BioTrade2020plus

Supporting a Sustainable European Bioenergy Trade Strategy

Intelligent Energy Europe
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Deliverable 2.5

REPORT ON THE ISSUES CONDITIONING THE OPERABILITY OF THE SUSTAINABILITY SCHEMES INCLUDING THE IMPACT ON COSTS.

DRAFT REPORT

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The BioTrade2020plus Project

Objectives

The main aim of BioTrade2020plus is to provide guidelines for the development of a **European Bioenergy Trade Strategy for 2020 and beyond** ensuring that imported biomass feedstock is sustainably sourced and used in an efficient way, while avoiding distortion of other (non-energy) markets. This will be accomplished by analyzing the potentials (technical, economical and sustainable) and assessing key sustainability risks of current and future lignocellulosic biomass and bioenergy carriers. Focus will be placed on wood chips, pellets, torrefied biomass and pyrolysis oil from current and potential future major sourcing regions of the world (Canada, US, Russia, Ukraine, Latin America, Asia and Sub-Saharan Africa).

BioTrade2020plus will thus provide support to the use of stable, sustainable, competitively priced and resource-efficient flows of imported biomass feedstock to the EU – a necessary pre-requisite for the development of the bio-based economy in Europe.

In order to achieve this objective close cooperation will be ensured with current international initiatives such as IEA Bioenergy Task 40 on "Sustainable International Bioenergy Trade - Securing Supply and Demand" and European projects such as Biomass Policies, S2BIOM, Biomass Trade Centers, DIA-CORE, and PELLCERT.

Activities

The following main activities are implemented in the framework of the BioTrade2020plus project:

- Assessment of **sustainable potentials of lignocellulosic biomass** in the main sourcing regions outside the EU
- Definition and application of sustainability criteria and indicators
- Analysis of the **main economic and market issues of biomass/bioenergy imports** to the EU from the target regions
- Development of a dedicated and **user friendly web-based GIS-tool** on lignocellulosic biomass resources from target regions
- **Information to European industries** to identify, quantify and mobilize sustainable lignocellulosic biomass resources from export regions
- **Policy advice on long-term strategies** to include sustainable biomass imports in European bioenergy markets
- **Involvement of stakeholders** through consultations and dedicated workshops

More information is available at the BioTrade2020plus website: **www.biotrade2020plus.eu**

About this document

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RE	Restricted to a group specified by the consortium (including the Commission Services):	
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Acronyms

1G	First Generation
ACI	The American Consumer Institute
AF&PA	American Forest & Paper Association
BP	Best Practices
C&I	Criteria and Indicators
CEN	European Committee for Standardization
CENBIO	Centro Nacional de Referência em Biomassa
CFS	Committee on World Food Security
DECC	UK Department of Energy, Climate Change
EC	European Commission
EFI	European Forest Institute
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSC	Forest Stewardship Council
GBEP	Global Bioenergy Partnership
GEF	Global Environment Facility
GGL	Green Gold Label
GHG	greenhouse gas(es)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IINAS	International Institute for Sustainability Analysis and Strategy
IISD	International Institute for Sustainable Development
ILUC	indirect land use change(s)
ISCC	International Sustainability Carbon Certification
ISO	International Standardization Organization
JR	Joanneum Research
LUC	land use change(s)
MS	Member States
NEN	Netherlands Standardization Institute
PEFC	Program for the Endorsement of Forest Certification
RED	Renewable Energies Directive 2009/28/EC
RSB	Roundtable on Sustainable Biomaterials
SAN	Sustainable Agriculture Network
SBP	Sustainable Biomass Partnership

SER Social and Economic Council of the Netherlands

SFM Sustainable Forest Management

SWOT Strength-Weakness-Opportunities-Threat

1. INTRODUCTION AND OBJECTIVES

1.1. Overview of Biomass Sustainability Governance

The demand of biomass not only for bioenergy but for the whole bioeconomy is expected to significantly increase in the EU in the coming years. Thus, in addition to the biomass demand for bioenergy, feedstock demand for the bio-based industry (i.e. bioplastics, construction materials, composite materials, etc.) is expected to expand (e.g. Panoutsou et al. 2014).

This anticipated biomass demand increase will not only come from so-called 1st generation (1G) biofuels (i.e. biofuels produced from food crops) but more remarkably for lignocellulosic biomass as feedstock for 2nd generation (2G) biofuels, biorefineries, co-firing, and biomaterials. Whether this biomass will be produced in the EU or come from imports will depend on several factors (e.g. IINAS, EFI & JR 2014) and is further investigated in other parts of the BioTrade2020plus project.

Sustainability will be a key issue for the supply of biomass for the bioeconomy. Given the limited amounts of land-based biomass and its competing uses, supply of biomass for non-food purposes is limited. Thus, the definition and applicability of sustainability will determine the extent to which biomass will be available for markets and, therefore, how the bioeconomy will evolve.

There is a broad range of policy instruments that can be used to require or promote sustainable practices throughout biomass supply chains in order to ensure that biomass (especially for bioenergy) is developed in an environmentally, economic and socially sustainable way. Those efforts affect not only the supply side but also the final use of biomass, especially in the framework of the resource efficiency discussion[1]. These efforts are present at several governance levels, including local, national, regional or international. These efforts can be divided in mandatory and voluntary schemes and regulations, efforts specifically targeting some types of biomass for given final uses (e.g. voluntary schemes to assure sustainability of 1G biofuels) or broader schemes (e.g. voluntary schemes to assure sustainable forest management).

The BioTrade2020plus project is focused on lignocellulosic biomass imported from selected non-EU countries. The feedstocks selected comprise primary and secondary agricultural and forest residues as well as other feedstocks that could be produced on surplus land (such as biomass from existing forest plantations, new forest plantations and dedicated biomass crops).

For solid biofuels, the market is less complex and trade dynamics are more straightforward than for liquid biofuels (Goh et al. 2013). At present, the EU is the main destination of internationally traded solid biomass for energy, especially pellets. Nevertheless, wood pellets are more expensive than coal, and this is not likely to change in the short term so government subsidies or quota systems determine the demand for solid biofuels, and subsidies typically come with sustainability requirements (Goh et al. 2013).

To assure that lignocellulosic biomass for bioenergy is sustainably sourced, lessons learnt in the production of biomass for various final uses (e.g. biofuels, co-firing etc.) should be taken into account.

[1] Approaches to resource efficiency for biomass are being particularly addressed in the Biomass Policies project (www.biomasspolicies.eu), see Pelkmans et al. (2014) for more details on the discussion about guidelines and indicators for the evaluation of sustainable resource efficient biomass value chains.

This know-how includes the experience acquired from forest certification schemes as well as voluntary schemes for biofuels, pellets and initiatives with respect to biomaterials.

- The general objective of this report is to have a better understanding of the regulatory framework governing the sustainability of lignocellulosic biomass not only for bioenergy but also for bioeconomy.
- In particular, this report aims to improve the understanding of the **role of voluntary certification schemes** in biomass sustainability governance. The focus is given to lignocellulosic feedstocks (or derived bioenergy carriers) when sourced from third countries to the EU. For this, particular attention will be paid to the following issues:

- Better understand the architecture of biomass sustainability governance and the **role that voluntary certification schemes** might play on this.
- Analyze the experience gained in the application of certification schemes in the **forest sector**, in the **biofuel and bioliquids** arena, for biomaterials as well as for pellets that could particularly apply to lignocellulosic feedstocks.
- Propose a list of **recommendations,** based on a SWOT analysis that could facilitate the integration of lignocellulosic certified biomaterials.

2. BIOMASS SUSTAINABILITY GOVERNANCE

At present, numerous sustainability systems for bioenergy have been developed on national and international level, promoted by different organizations, for different feedstocks (or intermediate products in e.g. the agriculture or forestry sectors) and with different scopes, as extensively discussed in Deliverable 2.3 of this project[2]. At a first glance, it can be distinguished between:

- International efforts that either directly or indirectly might be linked to the sustainability of biomass.
- Efforts in the sourcing regions that establish the limits or recommendations for sustainable biomass sourcing.
- Efforts in the importing regions that might impose binding regulatory frameworks or promote voluntary approaches to sustainability with respect to internationally traded biomass.

It is relevant to have a sound understanding of these efforts to better interpret the role that voluntary certification schemes are already playing and might play in the future with particular focus on lignocellulosic biomass.

2.1. Biomass sustainability governance at the international level

International efforts to assure sustainability of lignocellulosic feedstocks are very diverse and embrace different purposes. Relevant initiatives are:

- Global Bioenergy Partnership (GBEP), which developed a set of sustainability indicators (GBEP 2011) that, though not specific for lignocellulosic biomass, provide orientation about sustainability in the environmental, social and economic dimensions.
- The International Standardization Organization (ISO), working on a standard addressing sustainability issues related to bioenergy production (ISO 13065).
- Financing institutions and donors safeguards. Several financing institutions (e.g. World Bank, regional development banks) - and donors (e.g. GEF, bilateral agencies) require sustainability safeguards including those related to bioenergy from lignocellulose.
- Voluntary guidelines developed at global and regional levels related e.g. to the forestry sector (i.e. for plantations such as the New Generation Plantations[3] or the voluntary guidelines for responsible management of planted forests; FAO 2006) or to land (Voluntary Guidelines on the Responsible Governance Tenure of Land, Fisheries and Forests in the Context of National Food Security; CFS 2012).

2.2. Biomass sustainability governance in the sourcing regions (exporting countries)

Many countries all around the world have promoted different regulatory frameworks to assure sustainable production of biomass. In Deliverable 2.3 these initiatives and other voluntary approaches are briefly discussed with attention to identifying sustainability

[2] "Report on the assessment of criteria and indicators in existing sustainability schemes for lignocellulosic feedstocks"

[3] http://newgenerationplantations.org/

requirements (such as indicators, recommendations, etc.)[4]. Whether the voluntary approaches or mandatory schemes are promoted depends on the ways that policy-making has been developed[5]. Examples to illustrate these diverse configurations are

- Biomass sustainability governance in the US, particularly in the Southeast (origin of the vast majority of the internationally traded woody pellets to the EU). Here, the binding requirements that might be passed at the federal or state level leave great room for private owners decision making. To provide some guidance to these individuals, different institutions have developed guidelines[6].
- The Agroecological Zoning in Brazil determines the areas where diverse feedstocks can be cultivated[7]. This acts as an example of some binding requirements for production of sustainable biomass.

In both cases, two key questions arise:

- The enforcement degree of these regulations, and
- To which extent these requirements might be enough to the eyes of the importing regions.

In article 18.4 of the Renewable Energy Directive (EU 2009), the EC foresaw the possibility to "*conclude bilateral or multilateral agreements with third countries containing provisions on sustainability criteria that correspond to those of this Directive"*. However, as of the time being, there are no such agreements in place.

2.3. Biomass sustainability governance in the EU (importing countries)

Since the development of an international market for biofuels in the late 2000s and the increasing demand of solid bioenergy in the EU, there is an increased **awareness** of the importance that the production of biomass feedstock and biofuels be sustainable (Goovaerts 2013).

At the EU level and Member States (MS) level there is a complex configuration regarding biomass sustainability governance. Contrary to what occurs in other sectors (forest or agriculture sectors), the promotion of biofuels and bioliquids for bioenergy was linked to meet mandatory sustainability requirements in the EU, regardless where the biomass is produced. These requirements as stated by the RED (EU 2009) are related to the avoidance of certain land use changes and specific GHG savings.

- Despite the already occurring[8] and anticipated increase in solid biomass consumption, the EC proposed in 2014 not to pass mandatory sustainability requirements for solid bioenergy before 2020 (EC 2014). However, many stakeholders were in favor of having mandatory requirements (IINAS et al. 2013). According to the EC, current legislation, regardless of whether its scope is national or European is sufficient to provide

[4] Moreover in WP5 of the project, an extensive compilation and database of relevant policies with respect to bioenergy in the sourcing regions is on-going.

[5] Some countries promote strict binding legislations while others are more flexible and give room to private interests to act more freely.

[6] For details on this see the discussion paper of Endres (2013)

[7] see CENBIO (2013)

[8] 6,2 Mt of pellets were imported to the EU in 2013 mainly from the US (2.8 Mt) and Canada (2.1 Mt) (REN21 2014).

sustainable operation conditions. Given this, there is no EU-wide regulation assuring sustainability of solid bioenergy in a comprehensive way. Moreover, it is worth noting that any proposal at the EU level might lack of social sustainability considerations given difficulties to deal with social issues under the World Trade Organization.

The different treatment of biofuels and bioliquids on the one hand and solid bioenergy on the other might bring challenges to the deployment of the bioeconomy, especially when 2G biofuels enter into the market. 2G biofuels and bioliquids[9] produced from lignocellulosic biomass should comply with the sustainability requirements under the RED, whilst the same lignocellulosic material is not subject to these requirements if used for electricity, heating or cooling. Apart from the direct binding regulation in the EU, there are other efforts that indirectly affect the sustainability of lignocellulosic biomass such as:

- Non-specific regulatory framework that might deal with some of the common requirements of biomass sustainability. An example of this might be the EU Timber Regulation (TR).
- Specific provisions for biomass sustainability at the EU Member State level
- Voluntary certification schemes (e.g. for biofuels, bioliquids or biomaterials whether they are recognized or not by the EC).
- Standardization initiatives (e.g. CEN)

The **EU TR** (EU 2010) was passed with the aim of avoiding the entrance into the EU of illegal sourced wood and wood products. The EU TR came into effect on March 2013 and implies that all 'operators' have to be able to show due diligence. Moreover, it specifically affects to fuel wood and wood in chips or particles whether or not agglomerated. It is assumed here that respective bioenergy co-products of such timber harvest and bioenergy products derived from downstream processing of such timber (e.g. pellets) is being subject to this regulation.

Historical negotiations on **sustainable forest management** (SFM) have demonstrated the difficulties to develop a common international agreement on the application of this concept (see e.g. "The Non-Legally Binding Instrument on All Types of Forests"[10] or the negotiations under the Legally Binding Agreement in EU[11]). The question arising here is that an international agreement might imply a "*race-to-the-bottom*" that does not properly address the risks associated to boosting solid biomass for bioenergy. When sourcing forest biomass, "sustainability is in the detail" and agreeing in this detail at the international level might be quite challenging.

Since there is not a EU wide sustainability regulation for solid bioenergy, major **EU MS bioenergy imports** such as UK, NL, BE and DK are working on developing their own national schemes to assure sustainability of solid bioenergy, for example:

- The **UK** has put special focus to co-firing and heat production by means of various regulations (i.e. the Renewable Obligation or the Renewable Heat Incentive) and respective sustainability criteria were endorsed in 2013 (DECC 2013a;b). These sustainability requirements were passed on the basis of the EC recommendations of

[9] The Art. 1 of the RED (EU 2009) provides the following definitions for Bioliquids: liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass; biofuels means liquid or gaseous fuel for transport produced from biomass.

- [10] http://www.un.org/esa/forests/pdf/ERes2007_40E.pdf

[11] http://www.foresteurope.org/en/LBA

February 2010 (EC 2010) that became mandatory from 1 April 2015 onwards. The utilities are already obliged to collect information on the sustainability of the fuels they use (including origin of the biomass and GHG calculations) tied to obligation to publish an annual sustainability report (EurObserv'ER, 2015).

- **The Dutch** have recently published the "SDE+ sustainability requirements for co-firing and large scale heat production" providing an extensive and detailed list of sustainability indicators for various types of biomass (Netherlands Enterprise Agency 2015).

These national efforts might result in **different approaches** to sustainability (including different criteria) that could pose additional burden on market operators and hinder international bioenergy trade.

Under the RED logic, the EC has recognized a list of **voluntary certification schemes** that allows to show compliance with the respective mandatory sustainability requirements. This process commenced in July 2010 and as in May 2015, there were 19 schemes recognized[12]. Most of these schemes are focused on the sustainability of 1G biofuels but some of them might also address various types of solid biomass.

Although the overall approach of these sustainability initiatives is similar, the schemes differ in the ambition level of the criteria and indicators to be met[13], in the way specific issues are dealt with and how they operate (i.e. chain-of-custody systems that are used), which parts of the supply chain are covered, how information is handled through the supply chain (e.g. online systems or declaration documents), verification procedures involving the whole or only parts of the supply chain, and how they deal with recognition of other schemes (Pelkmans et al. 2013).

Apart from the schemes particularly for biofuels, there are also schemes for other commodities, especially in the forest sector, that are discussed in next sections. In the agriculture sector, efforts have been focused on fair trade and ecological production and are briefly included here.

2.4. Understanding the role of voluntary certification for biomass

Certification is a voluntary process conducted by an independent third party that issues a written statement or certificate guaranteeing that management in a management unit is done according to standards considering given ecological, economic and social aspects (Gafo, 2011). A certification scheme is generally regarded as a structure made up of three institutions (GIZ 2013):

- The **standard holder** has the role to develop the sustainability criteria governing production, the rules for traceability, verification and any other component needed to establish a certification scheme.
- The **certification body**, which is independent of the standard holder, is tasked with determining whether a business operation meets the sustainability criteria established by the standard holder. It is responsible for operational audits.
- The **accreditation body**, which is again independent of the standard holder, ensures that the certification body has the necessary expertise and that different certification

[12] http://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/voluntary-schemes

[13] See deliverable 2.3

bodies deliver the same result. They are responsible for quality assurance across all certification bodies.

Generally speaking about voluntary certification schemes, there have been several drivers explaining growth in voluntary certification (ISSD 2014):

- NGO media campaigns raising awareness about unsustainable forest management and aiding corporations in sourcing from sustainable supply chains
- Commitments from the private sector
- Green public procurement policies
- Green building initiatives
- Illegal logging legislation, notably the Lacey Act in the US and the EU TR. Major forest certification schemes (FSC and PEFC) address local laws pertaining to sourcing and processing of timber and have made special efforts to facilitate compliance with legal timber sourcing legislation in North America and Europe.
- Expanded market access (especially to the European Union) to comply with binding requirements
- Premiums for certified biofuel (or biofuel feedstock) production,
- Improve agricultural practices resulting in environmental and yield benefits (both present and future),
- Improved safety measures

When focusing on biomass for bioenergy, the main driver for operators to provide certified biomass is to show compliance with legislative requirements (Pelkmans et al. 2013). Additionally, there are other drivers why stakeholders might participate in certification (Pelkmans et al. 2013):

- To increase/maintain market access and shares.
- To develop a green business profile.
- Price premium for certified products. Even if there might be a higher willingness to pay for sustainable materials proven by labels or certificates, several studies conclude that there is not a price premium for these certified products (see Section 3.5).
- To improve practices in the supply chain and have a better control on suppliers/subcontractors.

As mentioned above, one of the mechanisms included in the RED (EU 2009) to show compliance with the sustainability requirements is that economic operators bringing biofuels onto the EU market use a private voluntary certification scheme recognized by the EC or any MS for that purpose. '**Co-regulation'** is that States set out sustainability criteria for certain economic sectors and recognize private control mechanisms that assure compliance with those sustainability criteria (GIZ 2013).

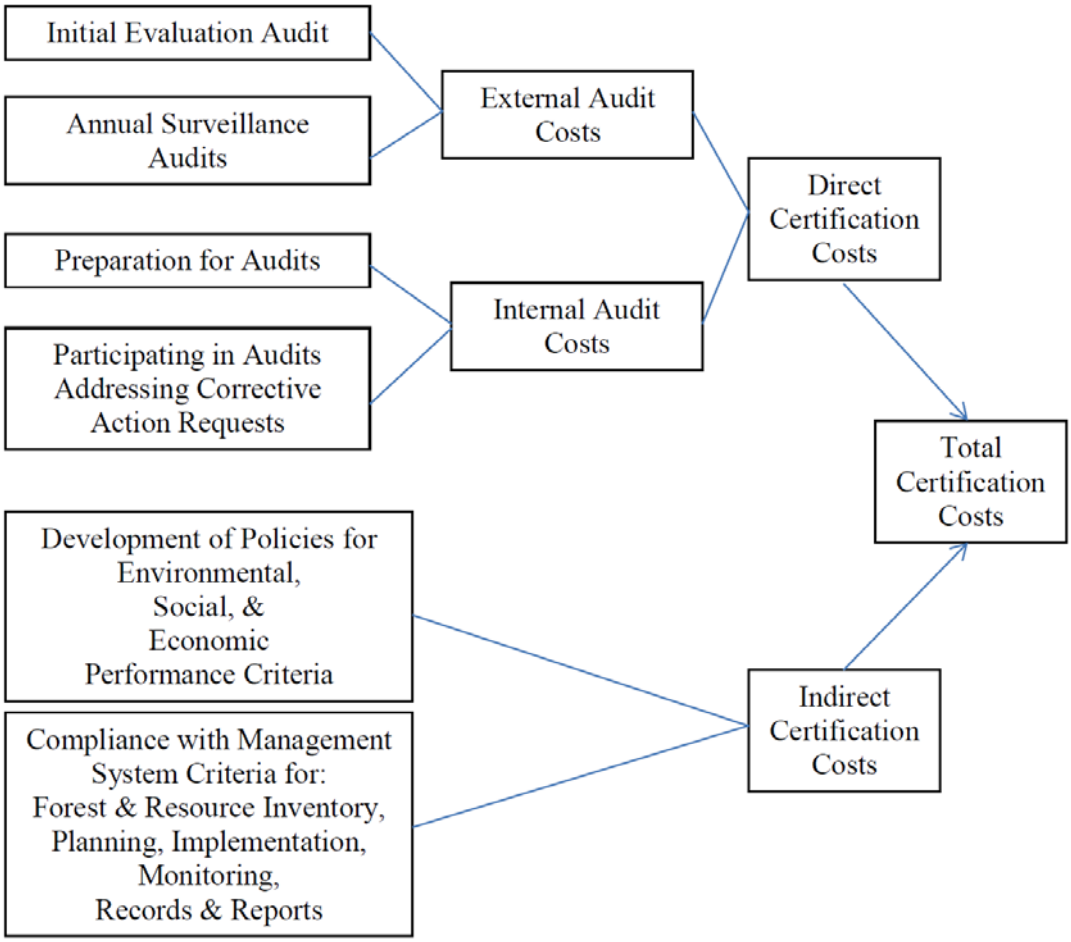
In the list of schemes recognized by the EC for biofuels and bioliquids, one can observe that some of these schemes stick to the binding requirements of the RED (e.g. French certification scheme for biofuels, 2BSvs) while others cover additional sustainability requirements (e.g. International Sustainability Carbon Certification – ISCC, or Roundtable on Sustainable Biomaterials – RSB). Then, we one distinguish two applications of certification:

- for co-regulation to show compliance with laws, and
- to increase the performance of the value chain over the business as usual scenario, in order helping promote social acceptance of biomass energy (Goh et al. 2013).

2.4.1 Costs of voluntary certification schemes

The use of voluntary certification schemes might have additional direct and indirect costs. As illustration of these certification costs, Figure 1 shows direct and indirect certification cost structure of a voluntary forest certification scheme.

Figure 1 Direct and Indirect Certification Costs



Source: FSC-US (undated)

The same cost structure can be found in the certification of biofuels (Paccini et al. 2013).

To better understand how sustainability governance that might apply to lignocellulosic feedstocks, it is needed to understand the interactions among the forest sector, bioenergy, agriculture (including food and feed), given the overlaps between these land uses, respective raw materials obtained and end-uses of biomass.

Sustainability schemes for lignocellulosic biomass can be differentiated in two principal **approaches**:

- From the **supply side**. When addressing sustainability of primary biomass supply, a key question is to which extent biomass harvesting (or collection of residues) poses additional risks on land use, including ecosystem services. When conventional forest activities are carried out, these are regulated and assessed under the conventional principles of SFM. However, when new activities are developed such as primary forest residues extraction, new safeguards may be needed to avoid potential negative impacts e.g. on biodiversity, or soils. Furthermore, GHG emission savings in comparison with a reference energy system are relevant for bioenergy systems, but

many schemes developed within the forest sector consider contributions of forest to climate change (Iriarte, Fritsche 2015), but do not particularly address GHG emissions of forest biomass (and respective savings in comparison with the reference fuel).

- The **demand side** addresses sustainability of bioenergy in another way, including both the sustainability of the end uses of biomass and all steps in the value chain. One of the main concerns of this approach is the consideration of GHG emissions savings in comparison with the reference.

Then, the schemes clearly overlap on the supply side but not necessarily in subsequent downstream phases. A key concern here will be whether both approaches share same understanding about sustainability or differences in their requirements are manifested.

2.5. Voluntary certification schemes in the supply side

There are several efforts in the supply side to assure that sourced is sustainably biomass cultivated or harvested. Usually, these schemes distinguish between biomass provided in the agricultural sector and forestry sector.

In the agriculture sector many of the standards developed are related to fair and/or organic products from the global South to the markets in the North[14]. Given that these standards are more focused on guaranteeing the quality (and sustainability) of more added-value products (e.g. coffee, tea), they are not considered in this report. Also, there are schemes addressing sustainable feed production or specific for some feedstocks that are beyond the scope of this project.

2.5.1. Voluntary certification schemes in the forest sector

The forest sector was a pioneer in the development of voluntary certification standards. As consequence of the UN Conference on Environment and Development held in Rio de Janeiro in 1992 (also known as the Earth Summit) and in response to the environmental challenges lived at that moment, the idea of voluntary certification standards was developed[15]. Its first aim was to limit deforestation and forest degradation mainly in the tropics and this resulted in the creation of the Forest Stewardship Council (FSC)[16] in 1993 with the participation of a broad range of stakeholders (Auld et al. 2008).

Later, the Programme for the Endorsement of Forest Certification (PEFC)[17] was consolidated with the aim of promoting sustainable forest management as well, although its origin was the joint effort of European forest owners' associations. FSC developed a list of common agreed principles to apply worldwide while PEFC has a set of minimum principles for the endorsement of national schemes based on inter-governmental principles and it endorses a large number of national schemes (PEFC 2012). Although there are other voluntary forest certification labels, these are the most extensive ones.

[14] See a comprehensive compilation of standards made by the International Trade Centre at: http://www.standardsmap.org/

[15] This report will focus on most extended voluntary certification schemes in the forest sector. An extensive compilation of volutary certification schemes that could apply to the forestry sector and somewhere else can be found at the International Trade Centre website (http://www.standardsmap.org/)

[16] https://ic.fsc.org/

[17] http://pefc.org/

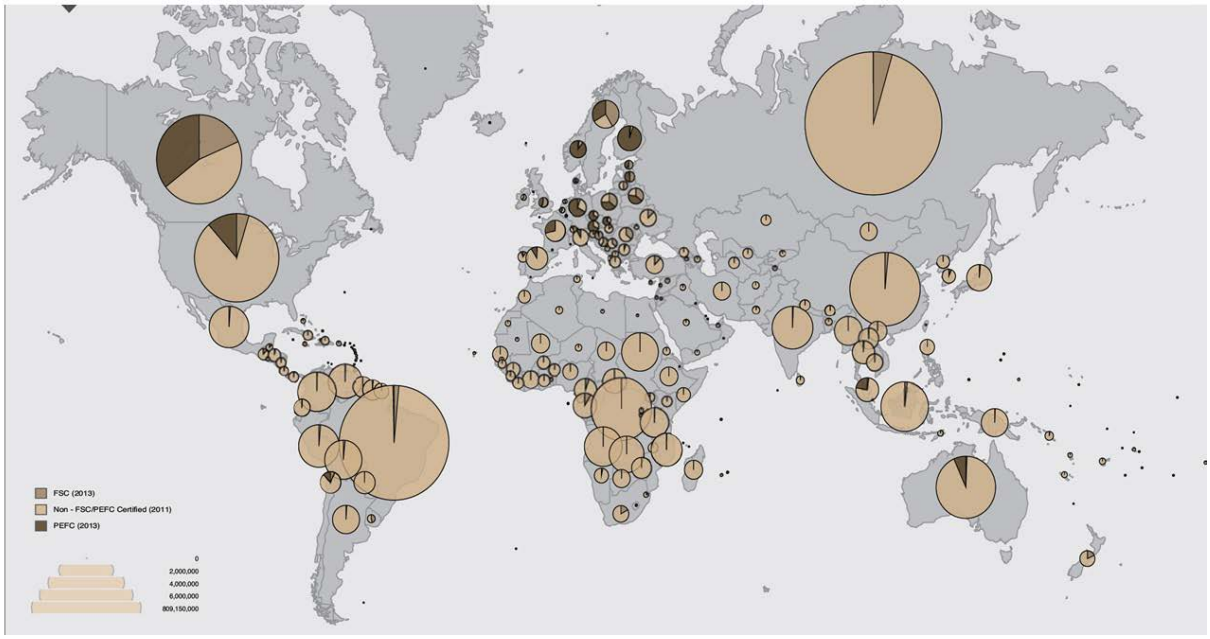
Voluntary forest certification might refer to the sustainable forest management or to the Chain of Custody, which involves tracking the origin of forest products all through the supply chain and guaranteeing that products meet specific content requirements.

However, at the time being, voluntary certification schemes have thrived in different ways as shown in Table 1 (and Figure 2). While in the EU and Canada voluntary forest certification prospered, in other regions such as in Africa and Asia and the Pacific, these schemes have not reached same level. Since 2006, the pace of international certification has slowed down and some reasons for that are, on the one hand, that most of the forest in the northern hemisphere has been already certified (except in the Russian Federation) and, on the other, the lack of price premium for certified forest products (UNECE-FAO 2011). Nonetheless, over the past five years, the certified area under the two leading global schemes has **grown** at an average annual rate of 6 per cent but with an uneven growth in forest certification (IISD 2014).

Canada, the United States and Russia account for a significant majority of certified area globally. In many European (especially Scandinavian) countries, virtually all forested area is certified under at least one of the two voluntary sustainability standards. Certification is also highly concentrated in leading forest product exporter countries. According to ISSD (2014) voluntary forest certification had achieved by mid-2013, 9.1 per cent of global forested area and 23 per cent of managed forests, taking into account a 13 per cent reduction in aggregate volume, in order to account for estimated double certification.

The concentration of certification is even more pronounced in roundwood production than in the forest area, with 96 per cent of all certified roundwood produced in Western Europe and North America in 2012. Both regions account for a combined total of 50 per cent of global roundwood production over the same period (IISD 2014).

Figure 2 Forest area certified by major certification schemes



Source: IISD (2014)

Note: Circle size represents total forested area; colored slices represent area certified under FSC or PEFC. Relative to total forested area, sustainably certified forest area represents about 9 per cent of global forested area (mid-2013), or 23 per cent of the total managed forests.

Table 1 Forest areas worldwide and updated forest certification

Region	Total Forest Area (Mha)	Managed Forests (Mha)	FSC certified forests (Mha, Feb 2014)	PEFC certified forests (Mha, March 2013)	Total certified forest in % of Managed Forests*
Africa	674	186	6.7	0.0	3.6
Asia and the Pacific	740	231	11.4	14.6	11.3
Europe	1005	844	80.0	77.0	18.6
- Russia	809	704	38.7	0.5	5.6
- EU28	130	99	31.7	67.9	100.0
Latin America and the Caribbean	891	83	14.1	3.2	20.7
The Near East	122	46	0.0	0.0	0.0
North America	679	554	69.1	149.0	39.4
- Canada	310	295	54.4	113.5	57.0
- USA	304	228	14.1	35.3	21.7
Total	**4111**	**1944**	**98.1**	**243.8**	**21.9**

Source: adapted from Sikkema et al. (2014)

*Note: * this share is only indicative since in several countries there are overlaps between FSC and PEFC certification (same stands certified under both standards).*

Under the international principle, criteria and indicators set up by FSC and the principles of SFM agreed by PEFC, these organizations develop more specific schemes adapted at a regional or national levels. Under the PEFC configuration, guidelines for forest activities are largely based on specific forest site assessment, with targets and thresholds being locally adapted depending on site conditions[18] (Thiffault et al. 2015). At the international level, the approaches to sustainability by FSC and PEFC show differences[19] and they do not enjoy same credibility. Currently these schemes do not mutually recognize (UNECE-FAO 2012) even if it seems that some convergence between them is taking place over time (Stupak et al. 2011).

Standards and thresholds set for various indicators with regard to woodfuel issues differ more between countries than between the general FSC and PEFC systems (Stupak et al. 2011).

These schemes not only consider environmental criteria but also take into account issues related to the **social dimension** including land tenure related issues. They do this to variable extents.

When focusing on **bioenergy**, these schemes approach different the harvesting of primary forest residues: while FSC prefers forest residues not to be harvested, PEFC´s approach does not pose this restriction. In both cases, the existing and suggested certification systems do not

[18] This also applies to regulations is some countries such as Canada

[19] See i.e. the benchmark and gap analysis carried out by Iriarte, Fritsche 2015 in which these schemes, among others were benchmarked against a list of sustainability indicators proposed for non-food biomass

have specific standards nor **C&I for bioenergy**-related woody biomass harvest, which limits their ability to address the bioenergy-related "additional" risks (and show a need for further advancement of the current criteria and indicators, see Fritsche et al. 2012).

Prices and premiums paid for FSC and PEFC certified products or stumpage fees are market driven and are inconsistent across products or countries. In principle, consumers are willing to pay price premiums that show a wide range of variability depending on among others the type of product, the quality and the market where it is destined (IISD 2014).

An important reflection dealing with the provision of sustainable biomass regards to the fact that biomass for bioenergy is generally situated at the **bottom of the willingness to pay** of the various biomasses. Thus, biomass for bioenergy is at the bottom of the pyramid of the various products[20]. This implies that when biomass for bioenergy is integrated in multifunctional forest, the major driver for biomass certification might not be bioenergy but other products with higher added-value. Neccesarily, this has impacts on costs and a sound and well-balanced approach between the cost of the various biomass and the costs of demonstrating sustainability should be analyzed.

A closer look to the US South East

As seen before, the US Southeast is and is expected to continue being a key player in the international trade of wood pellets, mainly to the EU markets. The US Southeast is well known as a wood-basket given the relevant forest area and respective wood supply.

Most plantations in the US South were owned by large vertically integrated forest product firms until early 1990s, but market and tax related drivers led industries to divest their holdings (Munsell, Fox 2010). Between 1998 and 2008, the forest products industry divested their ownership in favour of Timber Investment Management Organizations and Real Estate Investment Trusts (Butler, Wear 2013). At present, 86 % of forestland is owned by private landowners and 67 % of private forestland is owned by **non-industrial private forest owners** (families or individuals), with a mean size of the family forest holdings of about 12 ha (Butler, Wear 2013).

Established forest certification programs in the US Southeast include:

- Sustainable Forestry Initiative (SFI)[21], recognized by PEFC since 2005.
- The American Tree Farm System (ATFS)[22], that supports a program for nonindustrial family forest owners.
- The Forest Stewardship Council (FSC)- US[23]

The FSC standard enjoys more credibility than the other standards (Dogwood Alliance 2015) even if technical differences with regards to major indicators (e.g. conversion of forest, use of chemicals) might not be determinant (SFI 2012; ACI 2012). Regardless of the opinion of experts on which certification system is best, the market place is determining which scheme is used (Lowe et al. 2011).

In contrast to European countries, Canada or the US North East, only 17 % of US South forest land area is **certified** by means of voluntary forest certification schemes (Kittler et al. 2012).

[20] See Sims (2013)
[21] http://www.sfiprogram.org/
[22] https://www.treefarmsystem.org/
[23] https://us.fsc.org/index.htm

According to Kittler et al. (2012), the most common used scheme is SFI (10 % of forest land), followed by ATFS (6 %) and FSC (1 %).

Forest certification criteria of these schemes remain subject to interpretation so a given scheme does not necessarily confirm specific forest management practices or restrictions (Mendell & Lang 2013; ACI 2012).

Particular concerns have been raised with respect to the FSC understanding of planted stands of native species (traditionally thought of as plantations) that now are classified as "semi-natural" forests (ACI 2012).

On the other hand, the implementation of voluntary "Best Management Practices" (BMP) has been quite successful even if they are implemented in a voluntary basis[24].

Also, several states in the US South have developed BMPs focused on biomass harvesting (Barret 2013). There has been quite a strong lobby from the industrial stakeholders against using voluntary certification schemes.

The implications of forest certification costs in the US Southeast has been discussed in different studies. Mendell & Lang (2013)[25] analyzed the impacts on costs of different voluntary forest certification for landowners and found that the reduction of the net present value with respect to the base case was 4 % for SFI, 11 % for FSC natural forests and 26 % for FSC plantations. Suppliers and consumers do not appear willing or able to afford the costs created by the U.S. FSC program resulting in a lower FSC-US output (Winegarden & Rieck 2013).

FSC-US (undated) indicates that price benefits of voluntary certification have been limited. The key direct financial benefit of certification is market access. There are as well indirect economic benefits such as avoiding the loss of sales or being force into offering price *discounts* due to lack of certification.

There are options for individual or group certificates (the later the most common option). Direct FSC audit costs will depend on acreage and management intensity (FSC-US undated) but generally speaking for a five-year audit contract, it might be expected that:

- For an individual certificate will typically start at about $10,000 (for a relatively small owner with 2,500 acres)
- For a group certification: $35,000 for a family forest group with 100 members (with perhaps 5,000 to 50,000 acres total).
- A "super group" with upwards of 40,000 members and 2 million acres could expect to pay about $120,000.

In this region, it has been also observed that the voluntary forest certification schemes might require some additional adaptations to deal with the concerns raised from harvesting biomass for bioenergy (Alavalapati et al. 2013).

This refers, for example to the levels of harvest residues to be left on site to maintain habitats or measures to prevent erosion. Amounts of harvest residues will depend on site-specific conditions, although general guidelines could be formulated at State level.

[24] The mean rate of BMP implementation is 87 %, ranging from 68 - 99 % (Kittler et al. 2012))

[25] This study was conducted in Arkansas as representative of the US South.

2.6. Voluntary certification schemes for lignocellulosic biomass from the energy or bioproducts sectors

Sustainability of bioenergy addresses both the cultivation and conversion of biomass to energy. It is a multi-dimensional concept, aiming not only to reduce greenhouse gas emissions but also to focus on issues like soil carbon, biodiversity aspects, energy efficiency principles, social well-being and economic development (Pelkmans et al. 2013).

The demand side (i.e. energy and bioproduct sectors) has also progressed on developing third-party certification schemes that addresses the sustainability of bioenergy production or provision of bioproducts. With particular attention to lignocellulosic biomass, we can distinguish two blocks:

- Schemes promoted by a range of stakeholders
- Schemes promoted by the industry

2.6.1. Schemes promoted by a range of stakeholders

Some voices have echoed the need to develop standards that not only cover the sustainability of biomass for bioenergy but also for other biomaterials. There are three main efforts in this respect:

The **Netherlands Technical Agreement** (NTA) 8080 and beyond. The Dutch NTA describes the requirements for sustainably produced biomass for energy applications (power, heat & cold and transportation fuels) and the NTA 8081 describes the certification scheme that includes the 'rules' to enable certification against the requirements of NTA 8080[26]. This voluntary agreement was set up by a broad stakeholder panel representing market players, government and civil society organizations, under the supervision of Netherlands Standarization Institute. This scheme has been recognized by the EC as a scheme complying with the RED but it is more ambitious than the criteria stated by the RED and it not only considers GHG emissions but issues such as land use, biodiversity and working conditions.

Currently, there are 15 organizations owing a NTA8080 approved certificate[27]. Moreover, a revised version of the NTA8080 is in development and it states stricter sustainability criteria than those of the specific EU directives and includes sustainability provisions such as cascading use and competition (NEN 2014). This revision includes the Sustainability requirements and the Chain of Custody requirements.

Moreover, in 2013 the Energy Agreement for Sustainable Growth (SER 2013) was agreed by over 40 signatory parties including national government, energy companies and NGOs (de Nie 2014). The parties agreed that promoting the use of biomass by coal-fired power stations would not exceed the level of 25 PJ in the Netherlands (SER 2013) and to develop specific sustainability criteria mainly based on the NTA8080. These criteria (sustainability requirements for co-firing and large scale heat production) have been published (Netherlands Enterprise Agency 2015), including requirements for:

- Sustainable forest management and soil quality
- GHG balance, carbon debt and ILUC
- Compliance with legislation and Chain of Custody

These criteria apply differently depending on the biomass category.

[26] http://www.sustainable-biomass.org/publicaties/3941

[27] http://www.sustainable-biomass.org/publicaties/3999

The **Roundtable on Sustainable Biomaterials** (RSB). The RSB is an international initiative that brings together farmers, companies, non-governmental organizations, experts, governments, and inter-governmental agencies concerned with ensuring the sustainability of biomaterials production and processing. It was originally set up in 2007 to ensure the sustainability of liquid biofuels for transport, and it expanded its scope in 2013 to cover all types of bioenergy and biomaterials.

This certification scheme is a comprehensive and ambitious standard covering a broad range of criteria in the environmental, social and economic themes and it is recognized by the EC to comply with the RED. Until August 2014, there were 16 operators participating (RSB 2014).

The **International Sustainability and Carbon Certification**[28] (ISCC) is a holistic biomass standard that has an emphasis on GHG. This is a voluntary certification scheme applicable for all types of biomass and biomass-based products. Complementary to ISCC-EU aimed to show biofuels sustainability with regard to the RED, ISCC PLUS has been developed for food, feed, technical/chemical applications (e.g. bioplastics) and other bioenergy applications (e.g. solid biomass). All the sustainability core requirements of the various ISCC standards (EU, DE, PLUS) are aligned. Additionally to the core requirements of ISCC PLUS, several extensions have been developed for various purposes:

- ISCC PLUS 260-01 – Short Rotation Coppices
- ISCC PLUS 260-02 – Bioplastics
- ISCC PLUS 260-03 – Feed
- ISCC PLUS 260-04 – Food
- ISCC PLUS 260-05 - Waste fuels, renewable fuels, non biological origin

In April 2015 the certificates issued by ISCC are shown in Table 2.

Table 2 Certificates issued by ISCC

Type of certificates	Number
Valid certificates	2854
Expired certificates	5453
Withdrawn certificates	61
Fake certificates	47
Total	**8415**

Source: own compilation from ISCC website (April 2015)

These schemes, originally developed for 1G biofuels, have expanded their goals and deal with sustainability issues of solid bioenergy as well. All of them recognize the FSC and ISCC also recognizes PEFC (Goovaerts et al. 2013).

Despite that voluntary forest certification schemes don´t mutually recognize, there are other standards such as RSB[29] that partially recognize the following standards:

- Sustainable Agriculture Network[30] (SAN): compliant with the 12 RSB principles and criteria except for criteria on greenhouse gas and food security.

[28] http://www.iscc-system.org/en/

[29] http://rsb.org/activities-and-projects/cooperation-with-other-standards/

[30] http://san.ag/web/our-standard/types-of-standards-and-policies/

- FSC[31]: compliant with the provisions of the RSB Standard, with the exception of the Principles on Greenhouse Gas and Food Security.
- Bonsucro[32]: compliant with most of the RSB's 12 Principles and Criteria, with the exception of the Principles on Rural and Social Development and Food Security.

These schemes are on one hand very **credible** but on the other they are highly demanding so the question is if they can be promoted in all contexts and at the same pace.

2.6.2. Schemes promoted by the industry

The private energy sector, especially major utilities consuming pellets in the EU initiated the **Sustainable Biomass Partnership (SBP)**[33] scheme:

SBP has developed a certification framework to provide assurance that woody biomass is sourced from legal and sustainable sources. This framework consists of standards and independent certification procedures which together provide a tool enabling users of woody biomass for energy production to demonstrate the legal and sustainable sourcing of its feedstock material in compliance with regulatory requirements and to provide the data required to assess properly its carbon footprint.

The SBP assessment framework was first published on 26 March 2015 and it is composed of 6 standards. The Feedstock Compliance Standard (SBP 2015a) determines the principles, criteria and indicators that a standard should meet.

Feedstock received with a claim from an SBP-approved Forest Management Scheme need not be evaluated against this Standard (SBP 2015a). The definitions of 'sustainable' and 'legal' in the standard were adapted from the UK's Central Point of Expertise of Timber "Category B evidence" and supplemented with the sustainability requirements for solid biomass defined in the Netherlands:

The UK Timber Standard for Heat and Electricity (DECC 2014) was subsequently developed in recognition that "wood used for fuel is typically low value, and a significant proportion is expected to be sourced from forests in North America that are not yet certified". As such, the Timber Standard permits "a risk-based regional approach that uses credible information and evidence that addresses the CPET legality and sustainability criteria at regional rather than individual forest level or land unit." This is the basis from which the SBP Standard has been developed.

It is composed by 2 principles, 16 criteria and respective list of indicators:

- Principle 1. Biomass feedstock is legally sourced (6 criteria)
- Principle 2. Biomass feedstock is sustainably sourced (10 criteria)

The separate SBP Standard 6 is to calculate energy and carbon balances (SBP 2015b).

The biomass producer which usually is the organization that operates a facility such as a pellet mill, but can also be any organization in the supply chain that takes legal ownership of feedstock or biomass is the unit of certification (SBP 2015a). The biomass producer will need to develop systems and procedures to ensure that all indicators are low risk (SBP 2015a).

[31] https://ic.fsc.org/preview.principles-and-criteria-for-forest-stewardship-v5-1-fsc-std-01-001-web.a-3859.pdf

[32] http://bonsucro.com/site/standard-revision/

[33] http://www.sustainablebiomasspartnership.org/

3 OPERABILITY OF THE CERTIFICATION SCHEMES AND SWOT ANALYSIS OF SELECTED SCHEMES

A study carried out by ISSD (2014) about sustainability schemes in the bioeconomy (it includes reflections about biofuels, forest schemes, and to other feedstocks) concluded that:

- Sustainability standards continue **growing**, even if the rate is different between the various sectors.
- Sustainable markets continue to be defined by persistent **oversupply** of standard-compliant production. Therefore, the market may be placing downward pressure on the prices of sustainable products due to oversupply (negative outcome).
- Production for sustainable markets is concentrated in more advanced, **export-oriented economies** with more developed production capacity.
- Sustainability standards are creating **new opportunities** for stakeholder participation in supply chain decision making.
- Sustainability standards are strengthening the reliability of market claims through increasingly **independent** monitoring and enforcement processes.
- Average **criteria** coverage of voluntary sustainability standards is declining as standards target mainstream markets.

There can be multiple effects of certification on biomass production, availability and supply and trade, including (Goh et al. 2013):

- Certain producing areas or resources can become excluded from specific markets (which can in turn enhance opportunities and market access of other potential suppliers),
- Costs of production and feedstock supplies may increase, and
- Certification can act to increase coherence along the supply chain and facilitate the realization of benefits (both ecological and socio-economic) associated with increased market access

An extensive survey and discussion towards the sustainability governance of bioenergy concluded that certification is seen by stakeholders as a **useful** tool to operate and a mix of regulations and voluntary certification is generally preferred for meeting the goals for sustainable bioenergy (Pelkmans et al. 2013).

In ”developed” countries, voluntary certification schemes might only offer **limited add-on value** to existing sustainability governance. While **modifications in forest management** to obtain voluntary forest certification might be minor in the EU (Gafo 2011), adaptations needed in other parts of the world to get the certification might be relevant. Therefore positive impact of certification regarding sustainable forest management in the EU is limited, probably because the start point is already sufficiently good (Gafo 2011). Moreover, many actors believe that in North America and Europe enough legislation, regulations, guidelines and standards are already in place to support and meet sustainable bioenergy production (Pelkmans et al. 2013).

When developing **forest certification** standards that include sustainable management with bioenergy purposes, some problems must be discussed such as the terminology and scale confusion and the lack of a theoretical base to integrate environmental, social and economic indicators. It would be required to address certain aspects that are not covered at present by

the forest certification standards such as GHG emissions (including feedstock transportation) or land use change (Gafo 2011).

As shown in previous sections, during last years a relevant **proliferation of schemes** has occurred**.** This proliferation has led to confusion among actors involved, market distortion and trade barriers, an increase of commodity costs, questions on the adequacy of systems in place and how to develop systems that are effective and cost-efficient (Goovaerts 2013). The lack of confidence and acceptance among the stakeholders may limit the effectiveness of certification schemes, and lead to loss of belief that participation is meaningful (Pelkmans et al. 2013).

On the other hand, this proliferation has led to competition among them. A positive impact is that this may lead to improvement in the development of standards and tools for verification and monitoring, and may provide insight into the 'best' or 'most efficient' structure of certification systems (design, implementation constraints, cost-benefits) as well as operational experience and degree of effectiveness of the scheme (Pelkmans et al. 2013). These schemes should continue to learn and improve through regular and need-based updates of standards and other scheme elements.

In this, **ISEAL**[34], the International Social and Environmental Accreditation and Labelling Alliance, has developed codes of good practice to assure that schemes operate effectively to deliver on their social and environmental goals. Thus, ISEAL acts as 'setting standards for standards'. Those codes are understood as global references for developing credible standards. Full members of ISEAL are for example FSC and RSB. There are as well other associate members that are in their pathway to obtain the full membership such as the Roundtable on Sustainable Palm Oil.

Ultimate **credibility** of voluntary standards is primarily dictated by their ability to implement and enforce those criteria that define their identity (IISD 2014).

3.1. Participation in the definition of the standards

Voluntary certification schemes generally are **more adaptable/flexible** than regulatory initiatives. Most of these schemes have consultation processes and inclusive approaches to take into account the views from a wide range of stakeholders (e.g. industry, NGOs, public bodies, etc.). Many of them revise their standards regularly, for example at least every 5th year (e.g. Bonsucro, RSB, PEFC, and other schemes members of ISEAL). Certification schemes can thus serve as innovative bodies to explore how sustainability levels can be increased taking into account continuous scientific development and improvement of practices in place. They should complement regulations to improve awareness, facilitate discussion and the implications of certification and provide a forum for sharing information among stakeholders (Pelkmans et al. 2013).

3.2. Management of the scheme

Implementing a third-party certification system is complex from the **administrative** point of view. Certification schemes require that candidate certified bodies adapt their system to include for example a traceability tool that meets certain standards, and that they ensure the correct (and documented) implementation of systems' requirements. This introduces documentation and administration which can become very complex, certainly for small

[34] http://www.isealalliance.org/

players in the market, although bundling of small players is a strategy being tested and that has proven in the Clean Development Mechanism (Pelkmans 2013).

This **complexity and also the lack of transparency** and clear information on the full details of the different schemes, makes difficult to select which one suit your purpose best. A good balance between complexity and accessibility of schemes is needed.

The **credibility of a scheme is a key selection criterion** for companies to use it for their purposes and similar organizations such as International Organization for Standardization (ISO) could be used as an example (Pelkmans 2013)

Those schemes might distinct between small-scale producers and producer groups, might offer group certification, and might provide nationally distinct standards. IISD (2014) found that the majority of the schemes analyzed have **localized indicators**, suggesting a growing recognition of the importance of regional differences in pursuing broader sustainable development objectives. This was also revealed by Stupak et al. (2011) who found that major forest voluntary certification schemes might differ more between regions/countries than between schemes.

3.3. Do certification schemes promote more sustainable management?

Certification assures that bioenergy provision is made in a sustainable way, but the absence of certification does not mean that the product and respective management is not sustainable. Gafo, Caparros & Ayanz (2011) analyzed the effects of 15 years of Forest Certification in the EU and concluded that the impact of certification in the EU forest based sector was positive-neutral with respect to ecological aspects, positive-negative on the economic and positive neutral on the social ones.

However, in other contexts where management is not as sustainable as in the EU, the contribution of voluntary forest certification schemes might be different (Auld, Gulbrandsen, McDermott 2008). Nonetheless, the adaptations in forest management that might be needed are not uniform.

Then the key question is the risks that different biomass chains might pose. Moreover certification cannot deal with unsustainable practices beyond the boundaries where it applies.

However, in the biofuels sector there might have be necessary to change some aspects of the management but these adaptations are not uniform (Auld, Gulbrandsen, McDermott 2008). Also sustainability standards can help the market better achieve full-cost accounting in the pricing mechanism (IISD 2014).

3.4. Is it possible to promote mutual recognition?

The main aim in the long term should be that systems **converge** up to a level that ensures consistency and transparency without imposing less relevant requirements at national or local level. Schemes could work towards recognition, enabling companies to expand market coverage without extra certification and related administrative and cost restraints. There are two types of recognition:

i) mutual recognition in case schemes include the same/similar requirements (up to some level) and are implemented in an equal manner, and

ii) unilateral recognition in case schemes complement each other (e.g. focus on different types of feedstock, parts of the chain and/or regions).

In this way stakeholders are not confronted with a multitude of audits and requirements depending on the type of schemes used along the supply chain or the end-use. For example, forestry or agricultural schemes could adapt to provide the necessary information required by other schemes for chain assessment, e.g. in terms of GHG emissions, or different schemes would be able to use the same chain of custody.

3.5. Which is the impact on costs?

In the forestry sector, for FSC, the membership fees vary according to the location of the individual or organizational member (global North or global South) and depending on the type and size of the organization (FSC 2013). In the case of PEFC certification, the annual Member Fees depends on the organizational status, whether the organization is a for-profil or non-profit one and the turnover (PEFC undated).

With respect to the certification of biomass for bioenergy, the ISCC (2013) costs structure could be divided as follows:

- Registration fee: up to 500 €
- Certificate fee: up to 500 €
- Interfaces with ISCC membership: 0,08 €/ metric ton of product declared as sustainable
- Interfaces without ISCC membership: 0,10€/ metric ton of product declared as sustainable

The Annual fee per certificate under the NTA 8080 is up to 200 € and Organizations can choose to pay an annual membership fee (up to 5000 €) or the payment of EUR 0.03 per metric ton (with a minimum total of EUR 100).

Then, assessing the cost per amount of product provided by any company is extremely difficult and it will vary on a **case-by-case basis** (Paccini et al. 2013).

Not all players in the production chain share the same cost burden (Paccini et al. 2013; Gafo 2011). This appears to be a “push-the-bill-to-the-weakest” effect, where larger biofuel producers are likely to attempt to “outsource” certification costs as much as possible, by requiring smaller suppliers to adapt to the new requirements.

Pacini et al. (2013) report that required auditing days and indirect costs of certification are highest at the start of the supply chain (e.g. farmers). Adaptation might be costly in developed countries including BR or AR but producers in these regions are equipped to strategize and deal with certification trends and their consequences. Smallholders in lower-income developing countries can have problems to obtain the financing and technical capacities required by the certification process (Paccini et al. 2013).

Regarding the increased costs that sustainable certified biofuels have to support, hopes were that sustainably-produced biofuels would be rewarded with higher prices in the EU working as an incentive to improve the industry, as well as grant an opportunity for developing country producers to uptake sustainable production and engage in profitable exports of clean fuels to Europe. Related to this, Paccini et al. (2013) explain that premiums for ethanol and biodiesel evolved differently between 2011 and 2012, but have been in general very small or inexistent, with certified fuels becoming the new norm in the market.

Thus, the extent to which **price premiums** are paid for certified products usually is quite limited. As well, for certified forest products nowadays, there is not a premium price (Gafo

2011) and the main barrier to forest certification is the cost (Gafo 2011). Then, the most affected stakeholders would be those that have to cover the certification costs. In the EU, these costs are generally assumed by forest owners, being this an important negative economic impact. According to Gafo (2011), the price paid to forest owners should increase by 7 % to make the decision of certifying while industry would ask for a 3 % increase in product price to buy certified wood but they would buy certified wood if available (Gafo, 2011).

In the biofuel sector, pricing and premiums for standard compliant palm oil and soy ranged from 0.3 to 6 per cent over the past several years (ISCC 2015). Moreover, the pay-back time of this investment was assessed to range from 3 to more than 4.5 years for soy producers larger than 2,500 ha in Argentina and Brazil (KPMG 2013).

3.6. SWOT analysis

Based on the previous discussion and focusing on the schemes categories more relevant to assure sustainable provision of lignocellulosic biomass for bioenergy and biomaterials Table 3 summarizes key points with respect to a general Strength-Weakness-Opportunities-Threat analysis. Some of the issues identified might act in an opposite direction depending on how they are considered in the families groups. The table systemizes strengths and weaknesses while the opportunities and threats are discussed here since they are common to all the family groups:

As opportunity, the interactions of these schemes with policy development is relevant. Thus, these voluntary schemes can be aligned with requirements in policy and act as a co-regulation (see GIZ 2013). The existence of various certification schemes might be a driver leading that schemes are more transparent.

Regarding threats, we highlight the potential lobby against its implementation (especially for most demanding schemes). As discussed in Section 2.5.1 there are regions where the share of voluntary forest certification is very low and this might respond to interest of stakeholders against their implementation.

Table 3 Strength-Weakness-Opportunities-Threat analysis for selected voluntary certification scheme families groups

Issue	Voluntary Forest Certification Schemes (FSC and PEFC)	Multi-stakeholders certification schemes (ISCC, RSB, NTA8080)[(1)]	Industry-led sustainability schemes (SBP)
Strenghts Stakeholder inclusiveness and scheme development	In both standards (FSC and PEFC) all stakeholders are included in standard development and review[(a)]	ISCC leaves it open to any interested organization[(a)]; RSB considers all stakeholders[(a)], NTA8080 is administered by the NEN and considers interaction with stakeholders[(b)]	Developed by interested utilities in (international) pellet trade, not a multi-stakeholder scheme yet[(c)]
Credibility	FSC has more than PEFC. Nonetheless there are not relevant differences on the respective sustainability criteria considered[(a,d)]	High credibility (ISCC and RSB have more requirements than NTA8080) [(a)]	Several critiques received by NGOs)[(e)]
System consolidation	FSC founded in 1993 and PEFC founded in 1998	ISCC association inaugurated in 2010**;** RSB and NTA8080 from 2007 onwards	Formed in 2013
Regional approaches	There are regional approaches in both schemes (even if the approach is different – see section 2.5.1). Principle of subsidiarity (ISSD 2014)	All of them distinguish between the "EU-RED compliant" schemes and the international scheme	International standard but there are Regional Risk Assessments and Locally Applicable Verifiers
Sectoral approaches	Apply to forest management and chain of custody	ISCC has specific add-ons for certain feedstocks; RSB Standard on waste and residues; RSB Principles & Criteria; see section 2.6.1 for an overview about the NTA	N/Z
Weaknesses Implementation management	Not complete assessment framework (GIZ 2013)	Complete schemes	
Certification costs	Implementation of the certification implies costs	Implementation of the certification implies costs	Implementation of the certification implies costs

Source: own compilation and elaboration

Note: [(1)] if it is not stated otherwise, the information has gathered from the respective websites. [(a)] See standards map website ; [(b)] See the NTA8080-Sustainably Produced Biomass (http://www.sustainable-biomass.org/publicaties/4852); [(c)] See SBP website: (http://www.sustainablebiomasspartnership.org/about-us/faqs); [(d)]: see Iriarte, Fritsche (2015); [(e)] See Birdlife Internationa/Europe et al. (2014)

4 CHALLENGES

This paper has discussed the role that voluntary certification can play on assuring biomass sustainability. Biomass for bioeconomy to be profitable (in economic, ecological and social terms) needs to be based on a **long-term strategy**. Investors find the lack of European legislation on this issue **dissuasive**, as they need to have a clear view of the regulatory developments after 2020 (EurObserv'ER 2015).

European Member States are designing their own incentive systems and specific requirements for biofuels from waste and residues, often with diverging definitions, which creates distortions on the European markets (Pelkmans et al. 2013). These national efforts should be aligned to avoid market distortions.

To tackle the proliferation of country/regional specific policies and requirements, it could be preferred to develop an **international framework** of (minimum) standards creating more coherence between countries/regions (Pelkmans et al. 2013). In this, systems should converge up to a level that ensures consistency and transparency, without losing meaning at local levels. Unilateral and mutual recognition are important instruments (Pelkmans et al. 2013).

At present, there is not a clear and **common understanding** of what sustainability means and therefore different approaches (sometimes confronting) (see e.g. Goovaerts et al. 2013) are applied. Neither there is incentive for the market to move towards higher standards (GIZ 2013). A cross-cutting and common understanding of sustainability should be promoted. In this, the GBEP could have a relevant role to play.

Another challenge is to get **common language** such as that of ISEAL guidelines, tools for identifying high conservation value (HCV), social guidelines and calculation methodologies. Harmonization of definitions, such as the recent discussion over the definition of "primary forest" within the RED requirements as it applies to Canada (Thiffault et al. 2015) would be also desirable.

Third-party certification standards deal with the "**good**" management of a stand-alone area so the impacts at the macro level such as impacts on water basins or biodiversity, the indirect land use change (iLUC) effects and landscape-level carbon balances cannot be addressed through certification alone, and need other forms of governance/legislation. Certification systems should therefore be designed to interact with other governance systems for protection of ecosystems services (Pelkmans et al. 2013).

Given the lack of an EU-wide binding legislative framework for solid bioenergy, certification schemes might be used to comply with sustainability requirements in the countries that have developed regulations or rely on a **voluntary based-regulations** in other markets without binding requirements. Depending on the binding requirements in the importing regions and the strategies preferred by the utilities, different outcomes of certification might be achieved. Long-term strategies will be helpful to promote the introduction of certification schemes.

Considering the amount of schemes and various goals, try to facilitate mutual recognition between schemes could be helpful. The analyses carried out by the GIZ (2013) recommended that:

- Standards aim at **different levels**, so it is important that they cooperate (recognition among schemes). As long as they are at credible levels, they do not have to converge into one system, as they may serve different applications.
- It is important **not to lower standards** –this would be the wrong result if convergence is being sought.

- **Recognition**: Is it more the task for policy to recognize which schemes comply with regulation? Endorsement between schemes is also very important. Energy schemes can endorse schemes for sustainable forest management (to the extent they address new risks posed by forest bioenergy harvesting). On the other hand, when one schemes makes significant changes, this requires a new benchmark exercise.

Considering that the sustainability of the management is quite assured in developed countries, an improved understanding of which might be the **most risky on-ground practices** could be promoted.

Also, it would be helpful to establish a system to **control volumes** and reporting of certified materials across schemes (this has been also underlined by Pelkmans et al. 2013). The **Energy Agreement** achieved in the Netherlands (including a cap on the amount of solid biomass and respective sustainability criteria) might be a good example for replication at the EU level.

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