# SolidStandards

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

## D5.2c

## Case studies of sustainably certified solid biomass supply chains –

## *Carbon Footprint (TÜV Rheinland)*

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.

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# About this document

This document is the report on “Case studies of sustainably certified solid biomass supply chains – Carbon Footprint (TÜV Rheinland)” of Work Package 5.2 of the SolidStandards project. This document was prepared in March 2013 by:

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# Intelligent Energy Europe

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# 1. Introduction

## 1.1. General introduction

The importance of solid biofuels for the European energy generation is increasing permanently, especially in the heat sector. This development causes a discussion about the related environmental and social effects.

In 2009 the European Commission published the RED directive[1] in order to define standards for the sustainable production of liquid biofuels. 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"[2]. The report gives recommendations for the development of national legislation in this field. One aim of the report is to create a common ground for national initiatives for harmonization reasons. To avoid undue administrative burden the Commission recommends binding criteria only for larger energy producers of 1 MW thermal or 1MW electrical capacity or above. Operators of smaller appliances shall, however, be explicitly encouraged to increase the efficiency.

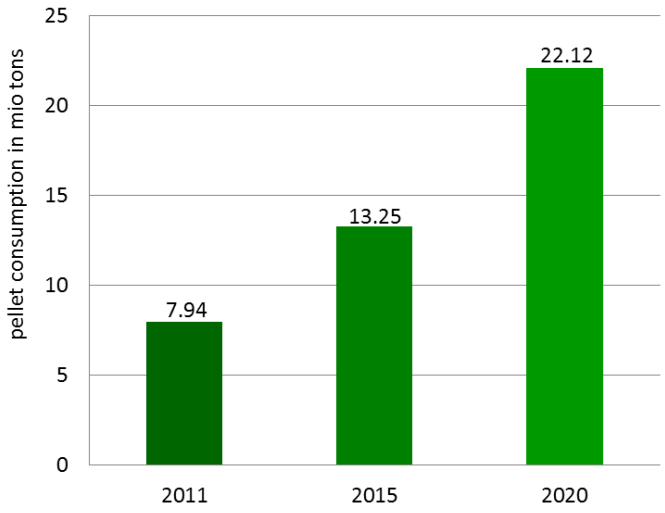


**Figure 1-1** Prediction of the use of pellets in the European heat market[3]

In 2011 about 7.9 million tonnes of pellets have been used for heat generation in Europe. An increase up to 22.1 million tonnes is predicted by the year 2020 [3] (see figure 1-1). Most of these pellets are used in applications with a capacity below 1MW thermal. Thus, the production and use of wood pellets for heating purposes offers a large potential to increase sustainability.

[1] European Parliament and Council (2009): Directive 2009/28/EC of the European Parliament and Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[2] European Commission (2010): COM(2010)11 - Report from the Comission to the council and the European Parliament on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling

[3] European Pellet Council (2012): European Pellet Report 2012

For this reason different certification schemes and eco-labels to proof the sustainability of high-quality pellets for the heat sector will be described and compared. A special focus is on the $CO_2$ footprint of the German pellet producer Westerwälder Pellets, a label developed by the German testing and certification body TÜV Rheinland.

## 1.2. Sustainability

In public discussion currently mainly address environmental sustainability aspects. The definition of social sustainability aspects of biofuel production in Europe is just at the start. Environmental aspects contain the efficiency of supply and use of bioenergy carriers as well as all effects on the environment, namely on the quality of air, soil and water. Three topics can be distinguished during the assessment of the certification schemes and eco-labels for the small and medium pellet user market, namely: sustainability of raw material sources and supply, sustainability of biofuel production and logistics and sustainability of conversion technologies (see figure 1-2).


**Figure 1-2** Sustainability related processes playing a role in different certification schemes and eco-labels

Main focus of this study is on the environmental effects of biofuel production and logistics, but most of the relevant schemes also address aspects of biomass production. Since the recommendation of the European commission covers all three sectors mentioned above, they all will be described shortly.

### 1.2.1. Production of raw material

The main instruments for the proof of the sustainability of woody biomass sources are forest certification schemes. The two main schemes in Europe and worldwide are the programme of the Forest Stewardship Council (FSC) developed by environmental NGOs and the Programme for the Endorsement of Forest Certification (PEFC), implemented by the European forestry sector.

Because of a very comprehensive environmental legislation in Central Europe, the proof of sustainability of raw material sources is not as important as in other parts of the world. However, more and more forest area in Europe has been certified over the last years. In 2009 more than 73 million hectares were certified according to the two main forest certification schemes PEFC and FSC[4]. In 2011 more than 3.1 million tons of pellets have been imported into the EU, mostly from northern America, Russia and Ukraine. Since imports will further increase with a growing consumption in Europe, sustainability requirements will gain more and more importance in the future.

Most of the sustainability labels assessed in this study request the use of raw material from sustainability certified sources.

[4] European Pellet Council (2012): European Pellet Report

More information about FSC and PEFC as well as other certification schemes from the United States (SFI), Canada (CSA), and Finland (FFCS) can be found in the SolidStandards sustainability guidebook[5].

### 1.2.2. Pellet production & logistics

The main focus of this study is on certification schemes and eco-labels covering production and logistics of pellets. Most of these systems combine quality requirements with requirements on raw material sources and an assessment of greenhouse gas emissions of all processes.

The integration of quality and sustainability aspects in one scheme makes sense since defined quality requirements are a precondition for an efficient combustion as well as for emission control.

### 1.2.3. Efficiency of combustion equipment

Emission control is a topic of national legislation in most European countries but a lot of end-users are highly aware of this subject. During the last years small scale wood combustion systems were hardly discussed, mainly because of some studies on respirable dust emissions.

Several eco-labels for small scale pellet combustion systems exist in Europe. Main topics of these schemes are efficiency and emission control (CO, $NO_x$, $C_NH_M$, $C_{org,}$ respirable dust):

- „Blue Angel“ eco-label RAL-UZ 112 for wood pellets and wood chips combustion systems[6] (Germany)
- Eco-label UZ 37 for automatically and manually filled wood combustion appliances[7] (Austria)
- DINplus certification scheme for pellet stoves[8] (Germany)
- Nordic Ecolabelling of Solid biofuel boilers[9] (Nordic countries)

[5] Goh, C.S. & Junginger, H.M. (2011): „Training materials: Sustainability”, a deliverable of the IEE funded project SolidStandards (www.solidstandards.eu)
[6] RAL gGmbH (2011): RAL-UZ 112: Holzpellet- und Holzhackschnitzelheizkessel, Vergabegrundlage für Umweltzeichen
[7] Österreichisches Umweltzeichen (2012): „UZ 37 – Holzheizungen“
[8] DINcertco (2008): Raumheizer zur Verfeuerung von Holzpellets mit schadstoffarmer Verbrennung (Pelletöfen)
[9] Nordic Ecolabelling (2007): Nordic Ecolabelling of Solid biofuel boilers

# 2. Carbon Footprint

## 2.1. The scheme

The Carbon Footprint is a label developed by the German company TÜV Rheinland providing technical services, mainly in the fields of testing and certification. The subsidiary company TÜV Rheinland LGA Products GmbH offers the preparation of carbon footprints for various sectors. In the pellet sector, Westerwälder Holzpellets (WWP) is currently the only certified stakeholder.

Based on the international standards ISO 14040[10] and ISO 14044[11] as well as on the British standard PAS 2050[12] the product-specific carbon footprint has been determined. 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 engeneering office situated in the same area as Westerwälder Holzpellets is specialised in consulting in the fields of energy efficiency and supply, $CO_2$ trading as well as of the assessment of the greenhouse gas potential of production and logistic processes.

In a first step, the boundaries of the analysed system were defined. Subsequently, all raw material and product streams as well as all energy flows were analysed. The following process steps were taken into account:

- Harvest of wood raw material
- Wood raw material transport
- Pellet production (Heat and power consumption)
- Production of additives
- Production of packaging
- Wood pellet delivery

In the next next step the consultants calculated the carbon footprint taking into account all $CO_2$ emissions as well as the emission of other relevant greenhouse gases of the whole production and supply chain according to the procedures defined in the standards.

The final step in the certification process was the review of calculation methods and results as well as the award of the certificate by TÜV Rheinland. Westerwälder Holzpellets received a certificate number and was listed in TÜV Rheinland's certificate data base.

The certificate is valid for one year; afterwards, a follow-up evaluation has to be done.

The costs for the certification consist of the fees for the independent expert's report and the certification fee charged by the certification body TÜV Rheinland. WWP indicates costs of about 0.15 to 0.2 Euros per produced ton of pellets, depending on the annual production volume. Preparing all necessary documents means about two days of work for one of WWP's employees.

[10] International Organization for Standardization (2006): ISO 14040 – Environmental management – Life cycle assessment – Principles and framework
[11] International Organization for Standardization (2006): ISO 14044 – Environmental management – Life cycle assessment – Requirements and guidelines
[12] British Standards Institution (2011): PAS 2050 – Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

## 2.2. Certificate holder: Westerwälder Holzpellets

Coming from a family-owned truckage company, Westerwälder Holzpelletsts' acting partner Markus Mann started the development of the renewable energy business in 1991 with the construction of a wind park. In 1994 the company MANN-Naturenergie GmbH & Co. KG was founded, producing power and heat from biomass. In the year 2000 Markus Mann founded the company Westerwäder Holzpellets GmbH together with several business partners.

Today, Westerwälder Holzpellets (WWP) is one of the most important German producers of wood pellets. In 2012 112.000 tons of wood pellets have been produced at three sites: Langenbach, Oberhonnefeld and Hosenfeld[13]. The pellet plants in Oberhonnefeld (Energiepellets Oberhonnefeld GmbH) and Hosenfeld (EnergiePellets Hosenfeld GmbH) are operated in collaboration with local saw mill operators.


**Figure 2-1** Westerwälder Holzpellets production site at Langenbach[14], modified

The production in Langenbach the production started in December 2001. At that time it was the first industrial scale wood pellet plant in Germany. Langenbach is situated in the Westerwald region in the northern part of the German federal state of Rhineland-Palatinate. The plant has a production capacity of about 42,000 tons per year; two ring die presses produce around 7 tons of pellets per hour. In 2012, 12 employees produced around 35,000 tons of wood pellets at this site. Only high class pellets according to class A1 (EN 14961-2) are produced at this site. The pellets are DINplus certified.

In 2010 Westerwälder Holzpellets applied for TÜV Rheinland's carbon footprint for the first time. Due to the fact that WWP is the first pellet producer displaying a certified carbon footprint, the management decided to create a special label in order to be able to promote the certificate in a better way. So they added the writing "$CO_2$ Footprint" and the figure of a "pellet footprint" to the official logo of the certifying body TÜV Rheinland and WWP's certificate number (see figure 2-2). Currently the recertification of the company is prepared.

[13] Pellets- Markt und Trends (2012): Marktübersicht Pelletproduktion in Deutschland, in Pellets- Markt und Trends, issue 06/2012

[14] Mann, M. (2013): „Wirtschaften mit Energie – Energiesparen in der Praxis", oral presentation at the conference „Wirtschaften mit Energie, Einsparpotentiale ermitteln – sinnvoll investieren" (2013-01-31, Ransbach-Baumbach)


**Figure 2-2** Label „$CO_2$ Footprint" by Westerwälder Holzpellets GmbH[15]

## 2.3. Assessment of WWP's pellet production and supply chain

For the whole supply chain from raw material transport to pellet delivery emissions of 21 kg $CO_2$ per ton pellets[17] have been calculated. As shown in figure 2-3, the largest share on the total emissions is dedicated to transportation processes.

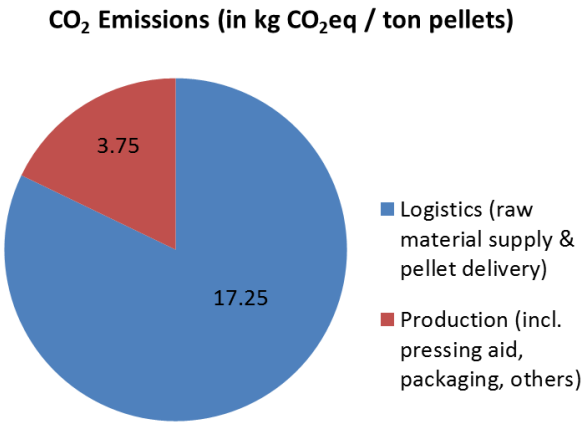


**Figure 2-3** Distribution of $CO_2$-emissions of the pellet supply chain

In 2009 the $CO_2$ balances of eight Austrian pellet supply chains have been determined performing average $CO_2$ emissions of 28.4 kg per ton pellets[16]. Despite of the fact that in the study on the Austrian supply chains the transport of the wood raw material has not been taken into account, the emissions calculated in the Austrian study are approximately 25% higher than the emissions calculated for the WWP supply chain.

[15] www.ww-holzpellets.de, retrieved in march 2013
[16] Moser, W. (2009): "Energie- & $CO_2$-Bilanz der Pelletproduktion"

### 2.3.1. Raw material supply

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 (see figure 2-1). The saw mill holds a PEFC certificate and uses roundwood from the near sourrounding (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 lumber. It originates from forests within a radius of about 50 km around the pellet plant.

The entire amount of wood raw material is delivered by truck.

Unfortunately WWP only indicates the corporate amount of $CO_2$ emissions caused by the provision of raw material and the delivery of the produced pellets: 17.25 kg per tonne produced pellets. In this value the harvest of the wood and the transport to the saw mill are included.

The total share of material from certified sources is not assessed by WWP since this is no criteria of the scheme. 70% of the forest area of Rhineland-Palatinate is PEFC certified (580,823 ha)[17], more than 5% is FSC-certifiied[18]. 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.

The approach of local raw material supply is also followed at the other two production sites at Oberhonnefeld and Hosenfeld which are supplied with residues from saw mills situated at the same place.

### 2.3.2. Pellet production

The heat for the drying of raw material comes from a biomass CHP plant which is very common in pellet productions in Central Europe. The plant is operated by MANN-Naturenergie GmbH & Co, another company owned by WWP's co-founder Markus Mann. The plant has a thermal output of about 4.5 MW and an electric capacity of 660 kW. It came on stream in 2005; in 2007 a flue gas condenser unit has been installed in order to increase the plant's efficiency. Landscape management residues from the surrounding communities and from the production process are used as fuel as well as bark chemically untreated used wood. The power produced by the CHP plant as well as by solar power plant with a capacity of 350 kW situated on the site is fed into the public grid.

For the pellet production WWP purchases power from a green electricity provider holding a certificate of TÜV Süd, a German testing and certification company. The certificate states the origin of the electricity from renewable energy sources.
WWP is permanently working on increasing the efficiency of the pellet plant. In 2002 140 $kW_{el}$ were needed for the production of one ton of wood pellets. Until 2012 it was possible to reduce the power consumption to 117 kWhel per ton by optimizing control engineering as well as the management of in-plant processes[19].

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

[17] www.pefc.de, retrieved on March 2013
[18] www.fsc-deutschland.de, retrieved on March 2013
[19] Mann, M. (2013): „Wirtschaften mit Energie – Energiesparen in der Praxis", oral presentation at the conference „Wirtschaften mit Energie, Einsparpotentiale ermitteln – sinnvoll investieren" (31.01.2013)

production related factors (such as pressing aids and packaging) emissions of 3.75 kg per ton pellets have been identified.

### 2.3.3. Pellet delivery

Bulk pellets produced in Langenbach are distributed by WWP in a radius of about 75 km around the production site. Main markets for the pellets from Langenbach site are the metropolitan areas of Frankfurt and Cologne.
All together the three pellet plants cover a service area within a radius of approximately 200 km (see figure 2-4), about 30 traders deliver pellets to the end-consumers.
Furthermore more than 100 traders are listed on WWP's homepage selling pellet bags with a weight of 15 kg.

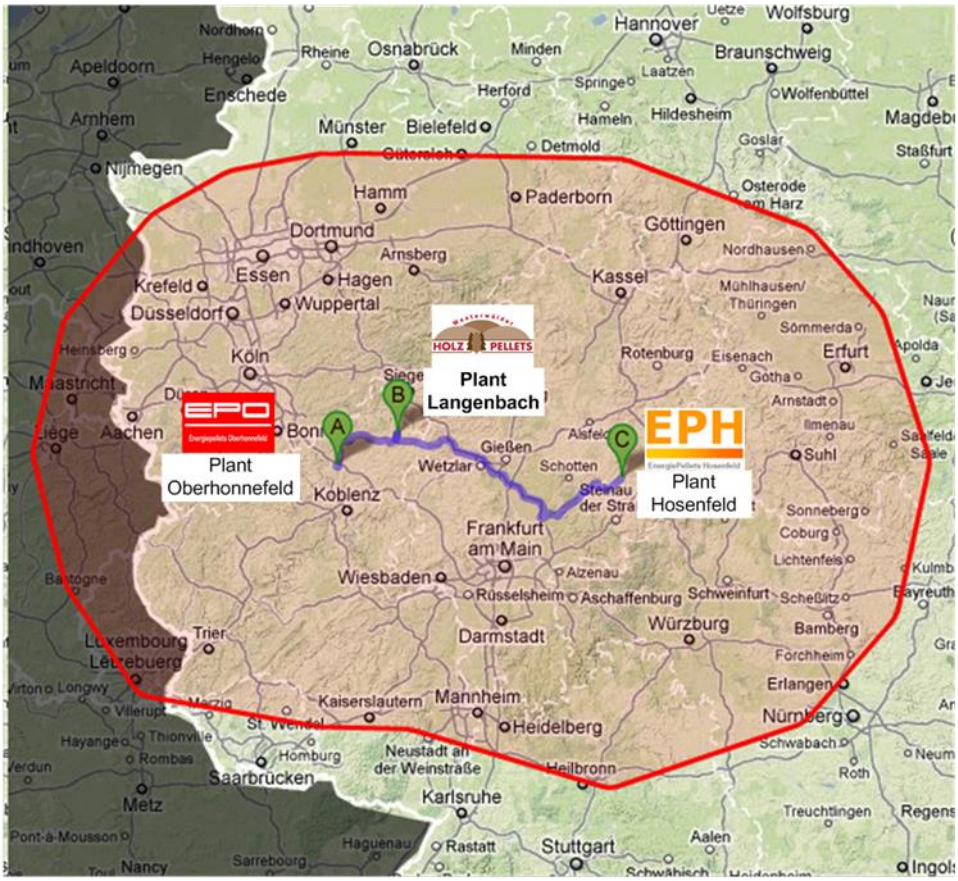


**Figure 2-4** Delivery area of Westerwälder Holzpellets [20],modified

For the calculation of the carbon footprint of pellet delivery, the supply of end consumers by WWP (direct marketing) has been taken into account as well as the transport distances to the sites of the pellet traders.

## 2.4. Reactions on the implementation of the carbon footprint

In personal contacts of WWP's employees with end-customers it turned out that most of them are not aware of the carbon footprint of products. When introduced into the subject they appreciate the display of product-related greenhouse gas emissions, especially when learning about WWP's efforts to minimize the emissions. That's why a comprehensive description of the company's carbon footprint and a comparison with the footprint of the

[20] Mann, M. (2013): „Wirtschaften mit Energie - Energiesparen in der Praxis", oral presentation at the conference „Wirtschaften mit Energie, Einsparpotentiale ermitteln – sinnvoll investieren" (31.01.2013)

"average" pellet production in Germay, Austria and Russia is displayed on WWP's webpage[21]. Since the $CO_2$ footprint does not seem to influence the purchase decision a lot, the company will not certify the pellets produced at the associated production sites at Oberhonnefeld and Hosenfeld.

Westerwälder Holzpellets considers the $CO_2$ footprint as a marketing tool to demonstrate the company's commitment towards an environmental friendly energy supply. Since the use of green energy is exceptional in the pellet sector, the eco-lable enables WWP to set apart from the competitors. For that reason, the company would appreciate if more pellet producers would display their carbon footprint.

The company's management currently thinks about applying for the eco-label "UZ 153-Blauer Engel" (see 3.2.1).

## 2.5. Assessment of WWP's $CO_2$ Footprint

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 enanble a company to display the sustainability of its products to the customers.

TÜV Rheinland asses if the carbon footprint is determined according to international standards (ISO 14040, ISO 14044, PAS 2050) which only set a basic frame for the calculation without going into detail too much.

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.

The Carbon Footprint is the only scheme assessed within this study which requires a comprehensice assessment of greenhouse gases carried out by an independent expert according to generally accepted procedures.

Other environmental aspects of pellet production and supply do not play a role within the scheme.

[21] www.ww-holzpellets.de, retrieved in march 2013

# 3. Sustainability requirements in other certification schemes

In order to benchmark the eco-label “Carbon footprint”, four other sustainability labels and quality certification schemes with sustainability requirements were assessed:

- ENplus (Germany)
- RAL Umweltzeichen UZ 153 “Blauer Engel” (Germany)
- Österreichisches Umweltzeichen UZ 38 (Austria)
- Nordic Ecolabelling of Biofuel Pellets (Nordic countries)

Quality certification schemes containing no requirements regarding the sustainability of raw material sources, the documentation of $CO_2$ emissions etc. (e.g. the German DINplus or the French Marque NF 444) have not been taken into account within this study.

## 3.1. ENplus

### 3.1.1. ENplus – the scheme

The basic handbook for the ENplus scheme was developed in 2009/2010 by the German Pellet Institute (DEPI), an institute associated to the German Pellet Association DEPV, together with the German Biomass Research Center (DBFZ). The scheme combines requirements on fuel properties (according to EN 14961-2[22]) with requirements on the internal quality assurance system (according to EN 15234-2 [23]) and sustainability requirements. Three quality classes have been defined: ENplus A1, ENplus A2 and EN B. The certification system is runned by the European Pellet Council, an umbrella organization of the national European pellet associations. The organization in the several countries is in the hand of the respective national association. Currently pellet producers from Austria, Belgium, Croatia, Czech Republic, Denmark, France, Germany, Italy, Lithuania, Portugal, Romania, Spain, Switzerland, United Kingdom and Canada are producing ENplus pellets – about 3.2 million tons in 2012.

### 3.1.2. Sustainability requirements

The certification scheme defines several sustainability requirements for the production of wood pellets.

**Requirements on ingredients**

Only chemically untreated wood raw material is allowed to be used for pellet production. In deviation to EN 14961-2, chemically treated used wood is not accepted for the production of class EN B pellets. External treatment with wood preservatives against insect attack is not classified as chemical treatment within the scheme.

Additives must origin from unaltered farming and foresting products. The harmlessness of new, innovative additives has to be proven by the certified pellet producer.

[22] European Committee for Standardization (2011): EN 14961-2: Solid biofuels. Fuel specifications and classes. Wood pellets for non-industrial use

[23] European Committee for Standardization (2012): EN 15234-2: Solid biofuels – Fuel quality assurance – Part 2: Wood pellets for non-industrial use

According to EN 14961-2, the scheme requires a certain product quality; therefore threshold values for several ingredients have been defined:

- nitrogen
- sulfur
- chlorine
- trace metals (arsenic, cadmium, chromium, copper, lead, nickel and zinc).

**Documentation of raw material from sustainability certified sources**

The scheme distinguishes between three raw material sources:

- Raw material originating from forests, plantations and other virgin wood: the total amount as well as the share coming from certified sources (FSC & PEFC or equivalent systems) has to be documented.
- Chemically untreated residues from wood-processing industry: the total amount as well as the share coming from chain of custody certified sources (FSC & PEFC or equivalent systems) has to be documented.
- Chemically untreated used wood (only for the production of class EN B pellets) – no proof of sustainability required.

The aggregated results from all certified producers are annually published by the European Pellet Council.

**Carbon footprint of pellet production**

The ENplus scheme requires the calculation of the carbon footprint of every certified pellet production site. For the calculation a tool is provided on the scheme's webpage[24].

The following process steps are assessed:

- Wood raw material transport
- Electrical energy consumption of pellet production (depending on the fuel mix)
- Heat consumption of pellet production (depending on the fuel mix)
- Production of additives
- Production of packaging

The aggregated results from all certified producers are annually published by the European Pellet Council.

### 3.1.3. Assessment of sustainability requirements

- The requirements of raw material ingredients are based on the European Pellet standard EN 14961-2. In despite of the standard's requirements the use of chemically treated used wood is strictly forbidden since used wood is a very heterogeneous raw material. It is not possible to avoid the exceeding of threshold values for critical ingredients without permanent control.
- No minimum share of wood raw material from sustainable sources is defined so far.
- The $CO_2$ emissions of pellet delivery are not assessed

[24] http://www.enplus-pellets.eu/downloads/ghg-calculator/, retrieved in march 2013

- The results of the assessment of the $CO_2$ emissions of the singular pellet productions are not published by the European Pellet Council but only the aggregated results from all certified producers
- No requirements are set for heat sources for the drying of raw material

## 3.2. RAL Umweltzeichen UZ 153 "Blauer Engel"

In 1978 the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety invented the environmental label "Blauer Engel" ("Blue Angel") in order to feature environment-friendly produced goods. It was the first governmental eco-label worldwide. The label is assigned by independent juries organized within the commercial RAL institute. The institute was funded in 1925, originally to set quality standards for industrial product. The "Blue Angel" is well-known in the German society since criteria were set and labels were published for a large number of products.

### 3.2.1. UZ 153 – the scheme

The eco-label UZ 153 for technically dried wood chips and wood pellets was developed by the German Institutes IFEU and Ökoinstitut[25] and has been introduced into the market in the beginning of 2011. The scheme combines quality requirements according to EN 14961-2 (class A1) with several sustainability requirements which are displayed in sub-chapter 3.2.2.

Currently only one company is certified, a German pellet producer producing about 120,000 tonnes per year[26].

Each certificate holder must hand in a report to RAL every second year in order to proof that the requirements of the scheme are met. An independent expert has to certify the accuracy of the report. The accurate product quality can be verified by submitting a DINplus or an ENplus certificate (quality class ENplus A1) or an external experts' inspection report. No independent controls of production facilities or management procedures are recommended.

### 3.2.2. Sustainability requirements

The certification scheme defines several sustainability requirements for the production and delivery of wood pellets:

**Requirements on ingredients:**

Only stemwood and chemically untreated residues from wood processing industry are acceptable for the production of pellets according to this scheme.

According to EN 14961-2[27], class A1, the scheme requires a certain product quality, therefore threshold values for several ingredients of the produced pellets have been defined:

- nitrogen
- sulfur
- chlorine

[25] Vogt, R. et al (2001): Technisch getrocknete Holzhackschnitzel / Holzpellets - Entwicklung der Vergabekriterien für ein klimaschutzbezogenes Umweltzeichen
[26] http://www.thermospan.de/, retrieved in march 2013
[27] European Committee for Standardization (2011): EN 14961-2: Solid biofuels. Fuel specifications and classes. Wood pellets for non-industrial use

- trace metals (arsenic, cadmium, chromium, copper, lead, nickel and zinc).

Only chemically untreated substances on the basis of renewable raw materials are allowed as pressing aid.

**Raw material from sustainability certified sources:**

The scheme distinguishes between three raw material sources and defines sustainability requirements for each:

- Chemically untreated wood waste from wood processing industry: sawdust, shavings and other wood waste from wood processing industry is currently the most important raw material assortment for European pellet producers. According to the certification scheme, the origin of the wood has to be documented.

- Raw material from continuously cultivated forest area has to be certified by FSC, PEFC or the German Naturland scheme. Stemwood plays a role for pellet production in central Europe since there is a lack on wood wastes from wood processing industry caused by the fast growing of the pellet sector in the last years. A special focus is on:

    - the prohibition of the use of tree parts with a diameter under 7cm
    - the prohibition of the use of pesticides (exception the wood has been affected by pest and chemical treatment is mandated by the authorities)
    - the prohibition of fertilization for yield increase
    - the conformance to site-related sustainability requirements defined in the European directive 2009/28/EG[28].

- Wood from short rotation plantations: The origin from cultivated area fulfilling the site-related requirements has to be approved by external audits, either by an ISCC- or Redcert- certificate or by an accredited environmental expert. Wood from short rotation plantations plays only a very small role as raw material for the pellet production in Central Europe so far.

**Requirements on the drying of wet raw material:**

- For the drying of raw material, heat from renewable sources (solid biofuels, rejected heat from CHP plants fired with biogas, digester gas or landfill gas, solarthermal energy) or industrial waste heat has to be used.

- Drying efficiency: the heat demand for the evaporation of the water contained in the wood should not be higher than factor 2.5 of the physical heat demand (evaporation heat of the water referred to 25°C = 2.441 MJ/kg water).

**Assessment of respirable dust concentrations:**

The respirable dust emission in the exhaust air of the dryer has to be determined as well as the concentration at the mills and the pellet presses. This has to be done twice a year by an accredited inspection body or an accredited environmental expert. Since currently only few data is available, threshold values for dust emissions have not been defined so far.

[28] European Parliament and European Council (2009): Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

**Carbon footprint of logistics processes:**

The $CO_2$ emissions for the transport of raw material as well as for the export of wood pellets have to be evaluated. In Annex I of the scheme's handbook emission factors for different transport vehicles are defined. The calculated $CO_2$ emissions as well as the location of the production site have to be documented on the package and the shipping papers when delivering bulk pellets.

- For fresh wood from forests and short rotation plantations the transport distance from the cultivated area to the pellet plant has to be taken into account. In case wood residues from wood processing industry are taken as raw material, the transport distance from the industrial site (e.g. sawmill) to the pellet plant has to be considered.

- When the produced pellets are exported into another country, the $CO_2$ emissions related to the transport from pellet plant to the sales point have to be calculated. Transportation in the country of origin has not to be taken into consideration.

Additionally the pellet manufacturing location has to be indicated.

### 3.2.3. Assessment of sustainability requirements

- Forest wood and plantation wood for the use as raw material for pellet production has to be purchased from sustainability certified sources. No such requirements exist for the purchase of chemically untreated wood waste from wood processing industry, which is currently the most important source for the European pellet industry.

- No comprehensive requirements on the assessment of $CO_2$ emissions are established. Power consumption of pellet production as well as the used fuel mix do not have to be taken into account. The $CO_2$ emissions of the delivery of the produced pellets play a role in the calculation only when the pellets are exported to another country.

- Together with the Austrian scheme UZ 38, UZ 153 is currently the only sustainability label defining requirements on the heat source for the drying of wet raw material. Since most of the central European pellet plants use heat from solid biofuel combustion systems, the requirement of using heat from renewable sources is easy to fulfill for most of the producers.

- UZ 153 is the only scheme requiring the assessment of respirable dust emissions. Indoor dust emissions that have to be determined according to the scheme, are not the problem for environmental reasons. In the past sometimes problems occurred when dust stored on open air areas had been blown away by wind.

## 3.3. Österreichisches Umweltzeichen UZ 38

The Austrian eco-label "Umweltzeichen" is awarded by the Federal Ministry of Environment. Since the foundation in 1990 criteria for 46 product groups have been developed. One focus of the scheme is on the certification of renewable energy products.

### 3.3.1. UZ 38- the scheme

The scheme[29] defines requirements on fuel properties and sustainability issues for wood chips and wood pellets. The system refers to the Austrian wood pellet standard ÖNorm M 7135[30] which is not valid any more since the European wood pellet standard EN 14961-2[31] has come into force. It is not clear if the scheme will be adapted to the new requirements in the future.

The compliance with the scheme's requirements is controlled once per year by an independent inspection body.

Currently three Austrian pellet producers are holding a certificate, producing all together about 250,000 pellets per year.

### 3.3.2. Sustainability requirements

**Requirements on ingredients**

Only the disposition of natural wood and byproducts from the processing of natural wood is acceptable. The use of any chemically treated wood is not allowed.

Only pressing aids on the base of chemically untreated renewable resources are allowed to be used.

Threshold values for several ingredients produced pellets have been defined:

- nitrogen
- sulfur
- chlorine
- trace metals (copper and chromium)
- extractable halogens in organic bonding

**Raw material from sustainability certified sources**

At least 70% of the wood raw material has to come from sustainable forestry. The sustainable origin has to be proven by a chain-of-custody certificate by FSC, PEFC or other schemes based on the EU Forestry Strategy[32].

**Requirements on the drying of wet raw material:**

For the drying of raw material, heat from renewable sources has to be used.

[29] Österreichisches Umweltzeichen (2009): Richtlinie UZ 38: Brennstoffe aus Biomasse
[30] Österreichisches Normungsinstitut (2000): ÖNorm M 7135 - Presslinge aus naturbelassenem Holz oder naturbelassener Rinde, Pellets und Briketts; Anforderungen und Prüfbestimmungen
[31] European Committee for Standardization (2011): EN 14961-2: Solid biofuels. Fuel specifications and classes. Wood pellets for non-industrial use
[32] Council of the European Union (1998): Council resolution of 15 December 1998 on a forestry strategy for the European Union (1999/C 56/01)

### 3.3.3. Assessment of sustainability requirements

- UZ 38 is the only label defining a threshold value for extractable halogens in organic bonding.
- Together with the German scheme UZ 153, UZ 38 is currently the only sustainability label defining requirements on the heat source for the drying of wet raw material. Since most of the central European pellet plants use heat from solid biofuel combustion systems, the requirement of using heat from renewable sources is easy to fulfill for most of the producers.

## 3.4. Nordic Ecolabelling of Biofuel pellets

The Nordic Ecolabel was established in 1989 by the council of ministers of the Nordic countries (Sweden, Finland, Denmark, Island and Norway) with the aim to provide an environmental labelling scheme that would contribute to a sustainable consumption. The scheme is currently covering 63 product groups.

### 3.4.1. Nordic Ecolabelling – the scheme

The scheme combines requirements on fuel quality and internal management procedures with sustainability requirements.

The present handbook (version 2.1)[33] is valid from December 2007 until December 2014. Unfortunately no information about the number of certified companies or the amount of certified pellets is available.

Prior to application a sample of pellets has to be analyzed by an independent testing laboratory, the sampling has to be carried out by the applicant. After the initial analysis additional tests will be carried out only in exceptional cases.

### 3.4.2. Sustainability requirements

**Requirements on ingredients**

Beside stemwood from forests and plantations, only chemically untreated wood residues (without bark) are allowed to be used as raw material with one exception. Residues from the processing of bonded wood elements can be used if the product contains less than 1 kg adhesive per 100 kg.

The use of additives is not allowed, exceptions are possible only by permission of Nordic Ecolabel. Only chemical untreated biomass is allowed to be used as additive. Emission and ash content analyses have to be carried out by an accredited laboratory. The amounts of halogens and heavy metals in the pellets with additives have to be equivalent to those in pure wood.

Threshold values for several ingredients of the produced pellets have been defined:

- nitrogen
- sulphur
- chlorine

[33] Nordic Ecolabelling (2007): Nordic Ecolabelling of Biofuel pellets, Version 2.1 - 13 December 2007 – 31 December 2014

**Raw material from sustainability certified sources**

The producer has to ensure that raw material does not originate from forest environments meriting protection due to their high biological and/or social value. At least 70% of the raw material from virgin wood must come from certified forests. The forest certification scheme has to be approved by Nordic Ecolabel. Requirements on standards, certification system and certification body are defined but not in a very precise way. No specific certification schemes are listed.

Supplier as well as geographical origin (country/state and region/province/district) of the wood has to be documented.

**Energy consumption and $CO_2$ emissions**

The production of pellets must not consume more than 1200 kWh of primary energy per ton of pellets. The energy consumption has to be estimated and documented for every process step:

- Preparation of raw material (barking, grinding, others)
- Heat production
- Pelleting (pressing, cooling, screening, others)

The handbook contains calculation factors for the determination of $CO_2$ emissions which have to be documented together with the energy consumption.

The amount of $CO_2$ emissions for the drying of raw material is limited to maximum 100 kg per ton of pellets.

**Requirements on packaging**

It is not allowed to use packaging containing chlorine-based plastics.

**New criteria**

The scheme provides and examination after the end of validation of the present handbook in the end of 2014 and a modification of the requirements if it is seen as necessary:

  - Reduction of energy consumption of production to at least 900 kWh per ton pellets
  - Inclusion of requirements on air emissions of pellets in the storage
  - Inclusion of threshold values for emissions from the combustion of the pellets.
  - Inclusion of a $CO_2$ declaration

### 3.4.3. Assessment of sustainability requirements

- Requirements on certification schemes for the proof of the sustainability of raw material sources are defined but no specific schemes are listed. A listing would make the scheme more user-friendly.

- Nordic Ecolabel is the only label defining a threshold value for the production's energy consumption. The energy consumption of every process step has to be displayed. Since most pellet producers are not able to measure the power consumtion of every process step, these values have to be estimated. It would be

much easier to not to distinguish the power consumption of every step but only for the whole pellet plant.

- No conversion factors are given for different power sources what complicates the calculation of $CO_2$ emissions related to power consumtion.

- The threshold value for the $CO_2$ emissions of raw material drying of 100 kg per ton pellets is high – especially when taking into account that other schemes require the use of heat from renewable sources

- Nordic Ecolabel is the only label with requirements on the packaging of bagged material.

# 4. Summary and conclusions

Most of the evaluated schemes combine quality requirements with requirements on environmental aspects. This really makes sense since the combustion emissions depend on the chemical composition of the fuel. Furthermore defined fuel properties are a precondition for an efficient combustion as well as for emission control.

Main sustainability aspects in the assessed certification schemes and eco-labels are:

- sustainability of wood raw material sources
- ingredients of wood raw material and composition of additives
- energy consumption and $CO_2$ emissions of wood raw material transport, pellet production and pellet delivery
- drying efficiency
- heat supply for the drying of wood raw material

A comparison between the assessed schemes and ecolabels can be found in the Appendix.

## 4.1. Sustainability of wood raw material sources

Three of the five assessed schemes require the use of at least a minimum share of raw material originating from sustainability certified sources. The easiest way to proof this is to request a certificate of a forest certification scheme. For residues from wood-processing industry the instrument of Chain of Custody certification should be used.

Not only the forest certification schemes which are widely spread in Europe should be taken into account but also schemes from other regions in the world exporting pellets to Europe.

In order to minimize the effort for potential certificate holders all accepted schemes should be listed in the certification handbook.

## 4.2. Ingredients

Three of the five assessed schemes refer to requirements defined in international quality standards or by quality certification schemes. As mentioned before standardised fuel properties are an important precondition for an efficient, low-emmission combustion. Requierements on the origin of raw materials as well as on the chemical composition of the produced fuel shall assure the environmental acceptability of wood pellets as a fuel.

In 2014 the international standard ISO 17225-2 will come into force, defining specifications and quality classes for wood pellets. It will replace the European wood pellet quality standard EN 14961-2. These standards name acceptable raw material sources and additives as well as threshold values for the most important ingredients regarding combustion behaviour and emission control.

## 4.3. Energy consumption and greenhouse gas emissions

In principle there are two approaches to reach low greenhouse gas emissions. One approach is to set a threshold value valid for all certified pellet productions. The other one is to define a procedure for the calculation of greenhouse gas emissions and to publish the results of the different pellet productions in order to enable the end-user to compare the product-related emissions. The aim of the second approach is to motivate the producers to minimize their emissions in order to reach better results as their competitors.

In order to achieve comparability between the greenhouse gases of pellets produced by different conies it is important not only to define the framework for the calculation but also the system boundary, calculation methods and emission factors.

In all schemes assessed within this study the pellet producers are the certificate holders and therefore responsible for the calculation of greenhouse gas emissions. Since the producer in most cases is not the one who delivers the pellets to the end user, he is not able to determine the emissions caused by delivery which is one of the most energy consuming processes in the whole supply chain. An approach to solve this problem has to be found.

Only one of the assessed schemes requires the assessment of greenhouse gas emissions carried out by an independent expert in order to assure that the calculation is done according to international standards.

If the calculation has to be done by the certificate holder, it is necessary to keep the calculation simple and to assist him comprehensively by providing emission factors and calculation tools.

The generation of electricity in nuclear power nuclear effects low $CO_2$ emissions compared to other technologies but causes other environmental problems (risk of accidents, problems of ultimate waste disposal etc.). A solution has to be found to deal with this subject.

## 4.4. Requirements on drying of wood raw material

Two of the assessed schemes require the use of heat from renewable sources. As mentioned before, most of the pellet plants in Central Europe produce the heat needed for the drying of wood raw material in their own heating or CHP plants firing bark and low quality wood residues. When requirements on the origin of heat are defined, the use of industrial waste heat should be allowed as well.

Two of the schemes define requirements on the efficiency of the drying of wood raw material. In case ambitious threshold values for the emission of greenhouse gases are set or the aim of a competition between the certificate holders in order minimize greenhouse gas emissions requirements on raw material drying are not necessary.

# 5. Appendix: Comparison of sustainability schemes for premium wood pellets

| Label | Require-ments on ingridients | Sustainability requirements on raw material | Documen-tation GHG-emissions of raw material transport | Documen-tation GHG-emissions of production | Documen-tation GHG-emissions of delivery | Binding threshold value for GHG-emissions | Publication of individual GHG-emissions | Other requirements/ remarks |
|---|---|---|---|---|---|---|---|---|
| **TÜV: carbon footprint** | no | no | yes | yes | yes | no | no | **Remark:** System boundary is set by the certified company. TÜV Rheinland only reviews the accuracy of the chosen emission factors as well as the calculation method. |
| **Blauer Engel UZ 153** | for wood raw material | depending on origin[1] | yes | no | only when the produced pellets are exported | no | yes, in the delivery papers | **Requirements:** Drying efficiency [2]. Drying only with heat from renewable energies or industrial waste heat. Assessment of respirable dust emissions. |
| **Öster-reichisches Umwelt-zeichen UZ 38** | for wood raw material & pressing aids | FSC, PEFC, others[3] | no | no | no | no | no | **Requirement:** Drying only with heat from renewable energies.<br>**Remark:** independent control only for ingredients. |
| **ENplus** | for wood raw material & additives | only document-tation of the share from certified sources | yes | yes | no | no | no | **Remark:** Comprehensive Excel-tool for the calculation of GHG emissions by certificate holder |
| **Nordic Ecolabel** | for wood raw material & additives | at least a share of 70% from certified sources [4] | no | yes | no | no [5] | no | **Requirement:** Drying efficiency [6]<br>**Remark:** It is not allowed to use packaging containing chlorine-based plastics. |

[1] Forest wood: FSC-, PEFC- or Naturland certificate; Short rotation coppice: an ISCC- or Redcert certificate or certificate from an accredited environmental expert; no requirements for wood waste from wood processing industry.
[2] The heat demand for the evaporation of the water contained in the wood should not be higher than factor 2.5 of the physical heat demand.
[3] Schemes based on the EU Forestry Strategy (1998-12-15)
[4] No listing of accepted schemes.
[5] A threshold value for the energy consumption of pellet production is defined: ≤ 1200 kWh of primary energy per ton pellets
[6] The amount of $CO_2$ emissions for the drying of raw material is limited to maximum 100 kg per ton of pellets.