SolidStandards

Enhancing the implementation of quality and sustainability standards and certification schemes for solid biofuels (EIE/11/218)

D5.4

Exploring the impacts of implementing sustainability standards

Co-funded by the Intelligent Energy Europe Programme of the European Union

The SolidStandards project

The SolidStandards project addresses on-going and recent developments related to solid biofuel quality and sustainability issues, in particular the development of related standards and certification systems. In the SolidStandards project, solid biofuel industry players will be informed and trained in the field of standards and certification and their feedback will be collected and provided to the related standardization committees and policy makers. The SolidStandards project is coordinated by:

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About this document

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Intelligent Energy Europe

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1. Introduction

1.1. General introduction of WP 5 - Sustainability certification

Within the Solidstandards project, work package 5 “Sustainability certification” aims to monitor and evaluate the development of voluntary (and possibly in the future mandatory) sustainability criteria and standards for solid biomass (all documents are available at http://www.solidstandards.eu/sustainabilty/result-documents.html). It is divided into four sections:

Task 5.1 (“Overview and analysis of sustainability certification initiatives”) consists of an updated overview of sustainability certification initiatives for solid biomass (both existing and in preparation) in the EU 27 (now EU 28). The final report of this sub-task includes current status and developments of certification systems, and contextual review of sustainability criteria. It analyses systems that have the potential to be used to evaluate energy use of biomass.

In Task 5.2 (“Investigation of 4 case studies of sustainably certified solid biomass supply chains”), four existing different solid biomass supply chains using mandatory or voluntary sustainability standards were investigated in detail, including all steps from sourcing the raw material (e.g. wood chips from forest biomass or industrial by-products or residues like sawdust), all pre-processing steps (e.g. pelletisation) to the end-user (medium-to large scale consumers). These four case studies are also described in Section 2.2. These case studies are used as basis for the analysis in Task 5.4.

The workshop “Voluntary vs. mandatory sustainability criteria for solid biomass” was organized by Utrecht University and NEN as main deliverable of Task 5.3, in which the main stakeholders were invited: with representatives of biomass suppliers (farmer and forestry associations), solid biofuels producers, traders, medium and large scale end-users, and with representatives from CEN, ISO and national policy makers from various member states. The workshop was held on 7 June 2011, as a parallel event at the 19th European Biomass conference and Exhibition Salon Koch, International Congress Center, Berlin, Germany. The workshop served as a platform for industry, EC representatives and scientists to debate the issue of mandatory vs. voluntary sustainability certification schemes, including case studies carried out by industry. Also, preliminary results of the ongoing benchmarking of existing legislation regulating the sustainable production and use of biomass in the EU were presented. A summary of the workshop presentations is available on the Solidstandards website

This report covers the outcome of Task 5.4 (“Exploring the impacts of implementing sustainability standards”), the last activity within this work package. It evaluates the applicability, barriers, costs, time efforts, etc. associated with the actual implementation of sustainability certification or verification of solid biomass. It is based mainly on the results of the individual case studies in Task 5.2, and supplemented with literature review and in depth interviews with similar market actors using forestry or agricultural certification systems.

Until the time of writing of this report (September 2013), the EC has not yet made any decision on sustainability criteria for solid biofuels, but recommended in its report of February 2010 to use the same criteria for biofuels and bioliquids with some amendments. Therefore, the analysis and comparisons are made based on the Renewable Energy Directive (RED) criteria for biofuels and bioliquids.[1]

[1] In August 2013, an unofficial proposal from EC on sustainability criteria for solid and gaseous biomass used in electricity and/or heating and cooling was published . This proposal includes the GHG reduction requirement and calculation methodology, the establishment of land criteria and sustainable forest management requirements. According to the proposal, to avoid undue administrative burden, the EC recommended binding criteria only for larger energy producers of 2.5 MW thermal or 1 MW

1.2. Aims and scopes of this report

This study mainly focuses on the development of voluntary initiatives designed for energy use of biomass, based on the nature of different supply chains. The purpose of this report is to understand the emergence of these schemes, and how will they converge or diverge in the near future. It focuses especially on four important aspects of certification schemes

1) the ***governance structure***
2) the coverage of ***sustainability criteria***,
3) ***operational experience***, and
4) ***economic feasibility***

The analysis includes typical barriers encountered whilst implementing a sustainability certification scheme with regard to these four aspects, and recommendations how these barriers can be overcome or avoided altogether. The report will also analyse the development of a single EU-wide harmonized approach for solid biofuels.

1.3. Emergence of sustainability governance

Over the years, the importance of solid biofuels for the European energy generation has been increasing drastically. This is reflected by the fact that international trade has grown from about 56 to 300 PJ between 2000 and 2010 (Lamers et al., 2012). The bulk of these solid biofuels originates from the forestry and wood processing sector, and is mainly used in renewable electricity and heat production. The majority of this volume comprises of wood pellets and wood chips consumed in the European Union (EU). The interest in solid biofuels and bioenergy production and investment has been largely driven by policies of national governments, both in developed and developing countries, with the purpose to reduce greenhouse gas (GHG) emissions and to reduce dependency on fossil fuel (imports). To enable bioenergy to contribute in the development of sustainable fuel and energy production systems, safeguarding the sustainability of bioenergy deployment is necessary. There are currently a number of initiatives, including binding regulations and several voluntary sustainability standards for biomass, bioenergy and/or biofuels.

In 2009, the European Commission published the RED in order to define standards for the sustainable production of biofuels and bioliquids. For solid biofuels, no binding sustainability criteria exist so far, but in 2010, the Commission published its report on “sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling”. The report gives recommendations for the development of national legislation in this field, for Member States that wish to implement such legislation, based on the same conditions on biodiversity and high carbon stock land as for biofuels and bioliquids.

Given the current absence of mandatory EU-wide sustainability criteria for solid biomass, it is quite likely that some individual Member States unilaterally will develop (further) sustainability criteria, while others maintain the status quo. A few individual Member Countries have defined their own sustainability obligations, e.g. the UK (ROCs) and Belgium (Green Certificates), particularly including comprehensive binding criteria for GHG emission reduction levels. The Netherlands has also been considering the implementation of a reporting system for sustainable certified solid biomass, and therefore developed the Dutch Biomass Protocol. At this moment, NTA 8080 is suitable for these purposes. In September 2013, it was announced that by the end of 2014, also the Netherlands will have implemented mandatory sustainability requirements for solid biomass.

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electrical capacity or above. Nevertheless, this proposal is unofficial, and more development is highly expected in the near future. Therefore, it is not specifically included in this analysis.

The UK, the Netherlands and Belgium expect to rely heavily on large imports of solid biomass from overseas for energy purposes. On the other hand, several Member States rely on existing European and national regulations and certification on forestry sector that usually do not make a specific link with energy use[2]. These regulations are usually designed for domestic forests based on specific local circumstances. The EU Timber Regulation (EUTR) prohibits the import of illegally harvested timber and timber products from outside the EU including woody biomass for bioenergy production, but this does not directly relate to biomass sustainability (EC, 2003; EC, 2010).

In addition to production and harvesting, the EC also recommended that Member States should promote installations that achieve high energy conversion efficiencies, such as high efficiency cogeneration plants. Quite a large number of Member States (mostly from the old EU-15) have implemented such regulations, either requiring mandatory minimum efficiencies for the production of heat, electricity or both, or providing financial incentives to stimulate high efficiencies or heat recovery (Pelkmans et al., 2012).

Besides regulations, as part of their long-term development strategies, some industrial biomass users have decided to invest in voluntary sustainability certification schemes too. Certification is considered a way to prove the sustainability of biomass energy that helps to promote social acceptance of biomass energy. Adapting and developing sustainable bioenergy supply chain has become a strategy in many utilities to maintain profitability and enhance long term value. Numerous voluntary certification schemes have been developed to promote good practices throughout the supply chain. Many schemes designed for woody solid biofuels are developed based on existing forest management schemes such as Forest Stewardship Council (FSC) and The Programme for the Endorsement of Forest Certification (PEFC). Similar to national regulations and policies, due to the distinction in the nature of supply chains, these schemes present different approaches and different levels of environmental stringency. In some cases, they may go beyond national obligations. However, voluntary schemes cannot be considered as a substitution to binding regulations.

Owing to the absence of binding regulations in most Member States and at the EU-level, this study mainly focuses on the development of voluntary initiatives designed for energy use of biomass, based on the nature of different supply chains. The purpose of this report is to understand the emergence of these schemes, and how will they converge or diverge in the near future.

[2] An exception is the Finnish forestry certification system which is based on PEFC includes also criteria for energy wood. This si probably due to the fact that in Nordic countries, producing electricity by CHP is very common.

2. Approach

2.1. Types of supply chains & voluntary initiatives

The voluntary initiatives are developed specifically for certain supply chains, with different priorities, and often without (or only limited) coordination between schemes. The content of the initiatives is dependent on the interests and motivations of the actors involved, their values and the balance between them (Goovaerts et al., 2013). To examine the impact of sustainability standards on the industry, it is necessary to first understand the underlying factors that shape the markets. These initiatives are categorized in two settings:

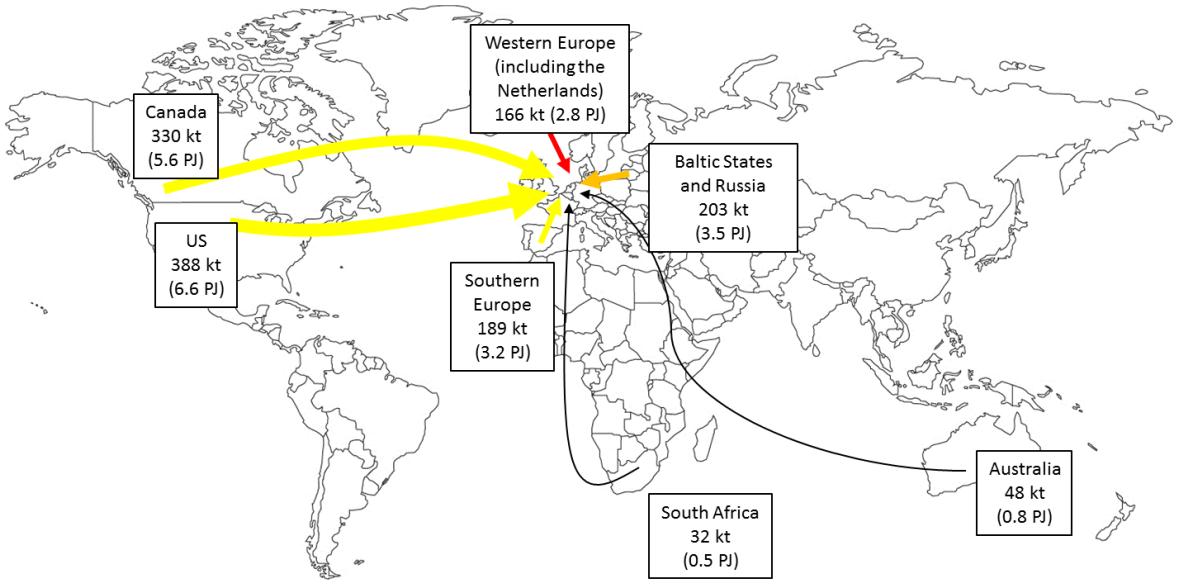
I. To serve for international (long distance) trade:

With the growing consumption of industrial pellets in recent years, the majority of international solid biofuels trade happens in the imports of wood pellets from United States, Canada, Baltic States, Russia and Southern Europe by Northern/Western Europe for co-firing in power plants. These pellets are mainly industrial pellets with lower quality compared to pellets used in household heating. In 2009, about 1.7 Mtonnes (29 PJ) were imported from outside the EU. The trade volumes of wood pellets between EU and non-EU countries in 2010 is about 2.7 Mtonnes (45 PJ) and has increased to about 3.4 Mtonnes (57 PJ) in 2011. By 2012 this volume had risen to about 4.6 Mtonnes (78 PJ) (Lamers et al., 2013). By 2020, EU wood pellet imports are expected to be in the range of 15-30 Mtonnes (Cocchi et al., 2011; Goh et al., 2013). The worldwide production capacity has recorded a 43% increase from 2009 (23 MT) to 2013 (33 MT) (Bioenergy International, 2013). The European Union is still the primary market for wood pellets and should remain as such for the next several years. This is driven mainly by the availability of feed in premiums for green electricity and the relative cost competitiveness of biomass with the cost of coal plus CO_2 emission allowances. Canada and the United States are expected to remain as the largest exporter of industrial pellets, followed by Russia and Baltic States. The markets are heavily relying on the continuity and stability of the supporting policy framework. In line with the promotion of biomass as a large part of the sustainable energy plan, certification schemes has become an ***important tool to justify the sustainability of imported biomass, and to support the long term bioenergy policy framework***. In the last few years, the market share of certified industrial pellets in the EU is increasing steadily. Belgium, the Netherlands and the UK are the largest buyers of these pellets. Figure 1 shows the percentage of sustainable certified / verified industrial pellets in the import flows to the UK and the Netherlands in 2011.

II. To serve for domestic (regional) supply chain:

In general, this type of supply chains consists of two types of biomass: unrefined biomass for small-scale heat and electricity production, and high quality wood pellets (or “white pellets”) for residential and district heating. The wood fuels used by small-scale heat and electricity production plants are mainly wood chips and other unrefined biomass, and come from local state or private forests and local wood processing industry. Depending on availability, by-products such as bark, saw dust and cutter chips can also be used. The sources are similar for high quality wood pellets, but these pellets are also exported to adjacent countries. Most feedstock is regionally or locally sourced, and regional trade fluctuations mostly adhere to winter conditions and local availability. The majority of the small-scale producers use only by-products from other activities while the large- and medium-scale producers may use purchased raw material from adjacent countries (but this is not common in Nordic countries). The regional trade largely influenced by national policies (such as incentives) and other economic factors. The main Member States that consume large quantity of wood pellets for residential and district heating are Germany, Austria, France, Italy, Finland, and Norway. In 2011, the heat consumption from solid biomass in the EU has reached 2700 PJ (EurObserv’ER, 2012), of which about 10% comes from district heating (heat plants and CHP). On the other hand, about 151 PJ of electricity was generated from biomass by CHPs in 2011 (EurObserv’ER, 2012). The formation of markets has lesser intervention from the government compared to Type I. The emergence of sustainability initiatives are either

developed to improve competitiveness in a specific (local) market or ***extensions from quality control schemes*** (such as EN Plus which is based on EN 14961-2 and EN 15234-2 standards). These schemes are usually tailor-made to fit for specific supply chains considering local conditions.



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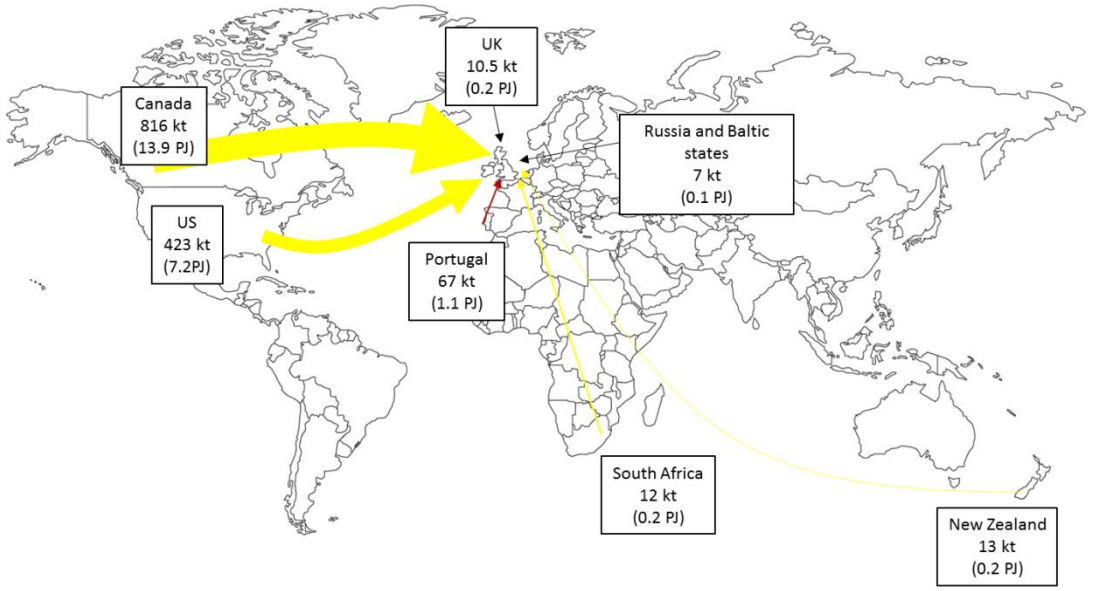

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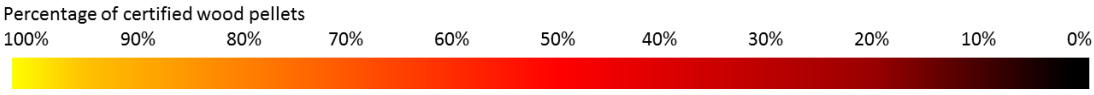

Figure 1 Trade flows of certified wood pellets to (a) the Netherlands in 2011 and (b) the UK in April 2011 - April 2012 (Source: Goh et al., 2013) (Assuming NCV at 17 MJ/kg)

Table 1 compares the two different types of supply chains from various aspects. The major differences lie within geographical boundaries, scales, and types of biomass. These differences are mainly derived from a country's characteristics, such as resources availability like coal and forests, population density, and etc. Ultimately, the markets are also shaped by supporting policies.

Table 1 Comparison of two types of supply chains

	Type I: International (long distance) trade	**Type II: Domestic (regional) supply chain**
Countries	Exporters: North America, Russia and Baltic States Importers: The Netherlands, UK, Belgium, Denmark	Forest rich countries like Germany*, Finland, Norway, Sweden, Austria etc.
Types of biomass	Wood pellets (industrial pellets, similar combustion characteristics to coal)	(i) Wood chips, residues like forestry slash, bark chips (Mainly unrefined and not suitable for long distance transport) (ii) High quality wood pellets ("white pellets") for residential and district heating
Function	Large scale electricity production (co-firing)	(i) Small heat and electricity production, CHP (ii) Residential and district heating
Market size	- About 110 PJ of electricity generated in power plants (EurObserv'ER, 2012) - Large bulk volume per supply chain - Centralized	- About 2,700 PJ generated in the form of heat (about 5% of that (135 PJ) comes from pellets as reported by European Pellet Council (2012)), and about 151 PJ of gross electricity at CHP (EurObserv'ER, 2012) - Small volume per supply chain - Decentralized (low population density)
Market characteris-tics **	- Existing export orientation of the forestry or wood processing industry: big scale bulk infrastructure (railways, harbors), handling equipment (chippers, cranes, terminals etc.), export market/trade know-how - Existing coal power plants - High local electricity and heat prices increasing the economic viability for biofuel imports - Availability of low cost domestic fossil fuels (e.g. in Russia, North America) allowing/stimulating exports of low cost domestic solid biofuels - Limited large-scale, low cost, domestic feedstock production potential	- Availability of cost excess residues from existing forestry, pulp and paper, or mechanical wood processing industries; also allowing the use of the respective infrastructure, know-how, and political influence - Preferential climatic conditions (i.e. potential) - Existing businesses with facilities allowing biofuel co-/mono-firing; especially fluidized bed technology due to feedstock flexibility - Tradition in using decentralized household and district heating system

	Type I: International (long distance) trade	**Type II: Domestic (regional) supply chain**
Solid biofuel characteris-tics **	- Refined, homogeneous solid biofuels with high net calorific value and/or monetary value (e.g. pellets), bulk density, flowability (reducing handling costs); low moisture and ash content - Large margin between supply costs (production and transport) and prices in consumer markets - Similar combustion characteristics to coal increasing the attractiveness for co-firing - Flexible end-use (combustion technology and scale)	- Local (short-distance) use is typical for solid biofuels which are either unrefined, cannot be transported in bulk (fuelwood), have a high moisture content, low monetary and/or low net calorific value (e.g. forestry residues, bark, chips) - Small margin between supply costs (production and transport) and prices in consumer markets
Supply related policies **	- Overproduction due to lack of local demand, overstimulation and/or highly competitive production prices compared to other international sources incentivizing exports	- Incentives to increase the residue use in the forestry and/or agricultural sector, or the planting of dedicated cellulosic crops via investment support, direct subsidies, low-interest loans, grants, or infrastructure projects - Mobilization of private forest owners (see e.g. EC, 2010 on good practice guidance on the sustainable mobilization of wood in Europe)
Demand related policies **	- Renewable electricity and/or heat targets enforced via regulatory or fiscal policies - National support policies for solid biofuels	- Renewable electricity and/or heat targets enforced via regulatory or fiscal policies - Emission standards - Ban on landfilling wood waste - Investment support via low-interest loans, grants, or subsidies for equipment
Trade related policies **	- Technical standards in the form of *globally* accepted quality standard (e.g. ENplus for wood pellets) - Hypothetically also sustainability requirement: When local biomass is not sufficient, biomass which fulfil the sustainability requirement and cost & GHG efficient will be imported from long distance sources.	- Hypothetically also sustainability requirement: When local biomass is sufficient and deemed sustainable.

* Germany is an exception where the government does not provide financial support for large-scale co-firing of wood pellets despite the existence of a large number of coal power plants.

** Modified and supplemented with additional information based on Lamers et al. (2013)

2.2. Description of case studies in Task 5.2

Four case studies have been carried out in Task 5.2. The case studies aim to investigate different supply chains in terms of:

- Size of the end-user: from medium-sized installations of ≥ 1 MW capacity to (very) large consumers such as utilities with capacities of ≥ 100 MW
- Geographical boundaries, i.e. regional, national and international supply chains (including one chain originating outside the EU-27)
- Type of biomass: e.g. wood chips, wood pellets, or other solid biomass

Each case study investigated applicability, barriers, costs, time efforts, etc. associated with the actual implementation of sustainability certification of solid biomass. Originally, it was also intended to analyse the implications of the EC decision on possible mandatory solid biofuel sustainability criteria. However, at the time of performing the case studies (January 2013), the Commission had not yet published any criteria. Nevertheless, the case studies of sustainably certified solid biomass chains provide valuable experiences to other market actors, but also to national governments which still may decide to implement mandatory criteria on a national level. Below are the descriptions of each case studies:

I. Green Gold Label

(See deliverable Task 5.2a)

The Green Gold Label (GGL) programme is a certification system for sustainable biomass. It covers production, processing, transport and final energy transformation. GGL provides standards for specific parts of the supply chain, as well as standards for tracking & tracing the origin of the biomass. GGL was established in 2002 by Dutch energy company Essent (now RWE) and Skall International (now Control Union Certifications). It was fully implemented since 2003 / 2004. GGL is currently registered and owned by the independent GGL Foundation. The GGL Foundation is responsible for the standards criteria and for communication with stakeholders. The member base is multi-stakeholder. Standard setters, primary producers, traders, end-users and NGO's are all welcome to join the initiative.

GGL has been operational since 2002 as a global certificate for sustainable biomass, and has been used mainly to certify wood pellets from Canada and the US, but also other countries. With more than 8 million tonnes of biomass certified with the Green Gold Label in 10 years' time, Green Gold Label is committed to supporting the development of sustainable biomass for energy, power production and chemical purposes. The scope of the Green Gold Label scheme includes the entire chain of biomass/biofuel/bio-liquids for energy production and biofuel conversion starting at the primary production. It concerns all products, by-products, residues remains and derivatives of vegetable origin from agriculture and/or landscape and environment management that are eligible for energy production. GGL involves tracing from source to power generation: It covers production, processing, transport and final energy transformation. It provides standards for specific parts of the supply chain, as well as standards for tracking & tracing the origin of the biomass. The GGL accepts certification under the following current schemes: Forest Stewardship Council (FSC), the Programme for the Endorsement of Forest Certification (PEFC), Sustainable Forestry Initiative (SFI), the Canadian Standards Association's Sustainable Forest Management (CSA) and the Finnish Forest Certification System (FFCS).

GGL was then further updated to GGL – RED based on the EC's recommendation of using the RED criteria. In 2012, the English Office of the Gas and Electricity Markets (Ofgem) has benchmarked the newly developed GGL – RED standard under the Renewable Obligations Orders (ROO). Forestry management certification systems such as FSC were also part of the

benchmark. As of January 2013, the GGL - RED standard is the only voluntary system that has been approved by Ofgem.

For this case study, the supply chains of wood pellets produced in British Columbia (BC), Canada and used for power generation in the Netherlands and the UK are investigated. Saw dust is still the main source for wood pellets in Canada, although in US round wood is also being used in recent years. These materials are processed and pelletized by different processors, and finally combusted in power plants. RWE Essent (The Netherlands) and RWE npower (UK) are the two major consumers of GGL certified pellets. Both consumed about 3 Mtonnes in 2012.

Currently, there is an effort in harmonizing sustainability schemes for industrial pellets, namely International Wood Pellet Buyers Initiative (IWPB), integrating GGL and other industrial verification initiatives such as Laborelec label to standardize technical specifications and sustainability requirements for wood pellets. In addition, the EN ISO 17225-2 standard (published in beginning of 2014) includes also the specification of industrial pellets, taking into account the IWPB work drafting guidelines. This standards will supersedes EN 14961-2 standard.

II. Finnish Ekoenergia

(See Deliverable Task 5.2b)

Ekoenergia is an ecolabel for renewable electricity and heat managed by the Finnish Association for Nature Conservation (FANC). First Ekoenergia was established for the Finnish electricity market. Year 2013 is a transition year for the Ekoenergia label. The fast internationalization of the electricity market has brought along the internationalization of electricity label – EKOenergy, developed together by FANC and other NGOs. EKOenergy is now a label managed by a network of 23 NGOs from 19 countries. The new (international) EKOenergy criteria for electricity have been approved in February 2013, and they will replace the old Finnish criteria for electricity no later than by the end of 2013. Electricity and heat producers, users and companies providing energy saving services can apply for this label. In Finland, 12 companies are selling Ekoenergia labelled electricity (of which 6 companies use biomass), total electricity amounted to 600 GWh in 2011 and maximum sold amount was 3 TWh in 2008 in Finland. Most of the plants using biomass are situating in the Eastern part of Finland. The Finnish Ekoenergia label can also be granted to electricity generated in Denmark, Finland, Norway or Sweden.

Companies producing electricity or heat from renewable biomass fuels must declare the fuel they have used and its origins, and the quantity of carbon dioxide emissions they have generated (annual limit is 100 g CO_2/kWh (27.8 g CO_2/MJ)). As of 1 January 2012, wood energy producers should also follow the *Tapio's guidelines* for energy wood cultivation and harvesting. Ekoenergia label also requires that ash is reused (e.g. as fertilizer). Tapio's guidelines contains 7 principles, and more detailed description of these criteria is available in the case study report. Ekoenergia for heat production is in pilot phase and two district heating plants as certified according to EKOheat.

The biomass user in this case study is Kyyjärvi fully automatized district heating plant with two boilers: 1 MWth and 1.5 MWth. District plant is located in Kyyjärvi town with 2,000 inhabitants. It is owned by Kyyjärvi municipality, but operated by an energy co-operative with 50 members consist of local forest owners and farmers, two wood harvesting companies, a local Forest Management Association, a boiler plant supplier, chipping and a transportation company. Kyyjärvi plant uses mainly small-sized delimbed stem wood or whole tree chips produced by two members of the co-operative. Total use is about 10,000 loose m^3 (7.5 GWh) annually and total heat production is 6,000 MWh annually. The Kyyjärvi plant is selling 100% Ekoheat (part of the Ekoenergia label). Kyyjärvi is first plant piloting Ekoheat label in Finland. Ekoheat system can be applied for small heat producers in Europe, i.e. less than 2.5 MW district heating plants or heating of large buildings like schools and industrial buildings.

III. TÜV Rheinland Carbon Footprint

(See Deliverable Task 5.2c)

The Carbon Footprint is a label developed by the German company TÜV Rheinland which mainly provides technical services in the fields of testing and certification. The subsidiary company TÜV Rheinland LGA Products GmbH offers the preparation of carbon footprints for various sectors. Based on the international standards ISO 14040 and ISO 14044 as well as on the British standard PAS 2050 the product-specific carbon footprint has been determined. It is used to proof the sustainability of high-quality pellets for the heat sector. The carbon footprint scheme by TÜV Rheinland does not define a threshold value for greenhouse gas emissions but reviews the procedure for the assessment of product-related emissions. Aim of the scheme is to enable a company to display the sustainability of its products to the customers.

Westerwälder Holzpellets (WWP) is currently the only certified stakeholder in the pellet sector. WWP is one of the most important German producers of wood pellets. 112 ktonnes of wood pellets have been produced at three sites: Langenbach, Oberhonnefeld and Hosenfeld in 2012. The pellet plants in Oberhonnefeld and Hosenfeld are operated in collaboration with local saw mill operators. Around 85% of the raw materials used by the company are residues from the wood processing industry, mainly from the saw mill Koch GmbH which is situated beside the pellet plant. The saw mill holds a PEFC certificate and uses roundwood from the near surrounding (approx. 50 km around the mill) as raw material. Additional raw material is delivered by another saw mill situated about 18 km away from Langenbach. In case of peak period demand, WWP buys wood residues from specialised traders. Approximately 15% of the used raw material is stemwood that is not usable for the production of sawn timber. It originates from forests within a radius of about 50 km around the pellet plant.

The assessment of the carbon footprint was done by the consultants of engineering office Neumeister on the basis of the declaration of all necessary information by the certified company. The heat for the drying of raw material comes from a biomass CHP plant which is very common in pellet productions in Central Europe. For the pellet production WWP purchases power from a green electricity provider holding a certificate of TÜV Süd. Since process heat and electricity for the production come from renewable sources, they were not taken into consideration in the calculation of the carbon footprint. For other production related factors (such as pressing aids and packaging) emissions of 3.75 kg per ton pellets have been identified. WWP only indicates the corporate amount of CO_2 emissions caused by the supply of raw material and the delivery of the produced pellets: 17.25 kg per tonne (about 1 g/MJ) produced pellets (including the harvest of the wood and the transport to the saw mill).

The total share of material from certified sources is not assessed by WWP since there are no related criteria in the scheme. However, about 70% of the forest area of Rhineland-Palatinate is PEFC certified (580,823 ha), more than 5% is FSC-certified. Hatzfeldt-Wildenburg'sche Verwaltung, a large private forest-owner in the region and co-proprietor of the pellet plant in Langenbach holds a FSC certificate for his total area.

Since the definition of the system boundary as well as emission factors used for the calculation of the carbon footprint is not defined, the scheme cannot be used for comparing the product related greenhouse gas emissions of several pellet producers. Other environmental aspects of pellet production and supply do not play a role within the scheme.

IV. Nordic Ecolabel – Swan Label

(See Deliverable Task 5.2d)

The Nordic Ecolabel is a voluntary ecolabelling scheme that evaluates a product's impact on the environment throughout the whole life cycle. The label guarantees among other things

that climate requirements are taken into account, and emissions of CO_2 (and other harmful gasses) are limited - where it is most relevant. The Nordic ecolabelling of pellets (with the Swan Label) was established in 2007 and includes requirements on manufacturing methods, transportation and storage. The Swan Label is aimed at manufacturers, importers and resellers that can apply for a licence. The aim is to identify the top-grade quality from an environmental perspective, primarily for private use in small to medium-scale burners. These boilers and stoves are often used in built-up areas. The Nordic Ecolabel scheme is managed by secretariats in each of the Nordic countries. The secretariats also manage the European Ecolabel (the Flower).

The Swan Label requires that the pellets are easy to use and thus meet the end-users' wishes when converting to a renewable energy source that reduces the emission of greenhouse gases. In addition, the energy required to manufacture the pellets is limited to ensure the energy efficiency. Finally the combustion shall not entail a risk to health or the environment. To minimise the effects of emissions on health and the environment, combustion must be optimised. This means that the pellets must be of a consistent, non-perishable grade, and that the size of the pellets must be suitable for the fireplace. Physical properties, such as density, size and moisture content, must not vary too greatly.

In terms of feedstock, the scheme requires a certain share of certified feedstock for pellets made from virgin wood. The scheme accepts forestry standards and certification under certain conditions. Regarding standards, they must balance economic, ecological and social interests and comply with the UN Rio Declaration, Agenda 21 and the Statement of Forest Principles as well as respect applicable international conventions and agreements. Also, the standard must contain absolute requirements and encourage and promote sustainable forestry. The standard must be generally available and it must have been developed in an open process to which stakeholders with ecological, economic and social interests have been invited. Regarding forest certification, the system must be open, have wide-spread national or international credibility and be able to verify that the requirements in the forestry standard (see above) are fulfilled. The certifier must be an independent and recognised entity. The certifier must be able to verify that the requirements in the standard are met, able to communicate the results and be suitable for the efficient application of the standard. Nordic Ecolabelling may request further documents to assess whether the requirements regarding standards and certification systems are met.

For this case study, the supply chain of Swan Labelled wood pellets produced in Norway (Norwegian Norsk Pellets in Vestmarka) and sold for small scale consumers and retailers by Shell Danmark A/S in Denmark is described. The Danish branch of Shell initiated marketing of the ecolabelled pellets in Denmark and marketed the pellets directly towards small scale consumers in Denmark under the brand name "Premium Pellets". The labelled pellets were also sold to a number of small scale retailers operating in Denmark, amongst these retailers of pellet stoves and pellet boilers. The pellets were certified by a Danish technological service provider. The described pellets are to date the only ones that have carried the Swan Label. As the demand for Swan labelled pellets in Denmark was limited the initiative was not prolonged after the pellet supplier went bankrupt in 2009.

To summarize, Table 2 shows the settings of the four case studies in Task 5.2, and Figure 2 shows their geographical coverage.

Table 2 Settings of four case studies

Schemes	GGL	Ekoenergia	TÜV Rheinland Carbon Footprint	Nordic Ecolabel – Swan Label
Types	I	II	II	II
Supply chain	BC (Canada) to UK and the Netherlands	Kyyjärvi, Finland (local)	Rhineland, Germany (local)	Between Nordic countries (regional)
Feedstock	Residues	Mainly small-sized delimbed stem wood or whole tree chips	Residues and small percentage of stem woods	Residues and small percentage of stem woods
Products	Industrial pellets	Wood chips	Residential pellets	Residential pellets
Market	Large scale electricity	District heating (for this supply chain) & electricity	Small scale heating	Small scale heating
Scheme	Certification	Certification	Certification	Certification
Audit	Third-party	Only book keeping for EKOheat and third-party for international EKOenergy	Third-party	Third-party

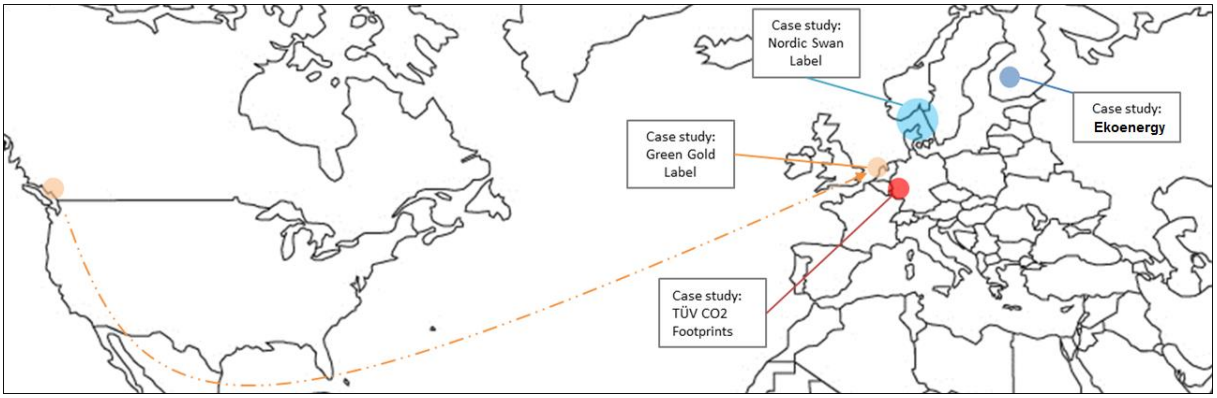

Figure 2 Geographical coverage of the four case studies

In addition to these four case studies, some examples of the Type I supply chains are listed in Table 3.

Table 3 Other examples of the Type I supply chains

Schemes	Laborelec	Drax	NTA 8080[3][4]	GGL
Types	I	I	I	I
Supply chain	Mainly North America to Belgium	North America to UK	Currently in the Netherlands[5]	Georgia (US) to UK and the Netherlands
Feedstock	Residues and small percentage of stem woods	Residues and small percentage of stem woods	Mainly residues	Residues and small percentage of stem woods
Products	Industrial pellets	Industrial pellets	Wood pellets, wood chips, wooden residuals	Industrial pellets
Market	Electricity	Electricity	Electricity and heat	Electricity
Scheme	Verification	Verification	Certification	Certification
Audit	Third-party	Aim to engage a qualified third party	Third-party	Third-party

[3] Scope of NTA 8080 includes solid, liquid and gaseous biomasses. The data in the table focuses on the application for solid biomass

[4] Based on Dutch Cramer criteria and European (RED) sustainability criteria, a certification system for biomass for energy purposes has been developed by a diverse group of stakeholders. The criteria have been turned into verifiable requirements. With the support of NEN, a broad stakeholder panel representing market players, government and civil society organizations has determined the sustainability requirements with regard to biomass in the form of a voluntary agreement. On the basis of that agreement, NTA 8080, a certification scheme has now been developed. The NTA 8080 is a certification system describes the requirements and certification rules for sustainably produced biomass for energy applications (power, heat & cold and transportation fuels). The NTA 8080 certification system is recognized by the EC as voluntary scheme to demonstrate compliance with the RED sustainability criteria. NTA 8080 is currently (September 2013) under revision to review and update the sustainability aspects and to broaden the scope to bio-based products (non-bioenergy).

[5] The NTA 8080 certificate system is designed to be applicable for supply chains all over the world. Currently this system is mainly applied in The Netherlands, based on the certificates issued. A total of 26 companies are included in the NTA 8080 certification register. The scopes of certificates show that 21 companies are 'producers', 20 companies are 'processors', 6 companies are 'traders' and 10 companies are 'end users', noting that one company can cover more than one part of the supply chain. Concerning solid biofuels, 3 companies deal with woodchips, 2 companies with wood pellets, 1 company with both woodchips and wood pellets, and 2 companies with wooden residuals. The other NTA 8080 certified companies belong to the biogas or liquid biofuels supply chains. There are no production volume figures available.

3. Analysis and discussion

3.1. The role of voluntary certification as a governing tool: Initiators and capacity in decision-making

Since the last decade, the governance of sustainability has been evolving from the early focus on sustainable and legal timber production to the energy use of solid biomass. The rapid expansion of cross-border trade has also stimulated the initiation of governance of the sustainability of tradable biomass that recognizable in both exporting and importing countries. The standardization of sustainability criteria and translation of outputs into measurable indicators can be monitored by various stakeholders including policy makers, industries, scientific community, NGOs and other experts. It gives authority to different parties under a wide variety of settings for the framing of sustainable governance of solid biofuels. It was observed that more rapid progress was made in developing voluntary standards than government regulation framework. These voluntary systems have been used to assess part of or the whole supply chain that seeks certification. As indicated in Section 2, these initiatives can be categorized under two categories. The schemes in the four case studies were initiated by different actors, i.e. the biomass producers/suppliers, large buyers (power companies), NGOs, at different scales. The governance of each schemes are analysed below.

For the Type I schemes like GGL, Laborelec Label and Drax verification, ***the initiators are the power companies***. More than ten years ago, the power companies in Western Europe started to use biomass in their power plants. While the industry was familiar with fossil fuels, biomass was still something new to general public, policy makers and even the power industry. As the power companies intend to include bioenergy as part of their long term strategy, they envisioned a need to develop certification schemes for solid biomass to prove the sustainability of biomass energy, also to promote social acceptance. As large imports outside the EU are expected to fill the demand, there is a need to develop protocols for the importation of sustainable biomass, covering the technical, environmental and economic aspects of conversion of clean biomass into sustainable energy. Several systems were initiated by the power companies, such as the GGL by RWE Essent, the Laborelec Label by Electrabel/GDF-SUEZ, and the Drax sustainability principles by Drax, together with their partners, particularly certifying bodies like Control Union and SGS with experience in certification. These schemes are closely linked to sustainable forest management schemes (SFMs). They recognize a range of SFMs such as FSC and PEFC for the production side of the supply chain instead of starting from scratch.

There is a risk that these schemes might be overly dominated by the power companies (i.e. the buyers) in shaping the standards which have to be followed by the producers, or the fears of “green-washing” that are always raised by the NGOs. To avoid the fear that schemes are set to favour only one party, the participation of players along the chain, experts and NGOs in governance structure is necessary. For example, RWE Essent has taken its initiative to make the GGL system independent by constructing an autonomous foundation with a multi-stakeholders governance structure, namely the GGL foundation which is the owner of the scheme instead of the power company itself. Each group in the supply chain, including producers, users, traders, NGOs are invited to join the board to participate in decision-making. However, the representation of these stakeholders was not entirely clear at the time of writing.

Nevertheless, these schemes are not designed with the intention to by-pass the need for regulations. In fact, for industry stakeholders, a stable long-term policy and regulatory framework is very important as the industry is heavily relying on government support. Discussions have been going on between power companies and both national governments and the EC to build a mandatory regulatory framework for the use of sustainable biomass for energy purpose. A public consultation was held by the EC to examine the need of additional measure at EU level regarding the sustainability of solid and gaseous biomass for energy

purpose (Directorate-General for Energy, 2011). Although the EC has not yet made any decision until 2013, the UK as a forerunner has started to move ahead. Since April 2011, the English Office of the Gas and Electricity Markets (Ofgem) obliged the UK energy generators to report against sustainability criteria for solid biomass under the Renewables Obligation. From April 2015 onwards, solid biomass will need to meet the sustainability criteria to be eligible to receive ROCs (DECC, 2013). In the case of the UK, the interference of government has superseded the capacity of voluntary systems.

The story is a bit different in the other Member States with the Type II supply chains. For these Type II supply chains, the starting point could be varied from one to another. For example, the Finnish Ekoenergia label was developed by the NGO, targeting electricity not only from biomass but also other sources like wind energy. In other words, they are not labelling biomass but electricity and heat. It focuses on giving the consumer tools to select sources of energy, and to guarantee that the purchase makes a difference on the field. Different from the Type I schemes, international EKOenergy label is largely ***driven by NGOs***, with a network consisting of 24 organizations from 20 countries. As the NGOs see the fast development of renewable electricity market in Europe, they spot a need to pool efforts to assist consumers in navigating the complex European electricity market. They also gradually expand their coverage to the heat market. It works like a “filter” that helps the consumer to assess the sustainability of an electricity or heat source. Electricity from biomass contribute to about 20% of the market that they are focusing on. It is the first ecolabel for electricity that results from a pan-European consultation process. Note that the EKOenergy label is an EU-focus scheme, as it only deals with biomass produced within Europe. At decision making level, it is mainly dominated by Nordic and Eastern European countries; however, stakeholders from the other Member States are also consulted. It works on the whole European market and will be recognized by major stakeholders in all European countries.

The market of household heating pellets has shown a different trend. Unlike industrial pellets market that relies heavily on governmental support, this type of products faces direct responses from the end-consumers in competition with other products. With this market characteristic, sustainability labels usually developed independently and lack coordination among developers. It highly depends on market demand – whether the end-consumers are attracted with the environmental benefits claimed by the label or not. One of the scheme case studies in work package 5.2, the TÜV “Carbon Footprints” label was ***initiated by a pellet producer and retailer*** with the technical expertise from certification company. The idea of establishing the label is to enable a company to display the sustainability of its products to the customers, and attract the consumers by promoting environmental friendly pellets focusing on GHG emission reduction. However, besides the newly developed schemes, there is also an effort from ***an existing wood pellet scheme which focuses on quality control***, namely EN Plus developed by the European Pellet Council (EPC) to incorporate sustainability aspects into the system. They have started to employ GHG emission calculation tool in their system, and also reporting of certified raw materials. With its relatively large share in household pellet market (about 50%), the emergence of other small environmental labels for household pellets has become unlikely.

Apart from labels dedicated for energy, there was also ***an attempt by the Nordic countries*** to include energy use of wood pellet into the Nordic Ecolabel (the Swan) which covers 63 product groups. This label is the official ecolabel of the Nordic countries and was established in 1989 by ***the Nordic Council of Ministers*** with the purpose of providing an environmental labelling scheme that would contribute to a sustainable consumption. The pellet label (for small-scale heating), namely Swan Label for pellets was established in 2005 – 2006. The label was developed and governed by five national ecolabelling organisations in each of the Nordic countries. However, since 2009 this label has not been in use in any supply chain due to various operational reasons.

On the other hand, the ***sustainable forest management schemes (SFMs) have not shown intention to include bioenergy*** in their scheme at the moment. Although SFMs are

usually recognized by the bioenergy schemes, the focus of SFMs will remain on the forests and they are unlikely to cooperate with or participate in other bioenergy schemes.

Discussion and comments:

One reason of the mushrooming of schemes is the lack of a EU-wide international multi-stakeholders platform on bioenergy that cover forestry, wood industry, power companies, traders, policy makers, scientists, NGOs and etc. (although there are platforms on forestry such as FLEGT). Private governance (voluntary schemes) of environmental performance of bioenergy products is trying to gain prominence in market and policy arenas to influence the sustainability outcomes. These heterogeneous systems are actually reflections of the natures of different market and supply chains. While the emergence of different schemes may cause confusion in the market, the convergence of governance rules is expected over time if there will be an EU-wide regulation framework that defines the rules of biomass sustainability. The latest trend shows that the Type I schemes will be harmonized via IWPB (refer to Section 3.5) in the near future, putting a more inclusive governance structure in place, and trying to ensure interest of each stakeholders are taken into account. Interestingly, the European Pellet Council also aims to join this harmonization effort to see if there are possibilities to harmonize criteria for both industrial and household pellets. More details on the harmonization progress will be discussed in Section 3.5.

3.2. Sustainability criteria: included to what extent?

As the scale of solid biofuel trade grows larger and larger, while sustainability standardization simplifies some individual transactions, it also increases the complexity of some other transactions, owing to a wide range of conditions in different regions and countries. This has led to the development of parallel or competing governance initiatives by diverse actors to serve different purposes as indicated in Section 2. Many of these initiatives are developed to fit specific supply chains, and the criteria designed or employed largely or partly focused on specific conditions:

- Geographical boundaries, i.e. regional, national and international supply chains (including one chain originating outside the EU-28)
- Size of the producers and end-users
- Type of biomass: e.g. wood chips, wood pellets, or other solid biomass

Table 4 shows the coverage of sustainability requirements in the four case studies. These schemes focus mainly on environmental criteria, and do not cover economic and social aspects. Forest management schemes always become the first candidate to prove (environmental) sustainability at the production side, except for the case study of TÜV carbon footprints (which only intend to calculate the CO_2 emission over the supply chain). To avoid overlapping cost and efforts, the bioenergy schemes often explore ways to coordinate and recognize existing schemes. For the Type I supply chains, North America and Russia together with Baltic States are three main exporting regions. These regions and also Europe have many years of experience with SFMs like FSC and PEFC. These schemes mainly take care of the management of the forests such as harvesting activities and conservation of biodiversity. The biggest difference between bioenergy scheme and forest scheme is the accounting of GHG balance, due to the fact that mitigation of climate change is not the main objectives for the SFM schemes at the time that they were developed. Miettinen (2013) indicated that the emission over the supply chain is not addressed by FSC, and there is no plan to launch any new policy on bioenergy. Indeed, woody biomass used for energy purpose represents only a small percentage of total use of wood in the world - as a comparison, the world production of round wood is about 1.1 – 1.4 billion tonnes compared to 4.6 million tonnes of EU pellet imports in 2012 (Lamers et al., 2012). However, the share could be high for the importing countries, e.g. in 2011 about 21% of total woods used in the

Netherlands was used for energy purpose, excluding recycled and waste wood in the calculation (Goh et al., 2013c). For bioenergy schemes, there is always an additional set of criteria for GHG emission calculation. Instead of developing a whole new scheme for the whole supply chain, recognition of SFMs or establishing complementary schemes on top of SFMs which cover the raw material production part will save a great amount of efforts and costs. This phenomenon is observed in the case studies in Task 5.2, where SFMs are recognized by three of the studied schemes.

Table 4 Coverage of sustainability requirements by the schemes

Schemes	Productions (Land use, harvesting practices in various environmental aspects)	GHG emission calculation over the supply chain	Economic and social sustainability criteria
GGL	Recognition of SFMs	Yes	No
Ekoenergia	Recognition of SFMs	No for the Finnish system, but Yes for the international system	No
TÜV Rheinland Carbon Footprint	No	Yes	No
Nordic Ecolabel – Swan Label	Recognition of SFMs	Yes	No
EN Plus	Recognition of SFMs	Yes	No
NTA 8080	Yes	Yes	No
SFMs	Yes	No	No

For the Type I market, the environmental criteria in SFMs on land use and biodiversity have shown significant difference with the RED criteria[6] recommended by EC (Also refer to WP 5.1 by Goh and Junginger, 2012). In the absence of the EU-wide sustainability criteria, most of the members are keeping the status quo, but a few have already started working on setting their own requirements for solid biofuels. As presented in WP 5.1 ("Overview and analysis of sustainability certification initiatives"), benchmarking of existing schemes for solid biomass have been carried out in the UK and the Netherlands against the RED criteria with some additional national criteria. For the Type I schemes, the priority is to show compliance with the mandatory requirements to gain financial support from the government. As the forerunner, the Green Gold Foundation has upgraded its GGL scheme to the GGL-RED standard which has been recognized by the UK government to prove the sustainability of solid biofuels for gaining government support. The GGL-RED standard incorporates the RED land criteria into the existing GGL scheme. Ofgem has benchmarked the newly upgraded GGL-RED standard under the Renewable Obligations Orders (ROO). At the time of writing, the GGL-RED standard is the only voluntary system that has been approved by Ofgem.

While the industrial schemes have started (or shown intention) to move on adapting the RED land criteria, the schemes for the Type II supply chains have no intention to go into that direction. Instead, their focus is on other aspects which are closely related to local conditions. In the case study of Ekoenergia, the current discussion is on the suitability of biomass for energy purposes. In certain regions where mobilization of wood to produce pulp is not viable, selling wood for (small-scale) energy purpose is deemed as an opportunity. However, using stem woods for energy remains an issue. In this case study, the use of wood is proposed to be limited by diameter measurement of logs. Such a criterion is however criticized for not

[6] European Commission. Renewable Energy Directive. Biofuels sustainability criteria. Available at: http://ec.europa.eu/energy/renewables/biofuels/sustainability_criteria_en.htm

considering the species. There are types of trees with a diameter breast height (dbh) values larger than the limiting value given by the scheme (i.e. 20 cm), but they are not suitable for the wood industry, and thus might still be used for energy purposes. Also, in certain areas far from saw mills, stem wood could be more economically utilized for energy purposes. Moreover, the cost of certification (i.e. to to carry out inspections of logs) may be high, as only the diameters of high value and high quality wood are measured on site. However, for the time being, according to Vanholme (2013), to ensure only green electricity is promoted to the consumers and to avoid the use of controversial bioenergy sources (such as the use of full trees), International Ekoenergy decided to take these out from the standards.

It is also challenging to formulate criteria, which take sustainability into account and at the same time avoid unnecessary administrative burdens, especially on small market actors. However, according to the outcome of this case study, when heat production is based on local wood fuels, the fulfilment of criteria is easy for heating plant and Ekoenergia certification is not too costly or time consuming for the municipality and key stakeholders. The cost would be even lower for small owners if group certification of several patches of forest can be included.

From the case studies in Task 5.2, it seems that regardless of the type of supply chain, GHG emission balance has been reckoned as an essential element in evaluating sustainability of biomass for energy use. It has been regarded as an important component to attract customers. It is generally agreed that emissions such as harvesting, processing and transportation along the supply chain should be taken into account. For small-scale users, the focus is placed more on the emission during the end-use phase. Case studies of Type II show that one of the main aims is to ensure good quality of biomass and to provide a clean combustion in small-scale heating facilities, e.g. has a high degree of cleanliness and physical stability. To some extent, several other schemes that designed for quality control have also tried to incorporated GHG balance into their systems. The market actors believe that the integration of quality and sustainability aspects in one scheme such as EN Plus makes sense since defined quality requirements are a precondition for an efficient combustion as well as for emission control. The EN Plus scheme now requires the applicants to carry out GHG calculation, report the percentage of SFM certified raw materials, and sign a statement of commitment about sustainability (Gauthier, 2013).

Discussion and comments:

In terms of environmental sustainability, the major disagreement between schemes actually lies within the land use- and management change issue – this is related to the use of round wood / stem wood for energy purpose, and does not apply to secondary biomass (i.e. processing residues like sawdust, bark, cutter chips). It seems that the Type II producers are unlikely to include the RED land criteria which are perceived as less relevant to them, especially those have their own long tradition in forest management. Indeed, the associated risks have not been sufficiently examined with empirical justification, especially on the land use change aspect. It is noteworthy that the definitions and limitations of forests in this context have not been agreed internationally yet. Even the criteria in SFM systems on land use and biodiversity have significant difference with the RED criteria[7] recommended by EC (Also refer to WP 5.1 by Goh and Junginger, 2012). This is the main issue debated now between the Member States. The main argument, especially by the forest-rich Member States, is that the criteria for liquid biofuels are mainly designed for agricultural products, which cannot be applied directly on forestry products, as forest management is significantly different from agricultural practices. Agricultural crops usually have a short rotation time, with harvesting and cultivation take place at the same area of land. On the other hand, forestry

[7] European Commission. Renewable Energy Directive. Biofuels sustainability criteria. Available at: http://ec.europa.eu/energy/renewables/biofuels/sustainability_criteria_en.htm

products have a much longer rotation times (e.g. more than half a century) and harvests take places in different areas each year. The activities include planting, thinnings and final harvesting, and these occur at separate locations (Hoglund and Gustavsson, 2011).

Besides the difference between forestry and agriculture, diversity of forestry in different regions (within the EU, but also globally) could also be another key consideration. The characters of the forests could be very different, ranges from old grown forests without management to intensive managed forests, even only within Europe (See WP 5.1). There are a variety of forest types, management structure, purposes and biodiversity. The general definitions of forest land in the RED criteria may cause confusions. Embracing this diversity in a set of sustainability criteria is challenging if an equal-level playing field must be established taking into account also other parts of the world outside Europe (Höglund and Gustavsson, 2011; IEA Bioenergy, 2013). A prominent example is the discussion about the use of woody biomass from Canada. The RED criteria preclude the use of biomass that comes from "primary forests", however the definition of primary forests might be open for interpretation if different definitions are referred to[8]. In the context of Canada, where forest management is not intensive and forest landscapes are largely driven by large-scale natural disturbances such as fire and insect epidemics, it could be very hard to operationally identify "primary forest". According to the current definition (given from FAO), large forested area in Canada may potentially fall under this group (Thiffault, 2012). Likewise, for the Type II supply chain, there is also a discussion on accepting stem woods with defects such as root rot (heterobasidion) or other pathogens for energy purpose in the case of international EKOenergy label. Such a change of use of material would results in a *management* change rather than a *land use* change.

In general, the RED land criteria are probably insufficient to address local conditions . As a comparison, the SFM schemes usually link to local forest laws and regulations, and focus more on the prohibition of biomass use from "protected areas". The situation becomes more complex considering the ownership of the forest, as it could be public or private, large scale or small scale. The RED criteria originally point to preventing conversion of high values lands to agriculture land, but they may not be suitable for solid biofuels which come from existing stands, where changes in forest management are often more relevant. To avoid overlooking sustainable sources of solid biomass, the types of forests might need to be redefined clearly according to scientific findings and local conditions.

In addition to geographical differences, different perspectives from each stakeholder have brought up more debates. The coordinator of the international EKOenergy label, Vanholme (2013) indicates that they found it rather difficult to integrate the criteria to the other existing biomass certification schemes, as they aim to introduce a series of points that seem to be crucial for the NGOs which are not being picked up by other existing schemes which are not originally designed for bioenergy. For example, the use of roots and stumps is not included in the existing criteria because there was no use for these parts of the tree before the boom of the bioenergy sector. And certainly, the large and small scale end-users and producers will have different ideas on the criteria as well, whether environmental, economic or social aspects. In fact, every stakeholders might have their own definitions for "sustainability". For most of the schemes, economic and social aspects are not included. In fact these are crucial components, especially for small-scale holders. For example, in the Finnish case study energy wood business generates income for the people who live in country side and small

[8] In the unofficial proposal by the EC in August 2013, a more detail definition of primary forest is given – *"primary forest and other wooded land, namely forest and other wooded land of native species, where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed, unless evidence is provided that obtaining the raw material from primary forests and other wooded land is the result of the felling of decay of trees due to a natural disturbances, such as a significant storm, fire or disease epidemic. Other types of forests as defined by the FAO, such as modified natural forests, semi-natural forests and plantations, should not be considered as primary forests."*

community (contribute to 50% of harvesters' income), creates jobs and keeps villages lively. In addition, the health and safety issues in the transportation and storage of biomass should also be taken into account too. There is a need to consider other concerns in addition to environmental sustainability.

When sustainability is considered at a wider scope, it will be difficult for forestry certification if specific criteria are only applied for one end-use only, i.e. energy purpose. Forest typically yield multiple products such as timber, pulpwood and low-quality/residue wood for energy production. Thus, one certification system should ideally also cover all the feedstocks used for these end-uses. This may lead to the potential risk of downgrading of sustainability standards when criteria for different end uses are to be harmonized. It is questionable whether all sectors are ready to accept one harmonized standards.

Another newly surfaced issue is also related to the use of round wood for energy, namely the "carbon debt" discussion. The term "carbon debt" is used to describe the temporal imbalance between the release of carbon during combustion and sequestration of carbon in (plantation) forests. This imbalance is particularly large if stem wood with a large diameter is used (see JRC report, Lamers & Junginger 2013). However, large-scale use of stemwood for energy purposes is highly unlikely due to economic reasons wherever there is regional competition from timber and pulp industry for the fibres (Aebiom, 2013). As indicated in the Ekoenergia case study, in certain regions in Europe that are not located in the supply area of sawmills or pulp mills, selling woods for energy purpose has become an option for the producer when it is not economically interesting for them to mobilise woods for material purposes. Also, there no clarity if and how generic criteria regarding carbon debt may (if at all) be able to effectively discern between biomass feedstocks that do incur a significant carbon debt from those which do not. Regional market perspectives may be a more appropriate approach to assess the temporal carbon balances issues when defining future policy measures (Lamers and Junginger, 2013). Nevertheless, the SFM and land use (change) criteria should always be employed to safeguard lands with high biodiversity values.

3.3. Operational challenges

A number of operational barriers have been seen in the Type I supply chains, given the fact that they cover market actors across countries or even continents. From the perspective of the power companies as scheme initiator, one of the biggest challenges at the beginning is to educate the producers (often situated in other countries), the logistics companies, warehouses, utilities and also the end-users (general public for electricity) in Europe about sustainability certification of (imported) biomass for energy purpose. The education and promotion of sustainability concepts requires a theoretical basis. In the case study of GGL, protocols for the importation and conversion of biomass to energy are developed through research programmes in cooperation with scientists. However, the introduction of sustainability concepts and criteria often encounters challenges that stem from 'cultural differences' and localities in terms of forest management and biomass harvesting. As most producers are familiar with the existing forest governance systems like SFMs (which are not designed for energy purpose) and local laws and regulations, a new scheme dedicated for bioenergy is perceived to have limited additional value. To encourage the producers to adopt the scheme, they were usually given a transition period after the contract was signed. As mentioned earlier, owing to the long rotation of forests, changes required for the producers' practices are mainly on the harvesting phase. Furthermore, the bioenergy schemes usually link to and recognize the existing SFMs, hence learning time is greatly reduced. The changes made to comply with the requirements primarily apply to processes and transportation, targeting at reducing fossil fuel input, such as using biomass instead of gas as fuel for drying, using larger vessel sizes for ocean transport, and utilizing renewable energy in the plant wherever possible. In addition, administrative burdens (such as extra procedures and handbooks) are also increased. These have caused some economic impacts to the supply

chain (which are discussed in Section 3.4). Overall, the experience of GGL in promoting the scheme can be considered a successful one - until 2012, RWE Essent managed to achieve the target in their 10-years plan to ultimately increase the certified share up to 95%.

Adapting to the legislation process to set sustainability requirements for solid biofuels is a different kind of challenge. The rapid development in policies, especially in the Netherlands and UK, as well as uncertainty in the EU-wide sustainability criteria, have big implications for the production side of the chain. These uncertainties may potentially lead to market confusion. GGL as the forerunner has upgraded the scheme, namely GGL-RED to comply with the proposed 2010 criteria (which are closely related to the RED criteria for liquid biofuels) implemented in the UK and possibly in the EU in the future. Due to these rapid changes, the producers located outside the EU have demanded a more frequent communication between the users and producers on the latest updates. As discussed in Section 3.1, including representative of producers in the decision-making group may help to facilitate discussion on the application of sustainability criteria in a wider scale.

In the meantime, large-scale imports in the Type I markets have raised the attention of NGOs. Wilde-Ramsing (2013) indicated that currently there is insufficient information on possible effects and risks to the environment due to low degree of transparency of the supply chain, with only a very few examples of power companies willing to publicly identify their suppliers of biomass. A detailed knowledge about the origin of the supply of solid biomass used for electricity generation is deemed crucial for ensuring that minimum social and environmental standards are respected throughout the biomass supply chain. In the Netherlands, the biomass users have signed the Green Deal, namely "Sustainability Solid Biomass for Energy", which require them to report annually to the government the amounts of biomass they use and how sustainability is demonstrated via certification or verification systems.[9] (Bio-based Economy Magazine, 2012).

There are also concerns on how proof is collected from the field. There are generally two types of schemes – verification (e.g. Laborelec label) and certification (e.g. GGL). Verification is a process verifying a specific standard for a specific moment (on the basis of available documentation), while certification has an add-on that it contains a note for non-compliance and a deadline to solve these non-compliances, otherwise the certificate will be lost. GGL is the only initiative that has (so far) become a widely used certification program for wood pellets with a large number of certificates issued. Also the NTA 8080 certification system is based on certification with a steadily growing number of certificates. Besides that, some schemes may apply third-party auditing but some may use self-declaration. These operational issues with certification and audits are one crucial aspect to examine to ensure effectiveness and transparency, and also to avoid any "green-washing".

Sustainability labels for the Type II supply chains are usually tailor-made to fit for specific supply chains considering local conditions. For the EKOenergy label, the aim is to push the suppliers to disclose as much relevant information as possible to the certifiers and consumers. For the other cases, the technical challenges are highly related to local or regional production, mainly on the inspection of biomass and final product quality, but seems to be less significant as those of Type I. The problems mainly related to economic aspect as discussed in Section 3.4.

Discussion and comments:

[9] The report is now available at: http://www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2013/09/02/rapportage-green-deal-duurzaamheid-vaste-biomassa-rapportage-i-12.html

For Type I, the outcome of the case study shows that more communication is always needed to overcome the 'cultural difference' between different regions (localities) in terms of forest management and biomass harvesting. Rapid changes and uncertainties in legislation within the EU also impacted the implementation of schemes. Communication between market actors on policies and legislation changes are crucial to reduce confusion. The industry is expected to gradually overcome the operational barriers to strengthen the schemes with high standard certification programs, independent governance, third-party audits, and also improve the transparency of supply chains to allow civil society to help monitor (and eventually improve) social and environmental conditions.

For Type II, at the moment, the operational issues are mainly related to specific local circumstances in different cases. However, when it comes to harmonization of criteria across countries, regional difference will be one of the largest barriers to overcome (See Section 3.5).

3.4. Economic feasibility: Additional cost and impact on market

The additional cost of certification is one of the key questions for the feasibility of sustainability standards. There are two types of costs: (i) costs of complying with the criteria by changing production systems and practices, and (ii) administration costs (e.g. preparing handbooks, filling forms and fees for the certifiers and auditors). For the Type I supply chains, the importing Member States have shown a tendency to require the highest standards available in current SFM systems, plus additional criteria regarding GHG emissions. For forestry, the expenses in changing the feedstock producers' practices mainly comes from harvesting practices. However, as residues are the major feedstock for the moment, the main concern of the producers is the additional cost incurred from extra work to follow procedures, handbooks, and other administrative work. Also, there are fees to be paid to the auditors, and possibly an application fee to the certification body. Since there are already existing standards applicable to forestry, the cost of going through multiple audits can possibly be avoided with (mutual) recognition of multiple standards, and thus the additional cost can be reduced, but still the additional cost of certification could be considerable to the profit margin made by the producers.

The issue of cost distribution between the producers and buyers (power companies) is noticeable in the Type I supply chains, in which the producers mainly located out of the EU. In this type of supply chains, sustainability certificates are required to gain market access in the UK and Belgium, and possibly in other countries like the Netherlands in the near future. So far, most of the Type I schemes are designed by the buyers mainly for their own use – in other words, each scheme has only (or at least primarily) one end-user. The cost distribution may vary with bilateral contracts based on volumes, period and other conditions, but the buyers seem rather unwilling to share the cost with the producers. The cost can be prohibitive for producers with thin profit margin and limited resources. As reflected by the pellet producers in the GGL case studies (from BC, Canada to the UK and the Netherlands), they reasoned that the additional cost comes from certification should be paid by the buyers. However, the buyers argue that the cost could be minimized over time by improving the management system.

At the moment, it is still too early to draw any conclusions on the impact of sustainability standards on industrial pellet market, as the market is still reacting to the (possible) changes in national requirements. The market is less complex and trade dynamics are quite straightforward. Procurement strategies of industrial wood pellets usually involve long-term contracts, and therefore are unlikely to change on short notice. In the last few years, the power companies show a tendency to carry out vertical integration, trying to control more parts of the supply chain (e.g. investments in plantations or pellet facilities). In parallel, as

discussed in Section 3.1, they also promote the use of sustainability schemes they initiated on their supply chains. Since industrial pellet is not yet a commodity, the impact of additional certification cost is usually on a case-by-case basis.

For the Type II supply chains, the additional cost of certification is usually borne by the pellet producers. Different from industrial pellet users, small-scale and household heating market, labels and schemes directly compete in the market based on consumer choices. Demand is usually mainly driven by the quality of the products, such as size, durability and absence of fines. Although the cost of certification may be deemed reasonable by the producers at the beginning, it could turn significant, when the scheme does not bring the expected benefits. It seems that the small-scale users have little concern on the sustainability criteria proposed by the labels, as they may regard wooden fuel made from residues or non-usable woods already as a good, sustainable substitute for fossil fuels like heating oil. These small labels seem to have limited added value from the consumers' perspectives. For example, in the case study of TÜV carbon footprint, WWP, the pellet company which applies the label found out that the customers are not really aware of the carbon footprint of products. Since the CO_2 footprint label does not seem to influence the purchase decision a lot, the company is unlikely to expand the use of the label. Similarly for the Swan Label case study, the label did not entail an increase in sales volume, resulting in an overall negative outcome of the investment. Consequently, this has also partly caused the current lack of Swan labelled pellets/supply chains. So, the limited awareness of customers that not all wood pellets may be equal in terms of sustainable production turns out to be the biggest limiting factor. The promotion effort needed is therefore high all along the supply chain, and this could be exacerbated when strong competitors on the labelling scene appeared – these competitive labels do not necessary cover sustainability criteria holistically, but most likely focus on quality assurance. Furthermore, one of the largest quality assurance scheme, EN Plus has also started to include sustainability considerations into their scheme such as GHG emission calculation and requirements of SFMs certificates for raw materials.

On the other hand, in cases like the Ekoenergia label, a fee is paid for certifying the electricity generated and not for the solid biofuels. The utilities usually bear the certification cost to obtain a label on the electricity or heat generated. Similar to the aforementioned schemes for heating market, the economic feasibility of this type of electricity label is determined by the choices of consumers in electricity and heat market. Also, as this scheme is an independent system initiated by NGOs, it requires external funding to develop and maintain the system. The certification body, FANC has faced challenges to get funding for system development and marketing.

Since sustainable certification for biomass in the Type II market (with local or regional supply) is not mandatory (and most likely will remain voluntary in the near future too), the economic impact of voluntary certification on market is rather small, but conversely the market factors such as consumer behaviour and supporting policies will determine the continuity of the voluntary certification system. In addition, due to limited users, small labels tend to disappear when the user-companies withdraw from the market. For example, the Swan label has not been applied any more or by others after the manufacturer that carried the label went bankrupt due to several economic reasons.

Discussion and comments:

For the Type I schemes, when there are government interferences, such as national mandatory requirements that create preconditions for market access, the consideration is more on how to balance trade-offs among beneficiaries and those who must bear the costs directly or indirectly. However, the distribution of additional cost varies from case to case, depending on the region, scale of operations, and most importantly bilateral agreements, as long as the commodity market has not yet been formed. On the other hand, for the Type II schemes (particularly in the case of small-scale / household heating), while they incur additional cost, sustainability standards or labels may have little positive effect when the

labelled pellets directly compete with other pellets in the heating market. It seems that environmental labels are less successful to attract consumers at the moment. Overall, sustainability schemes for the Type II market have shown negative economic effects on market operators.

3.5. EU-wide harmonization: Barriers, risks and opportunities

The trend in sustainability certification in the solid biofuels sector has been towards a proliferation of certification schemes. There are concerns about wasting resources through duplication of efforts. On the ground, the multiplicity of certification regimes could cause confusion to not only the producers but also the consumers. For the Type I schemes, there is also a question about how voluntary schemes fit with regulatory framework. It is unclear, across the total spectrum of voluntary and regulatory initiatives, which are most appropriate in which areas, and how they can benefit producers economically, while still contributing to a sustainable future. To avoid wasting resources and creating prohibitive barriers from transaction costs, stakeholders from the Type I supply chains have expressed the need for integration and coordination across different roundtables, initiatives and regulations.

For biofuels and bioliquids, the EC has imposed a set of EU-wide sustainability criteria on biofuel production that have to be met by the producers. The compliance can be proven with the application of a number of certification schemes recognized by the EC. For solid biomass, the EU is the globally the biggest commercial market, but there is no EU-wide regulatory framework. The EC recommends to apply similarcriteria to solid biofuels as for biofuels and bioliquids. However, the decision was not made in 2011 as planned. The liquid biofuel criteria are considered by market actors as less suitable for solid biofuels, given that they were designed originally for (biofuels derived from) agricultural products. Sustainability standards requires the implementation of criteria to address problems that range from very local to global. Translating simplified criteria into on-the-ground practice is difficult, and poses a number of problems. It is hence predictable that trailing the trend in the biofuel and bioliquids industry for the case of solid biomass might be impractical. After a long delay, the discussion about the possibility of a legally binding agreement on the sustainability of solid biofuels is still ongoing, centering around several issues:

(1) A public consultation held by the EC shows that some market actors worry that characteristics of specific supply chains and local conditions are not adequately catered in a universal set of criteria, and prefer existing legislations in the forest sector (Directorate-General for Energy, 2011). A number of Member States are currently reluctant to make an EU-wide universal set of criteria. As discussed in Section 3.2, there are clear distinctions not only between heat and electricity markets, but also between supply chains in terms of geographical boundaries, size and types of biomass. Generally the issues are twofold. The first argument stems from the size of energy producers. There are diverse opinions on the threshold, which was proposed as either 0 MW, 1 MW or 20 MW. A difficult point is that the total amount of biomass used by small producers could be significant in some countries. However, strict requirements may imply an excessive administrative burden for small users. Although some market actors argue that exclusion of small operators could favour the deployment of small and inefficient bioenergy installations, from our case studies, this is less likely to happen in terms of economic feasibility. In fact, the existence of small operators are mainly attributed to economic reasons derived from geographical and logistic constraints. In UK, from April 2013, generators of 1 MW capacity or above will need to meet the sustainability criteria to be eligible to receive ROCs (DECC, 2011). Furthermore, there are still questions on defining the criteria in different context, i.e. the consideration of local conditions and specific supply chains. As discussed in previous sections, the local forest governance systems could be significantly different in terms of governance structure and environmental conditions. It is often unclear how to apply global standards in local contexts. Different weights may be

placed on particular endpoints, depending on the specific values in an area. Also, in terms of economic scale, the decentralized supply chains in Type II are largely different from the large volume trade of industrial pellets used in co-firing in Type I. There is a risk to mismatch the scale of the sustainability problem or impacts and the scale of implementation.

(2) The public consultation also reveals that some Member States, especially the ones with high biomass production, are rather unwilling to subjugate a degree of national control on forests to EU-wide rule making. This issue is an extension of sustainable governance in forestry sector: Countries with domestically oriented timber economies are more likely to claim that a legally binding agreement would violate their national sovereignty (McDermott, 2012; Humphreys, 2008). The Swedish Ministry of Enterprise (2011) also pointed out that it would not be proportional to introduce criteria for the entire forest sector which are ultimately only aimed at a single specific end-use (e.g. energy). Directorate-General for Energy (2011) reported that public authorities from forest-rich Member States did not agree on mandatory criteria, arguing that existing mechanisms in EU member States are adequate. The situation is reflected in the current status of the Member States in designing national sustainability criteria. The forerunning countries are mostly biomass importers, such as the UK, the Netherlands and Belgium. Instead of the RED criteria that specified for only one end-use (i.e. bioenergy), the other Member states are proposing to utilize existing pan-European frameworks and initiatives such as Forest Europe and the Illegal Logging Regulations which cover all end-uses. Pan-European criteria and indicators have been adopted to promote sustainable forest management. Sweden had a leading role in the work (Höglund and Gustavsson, 2011).

(3) Some market actors, NGOs and citizens, fear that the standards will be designed to favour certain parties. Directorate-General for Energy (2011) reported that 40% of the respondents considered the new policy developments not to be sufficient to ensure biomass sustainability yet. They are criticized for being imposed by large power companies from certain countries without engaging a wide enough range of sectors and actors.

While there is still no EU-wide regulatory framework, the European utilities have been working together on a harmonized approach in sustainability principles applicable to wood pellets/woody biomass sourcing and trading, namely Initiatives wood pellet buyers (IWPB)[10], using existing industrial systems such as GGL, Drax Sustainability Principles, and the verification procedure developed by Laborelec and SGS in Belgium as based systems. Initially, most of the existing schemes are designed primarily for their own companies, such as Laborelec Label for Electrabel. At the moment, the immediate goal of the IWPB is to create a sustainability standard and implement a certification scheme to achieve legislative compliance on solid biomass sustainability in the UK, Belgium and the Netherlands. A harmonized scheme may also improve flexibility in logistics by allowing trading of pellets between power plants, and reduce administrative burden by saving time and cost. The IWPB working group consists of power companies like GDF SUEZ, RWE, E.On, Vattenfall, Drax Plc., and Dong, as well as certifying companies SGS, Inspectorate, and Control Union. In addition, there is also an effort in making a common set of criteria for both industrial pellets and household pellets, i.e. the participation of EPC in the sounding board of IWPB, which has just kick-started in May 2013. However, bringing each scheme into conformity is very challenging with the current disparities in sustainability requirement among the Member States. The key long term goal of the IWPB is to evolve the standard into a credible multi-stakeholder initiative, including a wide range of stakeholders from EU/member state authorities, forestry owners, NGO's, forest certification bodies and academia.

[10] See IWPB websites: http://www.laborelec.be/ENG/services/sustainable-process-technologies-sprt/biomass-analysis/initiative-wood-pellet-buyers-iwpb/

Discussion and comments:

The deviation of opinions mainly stems from differences in characteristics between the Type I and Type II markets. Some worries that imposing over-simplified criteria without sufficient scientific justifications on markets may create barriers on certain supply chains with high local varieties (such as decentralized bioenergy systems), and consequently cause the extinction of these supply chains. This may also indirectly impact on the forestry sector as a whole, with strict criteria specified for only one end-use. Cross-compliance could be a potential solution, but making rules with significant disparities based on end-uses may bring negative impacts on trade and market, as well as the original goal of climate change mitigation. While there are many years of experience for certification of woody biomass with sustainable forestry management schemes, it is worthwhile to point out that since 2011 the sustainability certification of solid biofuels has significantly increased (Goh et al., 2013b). By means of a wider scope of climate change mitigation, disparity in sustainability requirement between sectors may cause serious challenges in policy making. This becomes increasingly important when biomass is used in a cascade model for different purposes, while many schemes are still product oriented (biofuels, wood, etc.). At the moment, the systems are incompatible in various aspects, especially the measurement of GHG emission reduction and (indirect) land use changes. In pursuit of sustainability as a goal not only for energy sector, understanding cross-border and cross-sectorial market dynamics is crucial for harmonization, as economic feasibility is always the key factor that pushes the development of sustainability standards.

4. Summary and conclusion

Section 2 describes the approach for the analysis of the development of sustainability initiatives for biomass for energy. Sustainability initiatives are categorized to two major types based on geographical boundaries, scales and types of biomass (for either large scale co-firing, small-scale power generation or heating), i.e. Type I for international (long distance) and Type II for local or regional supply chains. The supply and demand mechanisms have strong influence on the development of sustainability standards. For the Type I schemes, which are usually initiated by the buyers, tend to have more generalized criteria to ensure supporting policies for bioenergy can be justified with sustainability of large volume import from the other parts of the world. On the other hand, schemes designed for the Type II supply chains usually developed by local producers, and largely focus on specific supply chains and local conditions.

These schemes, developed by various market actors with different motivations, have shown different trends. The divergence is primarily demonstrated in four aspects: (i) governance structure, (ii) environmental criteria, (iii) technical and operational barriers and (iv) economic feasibility. Section 3 evaluates the development, applicability, barriers, effectiveness, and other associated issues from these aspects:

(i) Governance structure: Different parties have taken initiatives for the framing of sustainable governance of solid biofuels under a wide variety of settings. In the situation that lacks of regulatory framework, the market actors, i.e. the biomass producers, large buyers (power companies), NGOs, whether large or small in economic scale, have attempted to define and setup systems to assess sustainability of biomass and bioenergy products. These private voluntary systems are trying to gain prominence in market and policy arenas to influence the sustainability outcomes. However, an EU-wide regulatory framework that defines the rules of biomass sustainability may supersede these heterogeneous systems (in terms of minimum sustainability requirements), if there will be one.

(ii) Sustainability criteria: for woody biomass, forest management schemes are always referred to when sustainability is being mentioned. Given the fact that SFMs were not designed specifically for climate change mitigation, GHG emission assessment along the supply chain is always added as a supplement. However, there is still a diverse range of opinions on the land use change criteria, particularly the RED criteria. Currently, the application of the RED criteria for biofuels and bioliquids on solid biomass is the biggest discussion. The potential dispute over definitions of land types, such as primary forests, lightly wooded forests and etc., should be addressed based on scientific knowledge underpinning sustainability principles, variety of contexts and ecological circumstances of countries, as well as impacts on the economic operators that affected by policies. On the other hand, there is a need to consider economic and social issues in the schemes because these components are crucial especially for small-scale supply chains. Furthermore, health and safety issues in the transportation and storage of biomass should also be addressed in the schemes. There is a growing need to have coordination between market actors not only for bioenergy but also other end-uses, owing to the nature of forestry sector.

(iii) Operational/Technical barriers: For Type I, the operational challenges arise when biomass is imported to the EU from another region or even continents that have significant differences in culture, perspectives and practices. Moreover, rapid development in legislations within the EU may also cause confusion to producers located outside the EU. More effective communication is needed to overcome the reluctance of the producers to adapt the new schemes. Besides obtaining sustainability certificates or labels, transparency on the biomass supply chain is also necessary to convince the public.

(iv) Economic feasibility: For solid biofuels made from residues, the expenses in changing the feedstock producers' practices is minimal. Thus, the additional costs mainly are a consequence of extra administration work such as reporting and documentation, as well as certification fees such as application and auditing fees. Negative economic impacts on the market operators (particularly the solid biofuel producers who pay for the labels) were observed in the case studies of small-scale heating. These schemes have little positive effect on sales volume because biomass is already perceived as a sustainable source of energy by the end-users (i.e. the general public) with or without an environmental label. Instead, biomass quality has become the determining factor for consumers' decision. For the Type I schemes, sustainability standards has become preconditions to obtain government (financial) support in some countries. The attention is placed on the distribution of additional certification costs over the supply chain. Since the biomass market is immature (not yet a commodity), the impact of additional cost varies from case to case, principally based on bilateral agreements.

While developing biomass resources in a sustainable way is indispensable, it is also important to accommodate conditions in different settings. However, proliferation of sustainability initiatives by different parties from different countries / regions can lead to a fragmentation of efforts. The current discussions about harmonization surround topics like land use criteria, threshold of plant scale to be included, national sovereignty over forests, authority in standards setting, and biomass end uses coverage. It seems that the Type I market has developed progressive international collaboration and harmonization of sustainability standards, i.e. the IWPB, mainly pushed by the policy development (legislation in the UK, and possibly in the Netherlands and the EU). Meanwhile, the Type II market does not show any sign of joining in this progress, except for the household pellets scheme, the EN Plus system which actively participates in the IWPB sounding board. In any case, climate change mitigation should always be given priority in environmental, economic and political landscapes, regardless of regions, scales and sectors.

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7. Appendix

7.1. Interview transcript I

Interviewee: Pasi Miettinen

Position: Program Manager (Forest Management)

Organization: Forest Stewardship Council (FSC)

Date: 2 August 2013

Location: Skype

Description: Pasi Miettinen has been working in FSC for 13 years. Before he came to the office in Bonn one month ago, he was coordinating the FSC activities in Finland. He has a forester background, and has been working in Africa, Asia, Latin America.

Q: Has FSC any plan to expand or develop a new sub-scheme to cover the energy use of woody biomass?

We do not intend to launch any new policy on bioenergy. Although we have recognized the importance of energy, but our main focus is on good forest management. FSC woods have been used for energy purpose but in a very different form like charcoal and firewood. There are some markets but very limited and local.

Q: (Will) Is FSC cooperating with other bioenergy schemes, e.g. take part in criteria setting and decision-making?

So far as I know there is not such attempt. We've to be very careful to make sure our logo are not confused with other schemes. However, community-based schemes which pay special attention to social and environmental criteria or strongly supported by ENGOs, then we could open the door and negotiate.

Q: (Will) Has FSC any policy or plan to cover the carbon accounting of biomass over the supply chain (harvesting, transportation and etc.)?

The emission over the supply chain is not addressed by FSC. We require the supply chain should be able to show the origins, but there are no policies on emission at the moment.

Q: Harmonizing the criteria of different bioenergy schemes (or national regulations) is very challenging. We believe this issue mainly stems from the forestry sector, and show a similar trend. What are your thoughts on this?

The issue is very likely. FSC supports the idea of having a harmonized set of EU-wide criteria instead of having national regulation. With the resources we have, we are really putting our efforts on forest management unit level. We've universal criteria, and we are now developing universal indicators which are more detailed. We're having quite uniform requirements all over the world, and I think this is our strength. Even if the local conditions may vary a lot regarding socio-economic situation and ecology, we still have very similar (or exactly the same) requirements in the world because we consider fair and just means for putting the requirement. The WTO does not accept any barriers for trade, that is why the requirements for certification have to be the same. There will be trade barriers if there are differences between countries.

Q: What are the challenges experienced by FSC in making a set of universal criteria in forestry sector? What experience we can draw from this for the bioenergy sector?

The major problem is tradition. There have been many tradition in managing the forest. For e.g. in the Scandinavia clear felling has been practised in a wide scale, that is actually the only mean for regenerating the forests, whereas in tropical country or temperate zone, even here in Germany clear felling is not accepted. We are trying to harmonize these requirement, we are hoping to introduce improvements to the clear felling situation, we are putting pressure on the Scandinavian countries.

Both in Finland and Sweden there are strong lobby to use all possible forest materials for bioenergy including the stems that definitely has a very deep and strong impact to the biological nutrients cycle in the soil and very long lasting impact to the forest soil. We really do not recommend to use stumps for energy, that does not fulfil the responsible forest management concept.

Q: How is the development of FSC in Finland and Sweden?

In Finland it has been very difficult to promote FSC, the forest certified is less than 2%. In Sweden the share is large, but honestly speaking we have quite a big problem on the way how they treat the forests, soils and large scale clear felling that they are doing. I've a feeling that the very recent development of introducing good forest management has become better.

Q: Do you have any additional comments on the certification of bioenergy?

It's a very important topic. I've a nightmare related to short-rotation bioenergy production. The rotation period has already been shortened in Sweden and Finland. There is a new forest law in place in Finland which accept even a shorter period. That could happen if energy cost rises high enough and short rotation forest management could kill the natural ecosystem.

7.2. Interview transcript II

Interviewee: Gilles Gauthier

Position: General Manager

Organization: European Pellet Council (EPC)

Date: 5 August 2013

Location: Skype

Description: Gilles Gauthier is in-charge of EN-Plus certification and developing the other services at EPC. He started as an electrical engineer, and then works on biomass topic since 2009. Previously he worked for Belgium Biomass Association, in-charge of energy crops and wood pellets. He is also a member of the AEBIOM team as bioenergy expert.

Q. What are the drivers for including GHG calculation & SFMs requirements?

There are two motivations. First is to prove that pellets are sustainable. That was an important part of the "Pellcert" project to promote sustainable biomass. The second idea is to push all the stakeholders in the wood pellet sector to be more and more sustainable. The aim is to ask all the producers to calculate their GHG footprints, and then EPC will aggregate this, calculate the average and put this online. You will be able to compare your value with the average on the website. I think this is a good way to push them to be more sustainable.

Q. How was the development of the GHG calculation tool? What challenges are encountered in incorporating different tools?

We've used part of the Biograce project which is another IEA project to implement in the EN Plus. I think developing the tool is not difficult (e.g. preparing the spread sheet). In my opinion the most difficult thing is try to implement in certification. I think we have to find a good balance while trying to prove that your activities are sustainable, but not being too pushy on the professional in the sector. If you are too pushy, that will be annoying because it's the only certification scheme that is doing so (the GHG accounting). The point is to start smoothly and increase the level of information required gradually.

In practical the applicants have to use the GHG calculator, record the result on the paper document in his office. Once a year we will do the auditing, we will check also this GHG footprints. The thing is that we don't want to put this information on the website for every companies, although it might be a good advertising for the producers, but for now the idea is to keep it secret.

For the moment, I haven't heard of any problems due to national difference, but I can ask my colleagues. There are 2 types of governance of EN Plus: in some countries there are some associations which take charge of the certifying companies working in their territories, if there isn't any association at national level, EPC will take charge of that. So far, problems mainly come from certification itself, i.e. technical issues such as procedures and fees, but not so much on the sustainability criteria. However, I don't think it will add burdens to the stakeholders. There is not so much work.

Q: Will EN Plus also cover the other sustainability criteria?

There are three different things. The first one is the GHG calculator. The second one is that the applicants have to mention what is the percentage of the raw materials certified with SFMs like PEFC. Lastly we ask them to sign a statement of commitment about sustainability. The aim is to make them aware they have to fulfil more and more sustainability criteria.

EPC also aim to participate in the sounding board of IWPB. I think in the following years maybe we will 'merge' (harmonized) our systems. The idea is to see if there are possibilities to use a common set of criteria for both industrial pellets and household pellets. Creating parallel systems makes the discussion so complicated. I don't see the point to do different systems.

Q: How much biomass is certified now?

About 3 million pellets (for household and small-scale heating, the top limit is 1 MW) are certified, which is about 50% of the total European pellet market. For the moment it is only for domestic use.

Q: Is EN Plus successful in adding sustainability as one component? What is your view in the near future development of a harmonized set of EU-wide criteria for solid biofuels?

I think it is not easy to implement sustainability criteria because it is a tricky topic. But still we can say that we start smoothly because everybody agree to use this. Until now I can say that we are successful, but there is still a lot of work to do.

To me the sustainability criteria are not the problems, but the problems come from different rules in different countries. I think we definitely have to have a harmonized system. It's not possible anymore in this kind of market to try to adapt to different systems, that makes things really complicated.