. It could eventually be a problem in case from a reporting it moves to something more weighted.

4. Roundtable on Sustainable Biofuels (RSB)

5. Transactional Cost: ☺ Social criteria and Principles are an integral part of RSB certification. We give it a green evaluation because the Roundtable is promoting, through educational capacity building programs, the training of local auditors to lower the transactional costs.
6. Traceability and Data elaboration: 😐/☺ The evaluation and traceability of the social impact of biofuels along the supply chain is not an easy task, especially in developing countries and for small-holders. That's why the yellow sign. At the same time RSB is trying to set up its system in the way to simplify as much as possible all the procedures.
7. Governance: ☺ Good example of targeted measures for small holders. As well as for GHG assessment, group certifications are put forward.
8. Trade: ☹ Incompatibility with WTO rules can arise because labor right and working conditions are part of the sustainability criteria.

5. Forest Stewardship Council (FSC)

9. Transactional Cost : ☺ Rationale for the green is the same as for RSB.
10. Traceability and Data elaboration: 😐/☺ Rationale for the green is the same as for RSB.
11. Governance: ☺ The governance aspects are particularly positive for FSC as, in addition to the particular interest towards local/regional condition and small holders challenges, there has been the involvement of parts of the population, such as indigenous people that otherwise would not have had any voice. More over, in some countries where domestic legislation was lacking, FSC has in a way been the basis for regulation or sometimes simply transposed into domestic law with evident synergies and mutual recognition.
12. Trade: ☹as for RSB possible conflict with WTO rules.

6. Energy Star

The social dimension it is not included in the Energy Star certification Program, so it cannot be evaluated from a practicality point of view in implementing social criteria.

7. **LEED**

As for Energy Star, the social dimension does not apply in the certification of the energy efficiency of the buildings.

8. **Organic Food**

- Transactional Cost : 😐 It is based on a third party certification process, but an effort has been made by EU Regulation 834/2007 tries to valorize and make it easier the certification by local auditors that, in any case, have to be recognized by the EU Commission.
- Traceability and Data elaboration: 😐 Rationale for the green is the same as for RSB.
- Governance: 😊 It is a process based approach, it means that traceability along the entire life cycle assessment has to be guaranteed.

  In the new Regulation a particular attention has been dedicated to developing countries capacities allowing local practices (that have to demonstrate to be comparable to the ones applied in the EU) for checking the compliance of organic products.

- Trade: ☹ Incompatibility with WTO rules can arise because labor right and working conditions are part of the sustainability criteria.

5.1.3 Economical assessment

Finally, we are looking at the economical assessment from a firm point of view. As we have described before, the evaluation will be based on the role that a particular certification can have. For example in case of mandatory certified biofuels, certification will be the entry point to have access to a market, in case of voluntary schemes it can represent a price premium or a reputational mark.

We will therefore evaluate the different certification schemes only on the basis of transactional cost and trade aspects. We do not consider the traceability and data elaboration relevant for the economical dimension as they can, in a way, included in the transactional cost part.

Table 5.3: Economical assessment/firm dimension

	EU/RES	EPA	RTFO	RSB	FSC	Energy Star	LEED	Organic
Transaction Cost	☺	☺	😐/☺	😐/☺	😐/☺	😐	😐	😐☺
Trade aspects	☺	☺	☺	😐/☺	☺/😐	😐	😐	😐/☺

- **EU RES and EPA**

For a firm that wants to export its feedstock or finished product into the EU and/or US, getting the certification is essential. It will become conditional to operate into the EU and US markets.

Therefore we have evaluated green both for transactional costs and trade aspects. This is because the certification will represent the key to participate in the business. Here is not about how much it will cost to be audited or to get data, but it is about having access to a market.

In case the underlying costs will be to high for a firm, than it can pursue business in domestic markets. However, it will be a short-medium term strategy as the EU and US certification standards and certification schemes will influence in the medium-long term other countries regulation. Some indications in this sense are already clear, as far as concerns regulation in India, China, Mexico on targets for the use of biofuels.

- **RTFO**

RTFO also represent an entry point for the industry into the biofuels market in the UK. It is true that, once the EU Directive will be into force (January 1st 2010) an operator will be more interested to get the EU certification that will be usable also in the UK other than only the UK one. The same reasoning applies to trade aspects.

- **RSB and FSC**

From a firm point of view, get the certification from voluntary schemes such as RSB and FSC can represent an advantage even if these schemes not mandatory.

In fact as we have seen before, they can play the role of meta-standards for other certification schemes such as the EU Directive and RTFO.

Moreover, there is also the positive reputational effect that emerges from taking part to these "green clubs" that has to be taken into consideration.

- **Energy Star and LEED**

Both the certification programs rely upon the market power of their brand that have been consolidated during the years.

This means that firms looking at the premium market of more efficient products, being appliances or buildings have to bear the costs of certification.

Moreover, as far as regards LEED, in some US States (i.e. State of Michigan) and Municipalities buildings that are constructed according to its guidelines do benefit of tax exemptions and other financial support.

- **Organic Food**

Firms will be ready to get certification from organic food because they will get a premium in positioning themselves in the niche of organic market. As we know this market is growing both in Europe, and to a certain extent, in USA.

From a trade point of view, as we have seen, there are no problems as they can be justifiable as protecting human health and natural resources.

5.1.4 Synthesis Assessment for the three pillars and dimensions

In Table 5.4 we have tried to make a synthesis of the evaluation of the different certification schemes according to the dimensions of sustainable development. It has to be clear that our point of interest is how challenging - according to transactional costs, data collection and methodologies along the supply chain, governance and trade – is the actual measurement and therefore demonstration of compliance of the certifications schemes.

By deduction, it is true that a certification scheme whose compliance with is difficult to achieve, will also be less effective in pursuing the goals it has been called to achieve.

As we have been recalled several time, we are here interested in the actual practicality of the schemes in being implemented as we have seen this is becoming a major issue of concern for producers, namely the operability of certification schemes other than the strictness of a particular standard.

After having assessed the certification schemes according to the main variable identified as challenges for implementation, we have tried to go a step forward in this analysis making a synthesis of the previous 3 assessments.

We have tried to define an average of the results identified in the single tables related to GHG/Environmental, Social and Economical.

We are convinced that this analysis is a first attempt, and even if we have tried to be as much as possible rigorous and objective in this evaluation, other elements not included in our assessment can have a role in terms of implementability. Among them we can mention or example the timeframe, we look at the situation as it will most probably be in the sort term and, due to economy of scale, it should change considerably during time.

Another element is the development of new technologies and systems for data elaboration and clarity and easiness for developing traceability along the supply chain.

As we can deduce from our matrix is that the demonstration of compliance with GHG especially, and less with other environmental issues, represent an area where does exist a significant degree of uncertainty especially in the case of certification schemes that are “process” based. This is due to the fact, as we have already explained in the analysis of the single schemes, that methodologies for GHG calculations are still not clear and especially not yet tested into reality.

As far as concern certifications schemes “product” based such as for example Energy Star and LEED, the calculation of energy efficiency, and the related GHG emission/savings, are more straightforward as the only issue to consider here is a product.

It is curios to end up in a situation, that might be also temporary, where one of the major issue related to the production and use of biofuels, GHG emissions, is at the end one the most difficult element to measure and therefore to achieve.

Our conclusion is not that process based certifications schemes are not useful at the moment toward the achievement of the GHG reduction goal that biofuels suppose to achieve, rather it is a "warning" position that highlight a current stand by situation where GHG reduction targets are in place but the way to demonstrate compliance with is still uncertain.

On the social side, we have seen that some certifications schemes do not even contemplate this component, for example US EPA, as well as Energy Star and LEED.

For those that have included in the sustainability assessment issues such as labour condition, land rights, etc there is a slightly better situation compared to the GHG one.

In fact, some certification schemes do require the compliance with ILO conventions, and of course the regulation that is applied at national level. Moreover, some schemes do have set up specific, facilitated, rules for smallholders biofuels producers, making in this way certification less costly and achievable.

In some other cases, as we have already pointed out in Chapter 3, FSC has been in certain counties the vehicle to engage minorities such as indigenous people in the discussions related to forestry.

Finally, we have evaluated the economical side in a slightly different way, keeping the point of view of business opportunities for the firms.

We have therefore considered the mandatory schemes in particular EU and EPA one, in a positive way because certification does represent in practice the only way to have access to those markets and be part of the business.

While in the case of other voluntary certification schemes such as RTFO, RSB and FSC we have considered them as a medium challenge with scope of improvement especially because they are potential meta-standards for the regulatory one, increasing in that case clarity, and hopefully costs, related to the compliance of mandatory schemes.

As far as LEED, Energy Star and Organic, from an economical point of view it really depends on the marketing strategy of the firm, and its willingness to positioning itself in a niche market at least for Energy Star in a first phase of development of a product.

It is about, especially in the case of Energy Star, for a firm to be a leader in innovative, green products, or to be a follower that during time have to adequate himself to market forces and sometimes also regulatory one.

In synthesis, sustainability certification schemes in general, and biofuels in particular steel need to be assessed in their effectiveness of measuring and demonstrating compliance with a given set of standards.

Moreover, in the case where there are different dimensions to be evaluated in the same certification scheme, the picture becomes more complex because the different dimensions present different challenges and sometimes can also interfere one with another (for example the Brazilian case of burning sugar cane and potential increase in unemployment).

Table 5.4: Evaluation Matrix of sustainability certification schemes effectiveness and impact

		EU RES	US EPA	RTFO	RSB	FSC	Energy Star	LEED	Organic
Global Level	**GHG/Env**	😐	😊/😐	😐/😊	😊/😐	😐/😊	😊	😐	😊
National Level	**Social**	😐	**NA**	😐/😊	😐/😊	😐/😊	**NA**	**NA**	😐
Firm Level	**Economic**	😊	😊	😊/😐	😊/😐	😊/😐	😐	😐	😐/😊

5.2 What our analysis tell us. Too many "theoretical" schemes risk to overwhelm biofuels development

Biofuels have been called to contribute solving a great number of today challenges: environmental problems, especially reduction of GHG emissions, energy security with the increase of domestic oil supply for transportation (better the Iowa bio-ethanol corn based than the Iranian oil?), agriculture development with a diversification of agricultural production, industrial development for developing countries most suitable for bioenergy feedstock growth due to he extension of land and climatic conditions.

We can therefore count almost 4 goals that biofuels have been called to achieve.

Moreover, when we examine the different criteria and standards for biofuels development, we see that biofuels need to demonstrate compliance with quite strict principles related to the protection of biodiversity, forests, labor rights, land tenure.

This is absolutely correct and we do not want to argue that the respect of natural resource protection, as well as inviolable human rights should be neglected.

Our concern is that, due also to the current dimension of world biofuels consumption, less than 2% of the total road fuel demand according to IEA WEO 2008, we are attributing too many responsibilities to a "child" industry that is still making its first steps as a global commodity in the trade market.

We will not solve the biodiversity problem through biofuels development, nor the child labor. What we can absolutely do is not to worsen current situation, finding a middle point that has sense in terms of implementability.

Other tools, such as the convention on Biodiversity, the different partnerships on the protection of forests, ILO Convention on human rights are the appropriate, ad hoc, instruments to resolve specific issues.

What we should understand better is how to build real synergies and inter-linkages among the different tools we have in place. How to make work a system composed of different tools, mandatory and voluntary, in order not to duplicate efforts and not overburden biofuels development with full respect of environmental, social and economical concerns.

Different solutions are on the table.

A first one is the proposal of an overall agreement on the sustainable development of biofuels, something similar to the "New generic standard" proposed by Schlegel S. (2008)[337], already discussed in Chapter 4.

This option could rationalize and put under a single umbrella all the standards related to sustainability. The pragmatic answer to this proposal is that it will be highly difficult to achieve it, due to the length and particular interests (governmental but also the ones of the Institutions that coordinated the single tools) that will create a strong resistance towards a new, single, approach.

A call for rationalization, similar to the one above mentioned but conceptualized for voluntary standards, is the approach proposed by Cashore B. (2010)[338], the "Better World" a single label that hold principal social and environmental certification systems. The idea is not to modify existing schemes rather to put them under the same umbrella in the way that the label of a product could be "Better World – FSC", another one "Better World- RSB", etc.

This option could help especially the recognition of "good products" from the point of view of consumers, signalling easier the distinction with other products not affiliated to Better World. On a negative side, we envisage difficulties in dealing with governance aspects such as who decide which schemes are eligible to be under

[337] Schlegel S. et Al "Options to develop a Global Standard-Setting scheme for products derived from natural resources (NRS)", WWF, Ecologic discussion paper, commissioned by FSC International, WWF Germany.

[338] Cashore B. (2010), Can Biomass Certification Schemes "Ratchet up" Global Standards?. Presentation to Symposium, "Ensuring a Green Recovery: Biomass Certification Schemes from both Sides of the Atlantic" National Council for Science and the Environment Washington, DC, January 22, 2010.

the Better World umbrella, how to guarantee a level of homogeneity in the requirements and degree of seriousness that the different schemes should guarantee?

Another option is the so called "scaffolding regulation" proposed by Hausmann R. and Wagner R. (2009)[339], defined as a flexible set of norms that can accommodate to future changes in the rest of the regulatory environment.

The positive side of this option is that the flexibility of the norm makes it adaptable to changes in biofuels technologies and in scientific findings about the correct methodologies to use.

On the negative side there is the uncertainty that this approach can give to producers, who have to plan their investments in the medium-long term and need a clear regulatory framework that has the same timeframe.

An option, that in our point of view, seem both to guarantee synergies among existing regulatory and should not present the same degree of difficulty as other option such as the negotiation of a new umbrella regulatory (in the case of an agreement) or voluntary (in the case of better world label) scheme is the one of meta-standard or benchmarking.

The positive element of this option is to make use of the knowledge bounded in the years by more experienced certification schemes, and be linked to something that has already gone through the process of scientific verification, consultation and agreement among stakeholders participating in the given scheme.

The challenging part should be the mechanism through the different benchmarking scheme follow up in case one of them changes its criteria due for example a follow up in technology or methodologies. In other terms how to ensure that the

[339]Hausmann R. and Wagner R. (2009) "Industrial Development and the making of a Global Market for Biofuels" prepared for the Conference on Biofuels Certification at Harvard University, May 2009

benchmarked schemes keep up and remain interlinked also in case of changes that occur for some or all of them. How to ensure the dynamism of the system.

5.3 What we do propose: a governance system that puts at the front effectiveness, practicality, synergy and clarity

As we have seen in previous paragraph, in many cases certification schemes for biofuels and other sectors have been developed with little attention to their implementability and operationality.

This is the case for example of the EU one, but also of other schemes such as the one of EPA.

Producers both from developed and developing countries are struggling in understanding the rules and how to comply with them. And on key effect is uncertainty, always from a producer point of view, in defining investments in a uncertain medium-long term framework.

Some producers[340] at the IDB workshop also put into doubt that there will be enough supply of biofuels to meet the target of use that many countries have established.

This is because the biofuels industry is becoming too complex and demanding from a regulatory point view, and the uncertainty component about the rules to be applied is playing a discouraging effect.

We are therefore encountering a situation where in less than 5 years we transitioned from a total enthusiasm related to biofuels development, to a situation where those that created such an expectation (policy makers), are now the ones that are curbing this development for a proliferation of rules doubled with a lack of methodologies for complying with these rules.

Our analysis has indicates us that schemes such for example the EU one, targeted mainly on guaranteeing the reduction of GHG compared to fossil fuels, are quite

[340] Interviews with biofuels producers at IDB on January 25-26, 2010.

complex to follow and in some case uncertain. This complexity makes difficult for producers to comply with the rules, compromising in this way the objective of the regulatory tool itself.

At the same time, adding to the GHG component also other dimensions such as the protection of biodiversity, the reporting (even if it is not clear whoa s to report and what) raise the degree of complexity and uncertainty.

Moreover, the lack in some cases of specific facilitated procedures for small holders producers, create an unbalance in the biofuels business opportunity, worsening in some cases situation in developing countries and rural areas already affected by unemployment or scarce labor demand.

As we have seen the component of capacity building, especially in those countries, should be strengthened.

Given the situation described above, what we propose is to put at the front effectiveness and practicability in the design of a standard. It means that we should be very clear on the objective we want to achieve with the standard and make sure that the methodologies to comply with it are clear and doable. Clear methodologies for the compliance with the standards are a key component of an effective certification tool.

Unfortunately current situation, described also by our above analysis, tell us that reality is going on a completely opposite direction, with a proliferation in the number of standards and within them in the number of criteria and principles to be met.

At the same time, in order for a scheme to be up to date and therefore truthful of current science and technologies development, a mid point has to be found in guaranteeing standards and schemes that provide certainty in the rules, but at the same time being “adaptable” in taking into account these developments and incorporate them in new standards and methodologies.

This could be done in different ways, such as for example revising standards regularly, every established period of time, like 3-5 years.

As we have already briefly discussed in the previous paragraph, in this rationalization and needed increase of synergies among sustainability certification schemes, the meta-standards approach can play an important role.

Once a certification program is recognized as being compliant with a meta-standard or benchmark, then it would be viewed as an acceptable alternative to the other biofuels standards. From a practical point of view, a biofuels producer would only have to achieve one of the certifications recognized by the meta-standard, and would then be free to sell into any of the markets that recognize the meta-standard. This would replace the current system where the producer would be forced to achieve many separate certifications to enter the same set of markets. For regulatory bodies, this would be a way to recognize voluntary certifications as being sufficient to meet regulatory standards on the sustainability of biofuels. Movement in this direction is being seen in the EU Directive of "recognized voluntary certifications".

It will not only take advantage and make use of the most experienced schemes that are already playing a role since years in the sustainability arena (such as FSC, Organic Food), but it will also guarantee a more systematic approach and order in a situation where there is a growing number of certifications schemes with identical or similar goals.

This "systematization" should also be beneficial not only from a governance point of view, but also from a transactional costs point of view.

5.4 Which negative consequences we envisage in not keeping at the front effectiveness and practicability

We have already touched upon the negative consequences we envisage in not taking effectiveness and operability at the front. We will try here to put everything together in a more systematized way.

First of all the major problem we see is the risk to kill an industry that is at an infant stage in some countries due to the challenges in meeting the substantial targets put forward by the EU and US, as well as by other countries. This emerged quite clearly during the IDB workshop, remaining producers in a "stand by" position, having problems in making operational current standards due to lack in clarity for applying methodologies (indirect land use change, co-products).

This means not only a failure of policies that have tried to promote diversification of energy mix,

reduction of climate change, agricultural and rural development, but especially it means to kill an opportunity of industrial development for developing countries.

In some of Latin America countries, as well as in Africa, there are promising potential for the development of a biofuels industry. This is not only for climatic conditions, but also given the extension of land, natural resources, native feedstock.

Moreover, the development of biofuels could catalyze and promote other activities determining a "cluster effect" where the development of an industry attract other correlated activities (research innovation) and increase specialized employment. In addition, it would spur also the development of basic infrastructures (roads, power facilities) that could be beneficial not only for the biofuels industry itself, but also for the overall community.

Another important negative effect we see linked to the lack of focus on implementability is the almost exclusive participation in this business of big industrial companies, those that can invest money an dedicate specific expertise to the development and understanding of all the steps that a certification for biofuels require.

As we have gone through the specific requirement and measurement in the part of the dissertation related to the supply chain methods, we have seen that the procedures requested are quite sophisticated and do also require advanced logistic systems. Moreover, there are costs, for example the ones related to the auditing that will be hardly bearable by small producers, especially from developing countries.

This means that current certification standards and schemes for biofuels can act as a *de facto* trade barrier for developing countries producers.

There will be in fact almost no global (or at least North-South) market for products that will not get certification, as they will not comply with regulation in EU and US.

Sustainability certification would in this way operate as a non-tariff barriers for global trade of biofuels, increasing the divide between developed and developing countries access to global market of products.

Given this potential situation we could soon encounter, a simplification and increase in clarity on how to comply with standards, as well as the focus on capacity building programs for developing countries is highly needed.

The meta-standard approach that we were proposing in the previous paragraph helps in this direction especially for the simplification part. Other ad-hoc facilitated procedures for small scale producers should be put forward an promoted by the individual certification schemes.

Another more negative general consequence we envisage here is the potential mistrust in public policies. People are receiving contradictory, and often non scientifically based, information related to the impacts of biofuels on environment and society.

This creates confusion in consumers, as well as lack of trust in policy makers that in some cases during the last five years have swung between enthusiastic and condemning effects of biofuels development and impacts on sustainable development.

It is time to look at biofuels with objectivity, trying to read off from anxiety in demonstrating that policies related to the certification of biofuels have to cover all the minimum details related to any sustainability impacts that biofuels can have. As we have affirmed in the introduction part of this dissertation we should trade off ambition with practicality.

This will not help only the real implementation of public policies related to biofuels, both complying with target consumption and sustainability standards, but it will also re-build trust from citizens and consumers giving them a more credible and objective look at the biofuels issue.

Conclusions

We will try to summarize the main findings that the research study has drawn, making recommendations to sustainability certification designers for biofuels, and proposing some actions to implement the proposed recommendations.

1. A first general conclusion we can drawn is that the present situation is overcrowded by an enormous number of sustainability certification schemes for biofuels. Some are feedstock based, other product based, voluntary or part of regulatory schemes.
   This situation not only creates confusion and misunderstanding among operators, but it also determines increased costs for producers that intend to export to different markets where different certifications schemes are in place.

   According to the analysis we have made, from a theoretical point of view in chapter 3 where we have addressed the interactions between different tools, from a practical perspective in the governance section of chapter 4 where we have analyzed specific certification schemes and their form of interactions and possible synergies, and finally from the analysis we have made through the analytical matrix in chapter 5, we can end up with the following findings for certification designers in order to improve the present situation:
   a. It is key to understand the inter-linkages, and possible coordination, among different voluntary schemes, such as the Roundtable on Sustainable Biofuels (RSB), the Global Bioenergy Partnership (GBEP), Better Sugarcane Initiatives (BSI), Roundtable on Sustainable Palm Oil (RSPO). A duplication of efforts is in place, which does not benefit producers, nor confer a positive reputational effect to the entire system of certification schemes;
   b. In addition to the previous point, and maybe also more important, is the effort towards determining links between voluntary and regulatory schemes that play a role in the global trade of biofuels (EU Directive; Environment Protection Agency regulation).

c. It is key and serious not ending in the game of "reinventing the wheel", it is absolutely important to leverage the experience of sustainability certification schemes in sectors other than biofuels, such as forestry with the experience of Forest Stewardship Council (FSC), Energy Star, Leadership in Environment and Energy Design (LEED), Organic Food. These sectors are already in place since years, and it is possible to learn from their good and bad experiences.

   On the top of that, as we have learned in previous chapters, there are common elements between sustainability criteria that apply to biofuels and other sectors.

Our recommendation for certification designers is to consider, in the governance policies of sustainability certification schemes, the implementation of a meta-standard approach, we have discussed in chapter 4 and 5, in order to build synergies among different certification schemes, both voluntary and mandatory, and simplify in this way the current confusing situation.

A meta standard approach will also, as "one stop shop" approach, make the compliance with certification schemes easier and in some cases also less costly reducing transaction costs. For a producer the possibility to deal with a single interlocutor, other than multiple ones, simplifies procedural questions and costs.

2. A second conclusion is that in most cases certification schemes are pretending to be too much ambitious in comprising a long and detailed list of criteria and principles for the different dimensions of sustainable development, without taking in due consideration the operationality of them.

   There is a sort of anxiety on certification designers' side to be as much as possible comprehensive in defining detailed lists of sustainability principles and criteria, loosing in this way the main point: how to translate them into practice.

   As we have learned in our matrix in Table 5.4 of Chapter 5, those certification schemes that try to address multiple issues at the same time, like for example the EU Directive, FSC and RSB, do not excel nor in the GHG/Environment dimension nor in the social one.

There is in practice a dispersive effect in ensuring that a particular scheme should address the question of sustainability fully.

Moreover, as we have presented in Chapter 4 in the section related to compliance, attention has to be paid to situations where an action can have as unintended consequence the deterioration of another one. The case presented by UNICA on the side effect of mechanization towards unemployment is a clear example in this regard.

Another example is given by EPA with the examination of the consequences of the renewable standards recently issued (February 2010). In fact, according to EPA[341], the full implementation of the renewable fuels standard program will reduce GHG by 138 million metric tons by 2022 (equivalent to remove 27 million vehicles from the road), but at the same time it will cause the increase of other air quality pollutants such as nitrogen oxides, particulate matter and hydrocarbons with impact that vary on regionally basis[342].

In both cases corrective actions are needed in order not to end up in a situation that could be, for some aspects, worsen than the initial one.

Another issue that we have seen recalled during interviews to producers and designers is the fact that if we raise a bar too high, which means if the criteria to comply with will be too strict, we will end up in a situation where only the top producers will probably be able to comply with them. These top producers are in most cases the ones that already implement good environmental and social practices and/or the ones who can demonstrate the compliance with such practices.

The issue to consider is: would this make a huge difference in terms of the impact on environment or the social dimension we are here considering to improve? How is it possible to attract new producers segments, those that are far from getting closer to good practices?

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[341] EPA (2010) Office of Transportation and Air Quality "Regulatory Announcement - EPA Finalizes Regulations for the National Renewable Fuel Standard Program for 2010 and Beyond" EPA-420-F-10-007 available at http://www.epa.gov/oms/renewablefuels/420f10007.htm#1 downloaded on February 27th, 2010

[342] EPA (2010) "Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis" EPA-420-R-10-006,
February 2010

As we have seen in Chapter 3, in the section focused on Energy Star certification program, a much more effective strategy would be to put the bar a little lower in order to signal it as accessible to a good number of producers, including those that are positioned far from excellence.
This means that sometimes to trade off ambition with real impact and effectiveness can be more successful towards meeting our goal.

Finally on this point, as we have examined in Chapter 4 when we have analyzed the EU Directive as well as other schemes, there are still grey zones related to how to demonstrate compliance with sustainability criteria, especially to meet regulation.
An example is the absence of an agreement on a methodology to measure GHG emissions for co-products, or in the case of land use change effects. There is a need of convergence in the methodology approaches because the current situation confuses the producers and can also create market distortions. Producers in the workshop underlined that the main concerns are not the standards themselves, but how to measure their compliance and how to demonstrate that producers do follow the rules.

Following the above rationale we would like to propose the following recommendations to certification designers:

a. In order to be effective it is key to trade off ambition with operationality. It would not help the certification penetration into the market, nor the success in meeting the goal if a scheme is not implementable in practice.
   Successful policies are not the ones that look nice and comprehensive on paper, but those that have the power to convene a change in practices (for real).
b. It is necessary to clarify issues where still dominate uncertainty from a methodological point of you. Methodologies for accounting GHG emissions in case of co-products, indirect land use change, chain of custody cannot be considered "*details*" when a producers is in the process to demonstrate compliance with a certification scheme. Different methodologies and accounting methods can pose at risk the profitability of investments for the private sector, as they can change considerably the numbers.

The declaration of one producer during the IDB workshop has been very clear in this regard: "*building the race car while running the race*" does not make sense and does not help towards green investments.

Our suggestion to certification designers is to spend much more efforts in the phase of field testing of sustainability criteria. Only when we translate into practice what has been the result of many meetings and compromise negotiations on numbers and wording, we can have a real knowledge of what can be achievable and measured according to the indications of the certification scheme.

And for those standards and methodologies that have been demonstrated to be not sufficiently clear and feasible in the phase of field testing, for reasons linked to the lack of knowledge or scientific consensus, it would be more helpful to put them in a situation of stand by and not include them in the certification, until more clarity on their implementation and implication is available.

It would be preferable to have now a regulation or a voluntary scheme that is not comprehensive, planning its update 5-10 years from now, with updated technological and scientific findings. We have to trade off a scheme that looks better (more comprehensive), but difficult (or impossible) to implement with one that works and has a clear objective.

3. A third conclusion is that our analysis has shown us that there is a high risk that small scale producers, especially in developing countries, may be edged out of the industry if sustainability certification and regulation does not take their interests into account. Sustainability certification schemes imply costs that are prohibitive for smallholders especially in developing countries. According to our interviewers the cost of auditing in a developing country can be double that in a developed one. This is due to the cost of auditors hired internationally to compensate for national capacity gaps. Moreover, small industries may encounter financial and technical difficulties due to the lack of reliable data, but also basis support of local laboratories for basic analysis. In practice there is not the same playing field.

This situation is very dangerous because the development of biofuels could be a source of income for small scale farmers in developing countries. And, as we have already elaborated in chapter 5 in the section related to the negative consequences in not dealing with effectiveness, we could end up in a situation where the position of already poor small farmers could even worsen.

Our recommendations for sustainability certification designers[343] are the following:

a. Simplified procedures for small scale holders need to be included in sustainability

   certification schemes for biofuels. These procedures, that are already present in some of defined or under definition certifications schemes for biofuels need to be strengthened with ad hoc capacity building programs.

b. It would not be obvious for a small scale farmer the added value of being certified, therefore ad hoc programs of raising awareness and capacity building have to be developed together with simplified procedures.

Our suggestion for implementing the recommendation is to follow the example of group certification models or cooperative certification that already operate in FSC and organic food models. They are proving not only to be an effective method for small scale holders to lower the cost of transactions for getting the certification, but they can be also a way to promote also for other purposes cluster approaches to small businesses.

At the same time, a source for capacity building programs both for awareness and for capacity building in collecting data and understanding procedures can be found in the programs promoted by the multilateral development bank. At IBD for example the Multilateral Investment Fund, whose focus is to support small and medium enterprises in Latin America and Caribbean Region.

In conclusion, going back to the core question of sustainability science that has driven this research " *What systems of incentives structures – including markets, rules, norms, and scientific information – can most effectively improve social*

[343] For "sustainability certification designers" we intend entities, such as regulatory agencies and voluntary partnership, that define mandatory and voluntary sustainability standards and certification schemes.

capacity to guide interactions between nature and society toward more sustainable trajectories"[344], we can affirm that sustainability certification schemes represent one of the tools that can improve the interaction between nature and society if designed in the correct way.

As it is becoming clear due to the failure of global negotiating agreements on environment or trade, we need to be more creative and flexible in finding other organizational forms (structures) to meet sustainability goals.
Certification schemes are a good examples to actively engage the private sector, with its adaptive capacity of innovation and dynamism, as well as the civil society in finding new ways for spurring action towards the protection of the environment and the well being of society. At the same time the role of government in setting the playing field is ensured, as well as its direct or indirect monitoring role.

The sensitive issue now, in this pivotal phase of the implementation of sustainability certification schemes, is to start in a sensible and correct way in order to meet our sustainability goals, avoiding the risk to destroy an approach that can in practice work.

We hope that this research analysis has been able not only to point out the challenges that producers are phasing in understanding and trying to comply with standards and certification criteria, but also to propose some corrective actions that in this phase we consider key for the workability and success of biofuels sustainability certification schemes.

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