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# Industrial Wood Pellets Report

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Authors:

Chrystelle Verhoest

Yves Ryckmans

LABORELEC
GDF SUEZ

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# 1. Introduction

The industrial wood pellets trade for power and heat applications is characterized by large bulk volumes (more than 10 million tons per year). While the residential pellet business is local with regional trade, the industrial pellets are traded globally. Future trade flows will include industrial pellet shipments from Australia, South America and South Africa.

This market has developed due to incentives for biomass power and heat from the local authorities. . The countries that are the most involved in the trading of industrial wood pellets within the EU are :

- Belgium, The Netherlands, United Kingdom, Sweden, Denmark for the users,
- Germany, Lithuania, Estonia, Latvia, Portugal, Finland, Sweden for the suppliers.

The primary application of wood pellets on a large scale facility was through co-firing, to substitute partly the coal. By the time, the strategy has changed, from one country to the other. While Belgium, Sweden and Denmark are moving towards 100% biomass fuelled plants obligations, United-Kingdom changed recently their mind and have kept subsidies for co-firing equal to full biomass firing while Germany doesn't and the Netherlands have put an end to their support scheme to co-firing and turned it into an 'voluntary' obligation of the power sector progressively without support. In such system the energy companies have committed to produce (purchase) a certain percentage of renewable electricity within given period.

The 20/20/20 target will require even more bio-energy production (along with other renewables, biomass should make about 50% of the target). Most of the utilities active in the above-mentioned countries (Electrabel, RWE, Drax, EON, Vattenfall and DONG Energy) have plans for large full biomass power plants, driven by their respective CO2 intensity of assets and increasing indirect costs for the coal that can be substituted by biomass. The projections from Eurelectric/POYRI, and the NREAPs refer to a future consumption of biomass of up to 2350 TWh (or 210 Mtoe) by 2020.On the medium-term, such a large demand can't be fulfilled only with the local wood production/availability. Countries having a significant shortage of biomass will not be able to find their biomass in other EU members states as they need their own biomass for their own target. But those countries like Belgium, the NL and UK can take advantage of their large port infrastructure to organize efficient import supply chains based on wood pellets. However, this import to Europe has several times been targeted by criticisms from the NGO's and public by lack of sustainability evidence.

Certain quality and sustainability requirements do exist in all the countries where wood pellets are use on industrial scale, but these do still vary between countries (regions) and actors. To ensure continuous qualitative trade, it is needed to replicate and construct on the existing experiences. Initiatives are


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undertaken to establish a consistent and practicable quality and sustainability assessment. This shall be homogenized among the actors, as well on the producers side as on the user side.

This report will make a short overview of the market and major trends for trading, with the associated perspectives for production and demand. However, there remain a quite important uncertainty range in the statistics. The figures should thus be considered as indicative.

This report also underlines some initiatives for a common definition of quality (technical specifications) and sustainability requirements.

# 2. Industrial pellets markets

The world production volume of wood pellets was about 14 Mio. ton in 2010 (Pöyry, 2011). The production capacity was unequally distributed amongst the largest producers, US – Canada and Scandinavia, and emerging producing countries, such as Australia, South Africa and South America.

These different origins also imply different types of wood feedstock and production systems (either from forest industry wastes or forest residues, or from plantations).

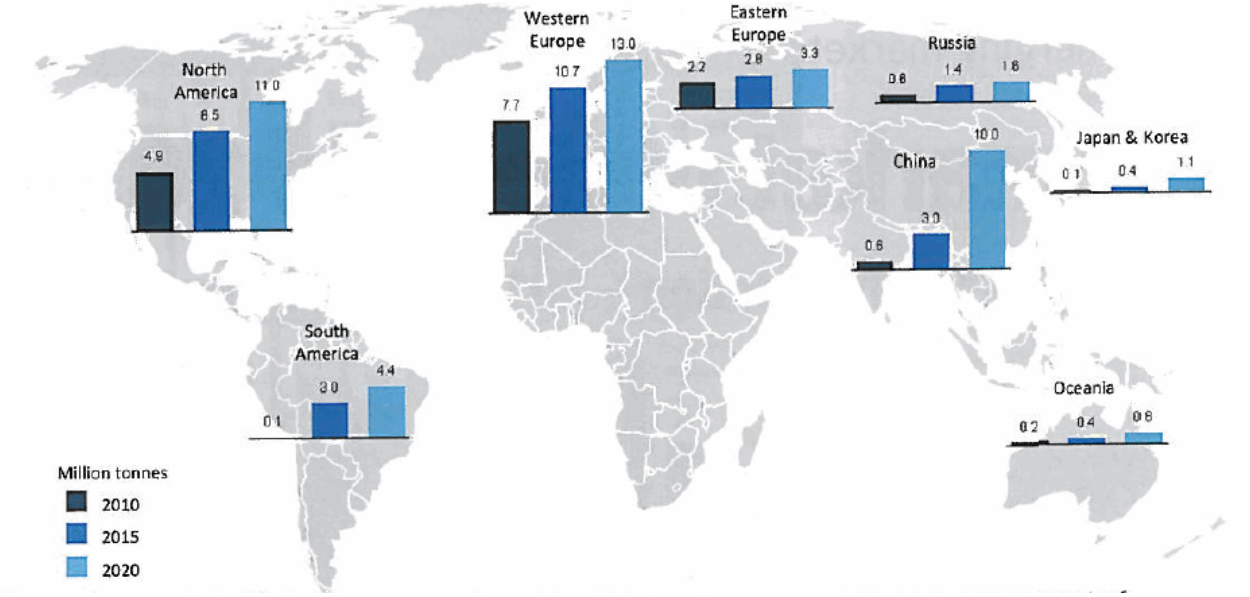


**Figure 1: The Global production of wood pellets (BioenergyInsight, July 2011 – Pöyry)**

Canada shows up to have the largest potential as a wood pellets producer. The installed production capacity was of 2.1 million tons in 2010 and is expected to reach 3.6 million in the next 2 to 3 years (Bioenergy Insight, July 2011).

Consumption of pellets in the European Union steadily increased from 3.8 million tons in 2005 to 9.8 million tons in 2010. It is expected to double by 2020 up to 24 million tons, whose 11 million tons would be imported. The major part of the pellet production is thus exported to Europe, where there is the greatest demand. This might however change in the future.

Not all production of wood pellets in Europe is dedicated to the industrial power and heat applications, but it represents the larger part. In the US and Canada, very little percentage of the production is used locally.



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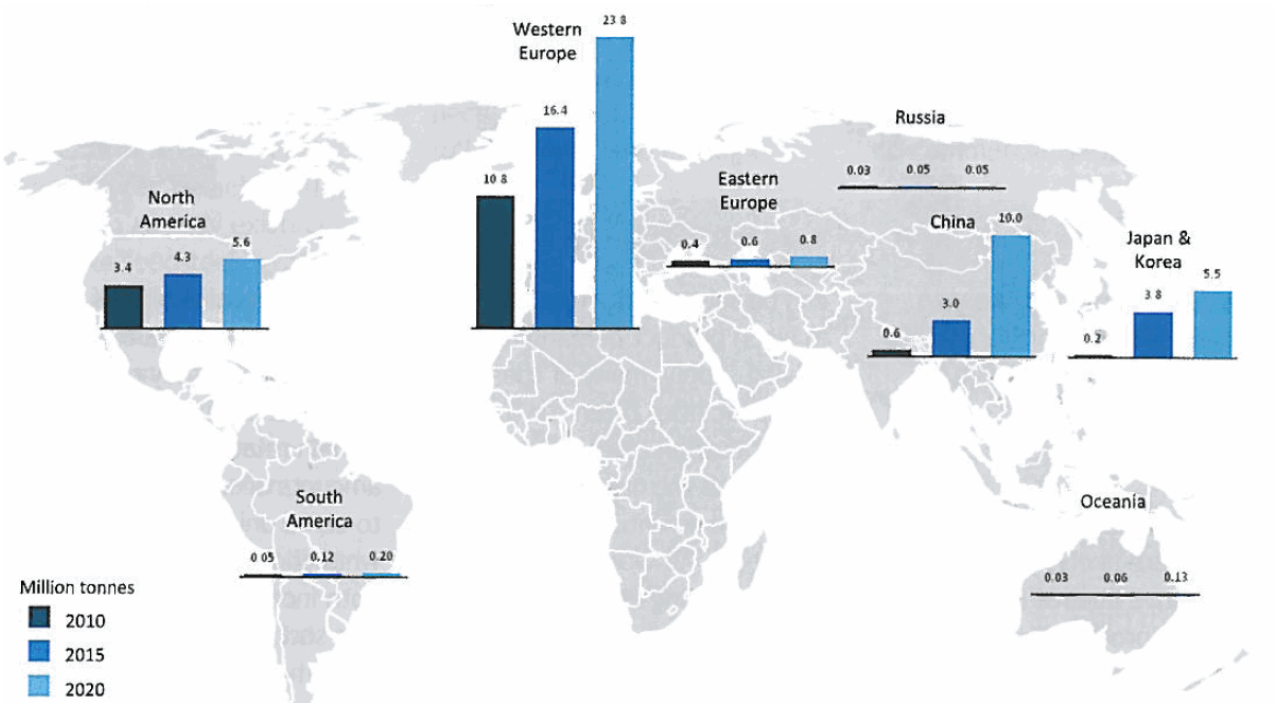


**Figure 2: The Global consumption of wood pellets (BioenergyInsight, July 2011 – Pöyry article)**



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# Europe

## *Wood pellets demand in Europe*

Not all countries have the same ratio of industrial wood pellets demand. The countries with the highest industrial demand are Belgium, the Netherlands, UK and Denmark, where large scale power plants use biomass in co-firing applications.

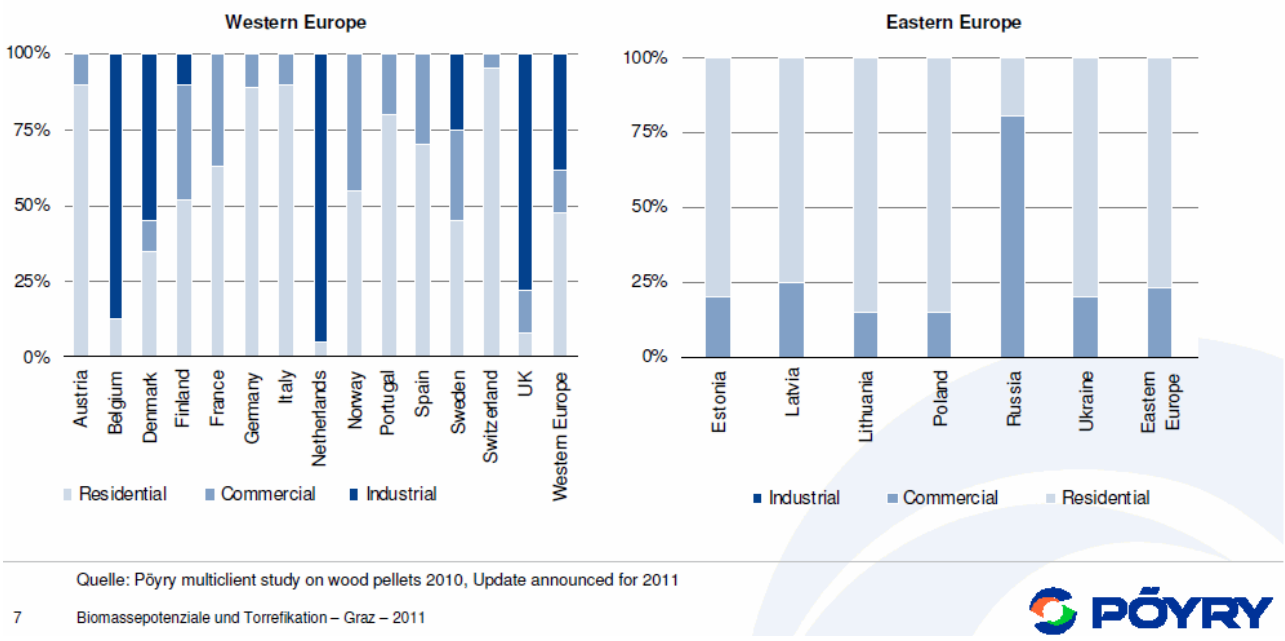


**Figure 3: Shares of residential, commercial and industrial uses in each EU27 countries (figures for 2010)**

In Sweden, Denmark and in Germany, pellets are used in medium to large Combined Heat and Power (CHP) plant. In Sweden, in 2008 the total consumption was around 1.85 million tons and 40% was used in large district heating plants and CHP plants, between 2 MW and 25MW (Pellet@las, Country Report, 2009).



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These two applications have also distinct market characteristics

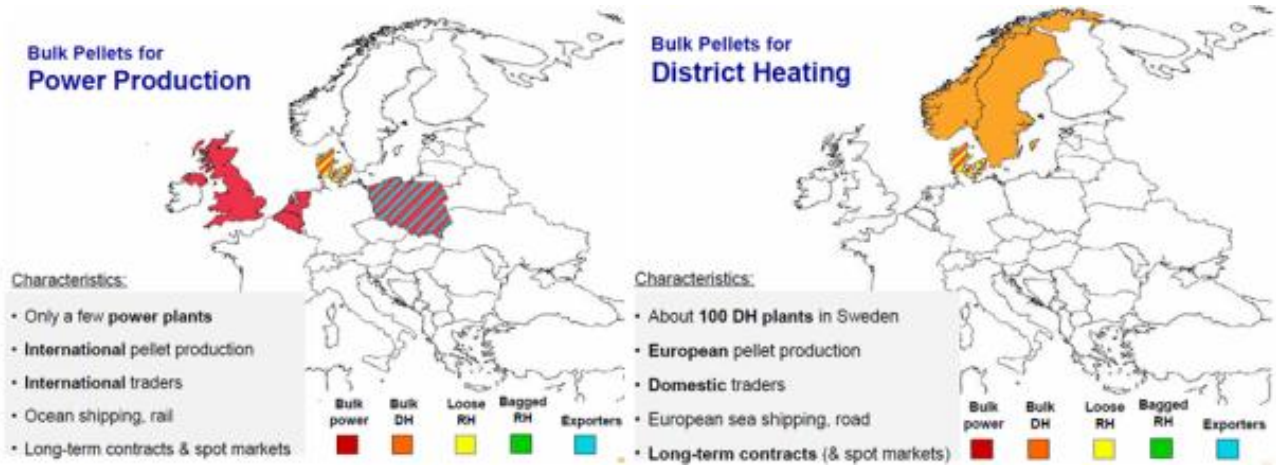


**Figure 4 : Overview of Wood Pellet Market in Europe , Monika Steiner (Pellet@las) 18.11.2009**

Power plants, industries and large district heating companies may typically require from a few ten thousands up to several hundred thousand tons per year in a single plant. The largest user in the world is the recently retrofitted Tilbury power plant operated by RWE Innogy that will use more than 2.5 mio ton pellets every year (when he will back in line after a fire that occurred on February 27).

| Year 2010 (kton) | Belgium | Denmark | Netherlands | Sweden | United Kingdom | Total (Company) |
|---|---|---|---|---|---|---|
| RWE-ESSENT | | | 1.000 | | 2.500 | **3.500** |
| GDF SUEZ | 1.200 | | 500 | | | **1.700** |
| DRAX | | | | | 1.000 | **1.000** |
| Göteborg Heating | | | | 700 | | **700** |
| DONG ENERGY | | 600 | | | | **600** |
| VATTENFALL | | 300 | | | | **300** |
| EON | | | | | 240 | **240** |
| **Total (Country)** | **1.200** | **900** | **1.500** | **700** | **3.740** | |

**Figure 5 : Wood pellets use for each Utility/Energy Company in Europe figures in 2010 (kt)**

The major Utilities consuming wood pellets on a large scale are (figures for 2010) :

- ELECTRABEL (GDF SUEZ): 1,2 million tons in Belgium, 0.5 million tons the Netherlands)
- RWE – ESSENT:
  - 2.5 mio tons in Tilbury power plant (UK),
  - 1.0 million tons in Geertruidenberg power plant (NL).
- DONG ENERGY: 0.6 mio tons in Avedore power plant (DK)
- DRAX uses about 1 mio tons wood pellets in co-firing in Drax and have planst o increase this up to 900 MW or 3 mio tons.
- VATTENFALL: each year, Amager Power Station (DK) burn about 100,000 tons of straw pellets.and 300,000 tons of wood pellets, imported mainly from the Baltic countries.



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- EON: US biomass producer Enviva will supply 240,000 t/yr of wood pellets under the agreement with German utility Eon It is likely the pellets will be consumed by Eon in the UK. In March, EON confirmed plans to convert a 500MW unit at its 1GW coal-fired power plant in Ironbridge in the UK to 100% biomass and said the unit will be fuelled with wood pellets imported from North America.

The medium scale heating sector is mainly present in Sweden, a famous example of biomass base heating being the Göteborg heating plant.

## Wood pellets production and trade flows

The main stream is from Canada and US. Canada plays a major in the trade flows. While nearly the half of the production was exported to the US in 2002, their main market is now Europe, with exports of about 1.4 million tons in 2010 (about 90% of exports). Canada consumes only 40 -50 thousand tons pellets a year. Figure 6 shows a global overview of wood pellets trade flows.

Within Europe, industrial wood pellets are exported from the Baltic countries, Finland and Russia to Sweden, Denmark, Belgium, the Netherlands and UK by vessel (EUBIONET 3). Russia also exports significant amounts, while Australia, South America and South Africa have seen an increase of their production capacity.

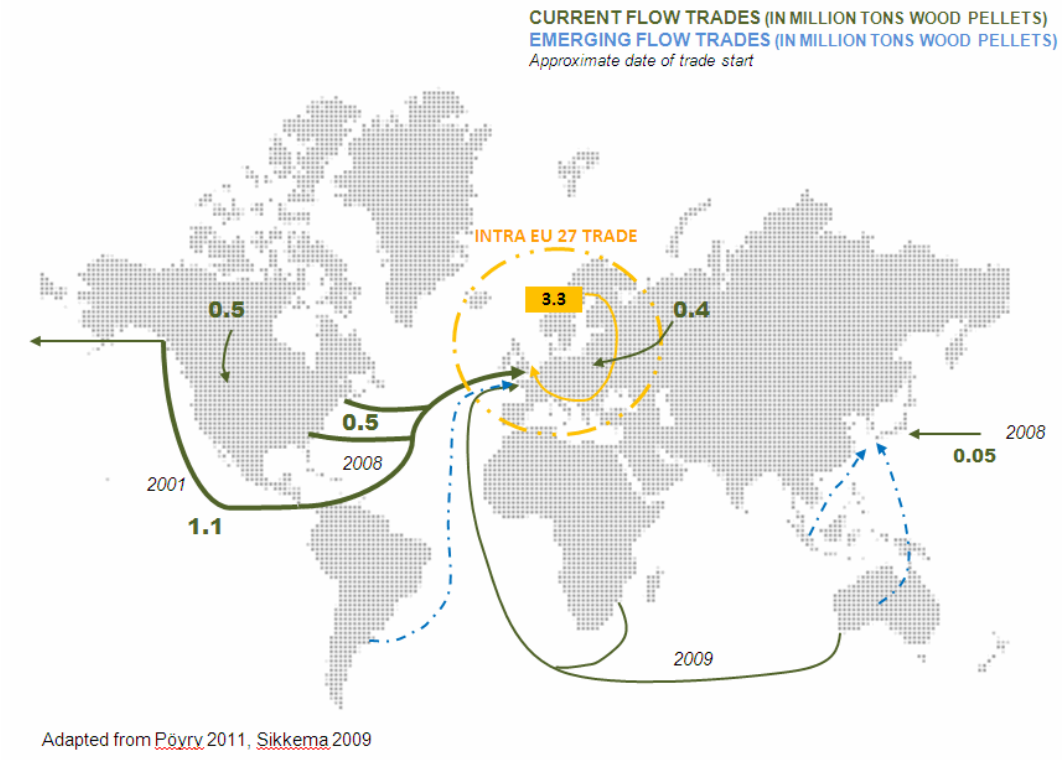


**Figure 6: Map of wood pellets trade flows worldwide (2010 status).**



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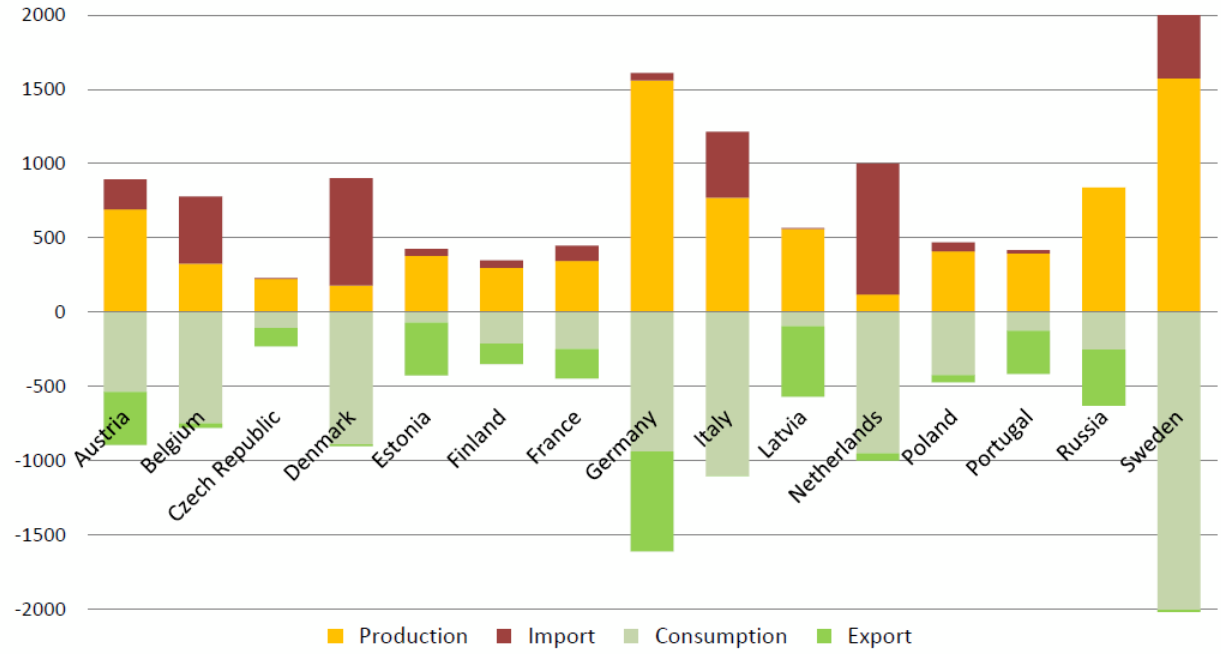
The balance of import/export illustrated in Figure 7 gives an idea of the major actors in the EU wood pellets market, where imports of wood pellet are more or less important compared to local production capacity. It is noticeable that the consumption of wood pellets of Russia (in 2008) was far beyond the level of production. Since 2008, change has occurred as there is an increase of wood pellets consumption for large scale power and heat production in other countries than Germany, Denmark, Belgium, the Netherlands and the UK.

Russian pulp and paper company Vyborgskaya Cellulose has started production in September 2010 at its 900,000 tons/year wood pellet plant in the western Russian city of Vyborg. The new facility, which is has been built near the border with Finland, represents a substantial rise in global pellet production and will be the largest plant in the world. Global forestry marketing firm Ekman is exclusive sales agent for the plant.




Source : Sikkema, Steiner, Junginger, Hiegl, Hansen and Faaij, 2011. In BioFPR 5(3): 250-278

**Figure 7: Major wood pellet markets in Europe, in 2009 (kton) (from AEBIOM 2011)**

# The Netherlands

On November 4 2012, the Dutch power and gas exchange APX-Endex opened in Amsterdam the world's first industrial wood pellets exchange. At the same time, they announced that they expect global pellets market to grow to 40 million tons by 2020 compared to current 13 million. This is 200% growth in only 8 years.

The country's economy ministry has, according to Argus Media, allocated € 1,7 bn to the green sector in 2012, up from €1,5bn in 2010. The funds are available through the Dutch subsidy system SDE+ [1], which is financed through a levy on household and industry energy bills. A third of all green energy produced in the NL comes from biomass, but the SDE+ will not grant subsidies to co-firing until the highly demanding Cramer sustainability criteria for biomass feedstock can be integrated into a certification scheme.

Most of the co-firing plants still have access to the previous subsidy scheme MEP, but most of these plants will lose their subsidies between 2012 and 2015. The MEP system is a feed-in premium scheme that ran in July 2003-August 2006 and was guaranteed to producers of renewable electricity. The subsidy was financed by a levy on all connections to the grid, with eligible plants securing a subsidy of 67 €/Mwh for co-firing wood. Given the importance of co-firing in the NL, the government has made clear its intent to mandate co-firing of biomass at all existing coal fired power stations (new built excluded). An obligation of at least 10% co-firing at coal-fired plants has been discussed under the country's "green deal", with the obligation forecast from 2015.

The obligation would result in supplier searching the market to find out where they can purchase or produce green energy most economically, allowing the market to determine the most cost-effective methods of sustainable power generation.

NL has an EU target of sourcing 14% of electricity produced from RES by 2020.

[1] Stimulering Duurzame Energieproductie can be seen as the successor to the MEP (Milieukwaliteit van de Elektriciteitsproductie). The SDE is a grant that pays for the uneconomic projects in the field of renewable gas and renewable electricity and is wider than the MEP



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# UK

UK has a huge amount of projects for firing large amounts of wood pellets or wood chips, including a series of retrofits of existing pulverized coal power plants.

| POWER PLANT | POWER | UTILITY | Comment | LCPD – Year end of operation | Amount pellets equiv |
|---|---|---|---|---|---|
| **UK POWER PLANTS CURRENTLY FIRING BIOMASS** | | | | | |
| Didcot A Power Station | 1958MW | RWE | co-fires gas and biofuel | End of 2015 | |
| Tilbury Power Station<br>biomass | 1038MW | RWE | co-fires oil<br>3 Units x 250 MW converted to biomass | End of 2015 | 2 500 000 |
| Ferrybridge Power Station | 1995MW | SSE | co-fires biomass | Unit 1 & 2 End of 2015 | |
| Fiddlers Ferry Power Station | 1961MW | SSE | co-fires biomass | | |
| Lynemouth Power Station | 420MW | Alcan | co-fires biofuel | | |
| Kingsnorth power station | 1940MW | E.On | co-fires oil | Unit A, End of 2015 | |
| **UK POWER PLANTS WITH BIOMASS COMBUSTION PLANS** | | | | | |
| Drax power station coal<br>biomass | 3870MW<br>900 MW | Drax Group | co-firing planned | | 2 000 000 |
| Ironbridge Power Station coal<br>biomass | 970MW | E.On | full conversion 500 MW planned | End of 2015 | 1 750 000 |
| Eggborough Power Station<br>biomass | 1960MW | IP (10%) | www.eggborough.co.uk<br>up to full conversion | | 7 500 000 |
| Rugeley Power Station coal<br>biomass | 1006MW | IP (50%) | co-firing planned between 30% and 85% | | 3 750 000 |

The UK government has proposed a reduction in the banding for converted coal plants to biomass of half a Renewable Obligation Certificate per MWh to 1 ROC/MWh. In the latest ROC auction held by the Non-Fossil Purchasing Agency November 24 2012, the average ROC price achieved was **£46.03** (or 55,9 €).

While reducing support for converted plants, the government has proposed maintaining support for new biomass plants at 1.5 ROCs/MWh to end-March 2016, guaranteed for 20 years. Dedicated



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biomass plants need to be commissioned before March 31, 2016 if they are to benefit from the proposed banding of 1.5 ROCs/ MWh. After that the rate is trimmed to 1.4 ROCs/ MWh.

### *Drax*

the UK government's 1 ROC/MWh proposed for co-firing of biomass could enable Drax to increase co-firing at its 4-GW Selby coal-fired plant, the company said. However a moderate uplift in ROC support would be needed to maximize their potential for producing low cost renewable electricity. Several questions about the availability of biomass, its cost and sustainability arise with such large development of biomass power plants in the UK.

### *RWE-Innogy*

The three units of Tilbury coal power plant located in Essex along the river Thames have undergone a retrofit to generate each 250 MW with wood pellets. The total annual use of wood pellets is assumed to be over two million tons. This power site is due to close by 2015 under the Large Combustion Plant Directive for NOx and SOx emissions. In October last year it had around 10,000 hours of its opt-out allocation left. A very severe accident occurred on February 27 resulting in a large fire and two damaged units that were put out of use. Hopefully nobody was injured or killed.

The blaze in two biomass storage hoppers at Tilbury power station broke out on Monday 27 morning, but was brought under control by late afternoon. The hoppers are about 60ft (18m) deep and can each hold up to 600 tons of wood pellets. Eight crews remained overnight to begin removing wooden pellets from nearby hoppers and to make preparations to empty embers from the affected ones.

Firefighters said it was a technically challenging fire

http://www.mirror.co.uk/news/uk-news/severe-blaze-engulfs-tilbury-power-744865

## *EON*

German Utility EON has confirmed plans to convert a 500MW unit of its 1GW coal-fired plant in Ironbridge, UK to 100% biomass.

The unit will be fuelled with wood pellets imported from North America, according to the company's responsible fuel sourcing policy. But it will also retain the capacity to co-fire up to 20% coal to allow flexibility, EON said.

Under the UK's renewable obligation certificates 5ROC) banding proposals, the company will receive the same level of subsidy (1 ROC/MWh) whether it co-fires at 80% biomass and 100% biomass.

Our Ironbridge power station is affected by the large combustion plant directive (LCPD) and has a limited number of hours remaining. EON's director of biomass Tim Forrest said.

To allow it to operate until the end of 2015, when the LCPD forces closure, we plan to convert the plant so that it can use up to 100% wood pellets for fuel.

EON has submitted a local planning application for a biomass storage silo at the site in Shropshire. The confirmation of the conversion comes after EON ran a number of tests last year to ensure that a conversion would be an efficient way to continue operating the unit.

The unit is scheduled to become operational in 2013, and will run on biomass until December 2015, when the plant has used its remaining hours under the LCPD.

# Belgium

GDF SUEZ  two full retrofitted coal power plants to wood pellets in Belgium.

Iin Belgium, GDF SUEZ currently operatestwo full retro-fitted coal power plants to wood pellets :

- Awirs 4 since 2005 – 80MWe Biomass (wood pellets)
- Rodenhuize Unit 4  - since 2011 – 200MWe Biomass (wood pellets) – MAX GREEN project.

The 200 MW MaxGreen retrofit in Ghent/Rodenhuize is a world premiere for the emission level that are fulfilled with wood pellets firing at that size. This is thanks to a SCR DeNox system and Low-Nox burners that were put in place.


**Figure 8 : Picture of the Rodenhuize power plant with the infrastructures dedicated to biomass.**

Beyond the “on-site” technical challenges related to the conversion of coal power plants to biomass (wood pellets) (emissions management, health and safety, combustion efficiency and boiler availability), off-site logistics is also crucial to secure qualitative and sustainable fuel supply.  For this reason,, GDF SUEZ has its own sea vessels for delivering wood pellets from Vancouver in British Columbia.

Moreover it can rely on the sustainability verification system developed by Laborelec and SGS, that is recognized by both Flemish and Walloon regions for the grant of Green Certificates. Greenhouse gas balance of the wood pellets imported from Canada and Europe are given as an example in Annex.

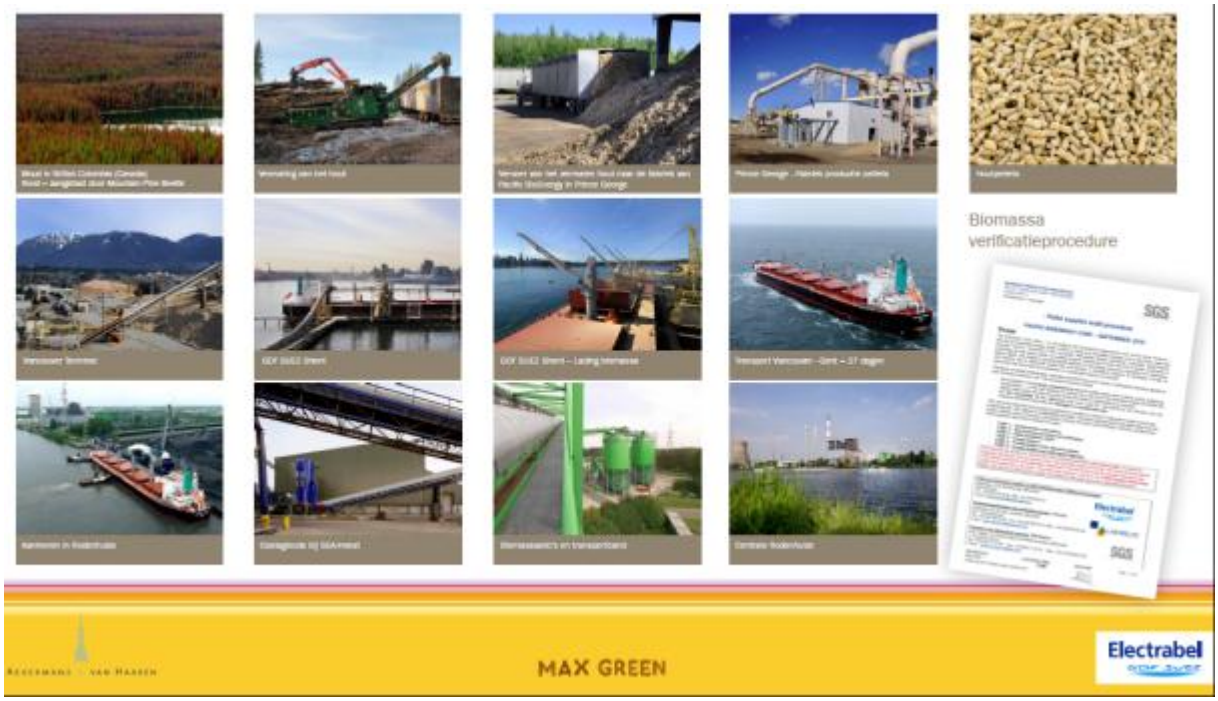


**Figure 9: Description of the supply chain of wood pellets. GDF SUEZ - Laborelec apply CO2 and Energy balance verification procedure for each step (starting from pellet plant), that is independently assessed by SGS .**

In Belgium, green certificates are granted according to the net energy or GHG balance of the supply chain. Last years the share of granted green certificates has been reduced in Flanders for co-firing including full biomass retrofits.

# 3. Pellet quality and certification

The quality requirements for industrial wood pellets are different compared to those for residential use (premium pellets). The combustion technology (temperature, boiler and burners configuration) and the logistics facilities (transport off- and on-site, storage capacity) will largely determined the quality requirements. Therefore not all industrial actors have strictly the same technical specifications for their wood pellets contracting. However, all acknowledge the need for a common reference of technical specification in case wood pellet bulks are traded.

The Wood Pellet Buyers Initiative (WPBI) gathering the main utilities using wood pellets in Europe in large scale applications aims at defining such a reference system for technical specifications, among the industrial actors. Their approach is complemented by a consultation of the audit companies and wood pellet producers. The latest are indeed interested in knowing which are the technical parameters they have to comply with, to avoid any risk of contractual problems and ensure their access to the bulk market. They had the opportunity to express their view on some of the technical limitations they face.

The more critical points of discussion regarding pellet quality were: the percentage of fines, ashes, chlorine, the durability and the particle size distribution.

These parameters are key issues with regard to the security of the wood pellets sea transport and handling (fines and durability), the combustion efficiency (particle size), availability of the boiler (ash and chlorine) and environmental regulation (air emissions – heavy metals).

The final agreement among the user lead to a list of 3 specifications, with different levels of requirements.

I1 : 100% biomass

I2: 100% biomass and large co-firing

I3: < 20% co-firing

Additives are authorized in these specifications with a maximum content of 3% on dry weight. Only vegetal additives are authorised (based on NL regulation and DK list of authorized products). Some of the utilities may forbid additives given the local regulation, e.g. U-K where additives are submitted to a full sustainability assessment.

This document remains a draft version that will be discussed further with the suppliers (March 2012).



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There is neither a standard, nor a label of quality for the industrial wood pellets, yet, as the technical specifications were applied according to an internal procedure (end-user's specific). The technical proposal will be proposed as a basis for the ISO 238 standard development[2]; The verification of these parameters should be performed by independent audit companies such as SGS, Control Union, Inspectorate.

The EN plus labelling of the wood pellets bulks would then facilitate the trade between the users. It will also enable more sustainable use of convenient fuel, for a given power/heat technology.

See the proposed specifications in Annex.

[2] ( *It has been submitted to Ella Alakangas (in the framework of EUBIONET 3 _ March 2012).*

# 4. Sustainability

Since 2008 there has been a steady increase of biomass use for energy and transport fuel applications, leading to some issues of public acceptance and critics about the lack of sustainability of such a "bio-mess" (Greenpeace, 2011). Sustainability criteria are included in the Renewable Energy Directive, for the liquid biofuels and bioliquids. Though EURELECTRIC and AEBIOM have clearly reported sector's expectations for such sustainability framework applied to the solid and gaseous biomass, no decision has been communicated by the European Commission (to date March 2012).

However, this didn't prevent several Member States to define their own (differing) biomass sustainability obligation.

Belgium was the first country to require partial sustainability criteria for allocation of Green Certificate. *The Belgium systems in Wallonia and in the Brussels region are based upon avoided CO2 emissions with respect to a defined reference and require a traceability of the supply chain.*

In the UK, the Renewable Energy Certificates (ROCs) have to be linked to binding sustainability criteria as per 1 April 2013. The Netherlands has the so called 'green deal' between the government and energy sector to keep the share of cofiring at 10% in period 2012-2015 with binding RED sustainability criteria. Various other European countries already cover limited sustainability aspects (e.g. only on end-use efficiency or sourcing) in their national schemes.

On the other hand, some countries are against any new obligation on forest management, such as Sweden (SQ Consult, Dec 2011).

Beyond the forestry management aspects that can be partly certified on basis of the FSC, PEFC and similar schemes, there is also a need for each industrial actor to develop a methodology for the $CO_2$ balance calculation. Such methodology consists in data gathering calculation methodology (proposal made by the Commission in the Annex I of the 2010 report on *sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling*).

Until now, there remain a gap in homogeneity in the adoption of this methodology as each EU country requires a specific method to be applied. The BIOGRACE 2 project objective is to define common methodology and data references for the solid biomass for bio-energy applications. Laborelec and AEBIOM are involved in this project (starting in 2012).

Meanwhile, the major industrial users of wood pellets have decided, in 2010, to sit together to define which should be the minimum requirements for sustainable wood pellets bulks, to facilitate the

trading. The utilities involved in the Wood Pellets Buyers Initiative (WPBI), have thus worked on a proposal of nine sustainability principles, along with the definition of technical specifications. These principles and the description of criteria attached are based on an aggregate of the following utilities' experiences with their systems:

- the Green Gold Label developed by Essent and Control Union in the Netherlands,
- the corporate approach developed by Drax in the UK for biomass sustainability,
- the agreement of Vattenfall with the Senate of Berlin for the use of biomass as a sustainable fuel,
- the verification procedure developed by Laborelec and SGS in Belgium for the grant of green certificates with sustainable solid biomass.

This proposal is meant as a description of the needs of the utilities participating to IWPB for trading biomass fuel and for covering their corporate risk management when generating bio-energy.

The sustainability documents from which the following nine principles are extracted, should however not be considered yet as a formal engagement of the six utilities since their management has not yet formally approve and endorse the current documents.

There exist other examples of voluntary standards or initiatives such as the NTA8080/8081, or the Blue Angel Label in Germany, who has recently included chips and pellets for stoves and boilers. Other large utilities such as Electricité de France or Enel have started their analysis on these topics; however they have not yet led to proposed criteria, and potentially, they could adopt a different set of sustainability criteria for their operations. (SQ Consult, 2011).

# 5. Conclusions and outlook

The 20/20/20 EU Renewable Energy targets require installed biomass power generation capacity to be increased from circa 24 GW in 2010 to 43 GW by 2020. A massive expansion of biomass power and heat generation will be required – both new build and the adaption or conversion of existing fossil plant (EURELECTRIC 2011).

Which will require at least a doubling of the wood pellets use in medium to large power and heat plants. EUBIONET 3 has evaluated the increase of pellet demand for power production up to 2015:

- UK: 4,5 Mt (estimation RWE)
- Netherlands: 1,5 Mt (estimation RWE)
- Denmark: 1,5 Mt (estimation FORCE)

*Following Sikkema and al, scenarios, additional 2020 demand for woody biomass varies from 105 million tons, based on market forecasts for pellets in the energy sector and a reference growth of the forest sector, to 305 million tons, based on maximum demand in energy and transport sectors and a rapid growth of the forest sector. Additional supply of woody biomass may vary from 45 million tons from increased harvest levels to 400 million tons after the recovery of slash via altered forest management, the recovery of waste wood via recycling, and the establishment of woody energy plantations in the future. Any short-term shortages within the EU-27 may be bridged via imports from nearby regions such as north west Russia or overseas.*

*(Sikkema, The European wood pellet markets: current status and prospects for 2020, 2011 )*

Similarly the EURELECTRIC report "Biomass 2020: Opportunities, Challenges and Solutions" (EURELECTRIC 2011) reports that the supply gap (around 25-40 Mtoe) of solid biomass production in EU could be filled by the annual importation of 60-90 million tonnes of pellets from outside the EU. Internal market conditions may imply that imports are even higher.

Stable, consistent and sufficient incentives are required for the production of electricity and heat from biomass towards the 2020 RES target (EURELECTRIC 2011). It is a prerequisite for such an evolution on the large scale power and heat production.

Due the economic crisis there is a risk for less "industry waste" raw material for wood pellets production, which leads to sustainability questions, when it comes to the use of whole logs or forest residues. Therefore, to be sustainable, the industrial wood pellets market does require to have a well-defined market environment. This doesn't only involve the need for more stable policies, but also a secured trade based on common technical references and sustainability requirements.

The largest actors are already positioning themselves in the framework of the WPBI. The work that has been done in the working groups could be a good basis for the development of the ENplus standard for industrial wood pellets.

The producers should however be consulted by 2012, as well as the NGO's and audit companies, so as to receive all stakeholders expectations and perceptions.

# Annex

- Characteristics of the different wood pellets market actors – large scale and medium scale users
- Wood pellet specifications as proposed by IWPB (31.01.2012)
- Overview of pellet markets world wide
- **R**esults from the audits performed on the wood pellets supply chain

**Characteristics of the different wood pellets market actors – large scale and medium scale users (Sikkema, The European wood pellet markets: current status and prospects for 2020, 2011 )**

| | Large-scale users (bulk) | Medium-scale users (bulk) |
|---|---|---|
| Suppliers | International pellet production plants. | European pellet production plants. |
| Intermediate companies | International operating traders (with one main European office) | Predominantly domestic traders |
| Typical way of transport | (Inter-) continental shipping (in Panamax or Handymax vessels, freights: 10 000 to 100 000 tonnes). | European short sea shipping (average 5000 tonne) or lorry transport (max volumes 40 tonnes). |
| Contracts | Both long-term contracts (up to 3 years) and purchase from short-term markets, e.g. within one month deliveries. | Predominantly long-term contracts (up to 3 years), plus short-term delivery from daily spot markets. |
| Number of demand players per country | Few, internationally operating utilities. For example, in 2009, the Netherlands had four power companies that cofired wood pellets in six existing units. | For example, Sweden has about 100 district heating plants, using pellet boilers. In Denmark larger CHP plants use pellets, too. |
| Actual storage at end users | Both at harbor (up to 200 000 tonnes) and on-site (up to 10 000 tonnes per plant). Annual stock changes at a country level may be considerable. | Storage in harbors could be large, up to 10 000 tonnes (like in Sweden). On site less stock volumes needed: up to 500 tonnes. |
| Quality requirements | Company-specific criteria, like in harbors.[46] Implementation of a flexible, pan European EN 14961-1 standard for industrial pellets[47] since April 2010. Feedstock may exist of woody biomass, herbaceous biomass, fruit biomass or blends and mixtures. | |

| All impacts in € per tonne pellet | Large-scale users (bulk) | Medium-scale users (bulk) |
|---|---|---|
| Feedstock costs | Topic W. USA: upward price in 2010 for delivered sawdust: €45/tonne pellet. Proposal USA: BCAP programme subsidy for feedstock (equal to €13 per tonne[62]). | Topic Latvia: Since 2008: low quality logs (and chips) are also used.[33] Higher feedstock costs and primary energy input.[7] |
| Pelletization costs | Topic Canada: larger-scale plants are constructed for lower costs per tonne of pellets.[61] | Topic Sweden: higher costs for power consumption per tonne of pellet produced[7] |
| FOB prices | Topic USA & Canada: upward prices in 2010: level €110-115 per tonne.[31] | Topic Russia & Latvia: upward prices 2009 between €105–115 tonne.[34] |
| International pellet transport | Ocean shipping prices are fluctuating: between €30 and €70 per tonne in 2007–2010.[57–59] | Short sea shipping: in 2009 about €20 per tonne from Riga and €25 from St Petersburg.[33,59] |
| | Some future options. First a $CO_2$ levy on international shipping fuels:[65] a levy of €15 per tonne $CO_2$ results in €4 per tonne pellet extra costs, based on 16 500 km distance and 15.9 g $CO_2$ emissions per tonnekm.[66] Second, torrefied wood pellets (TWP) are developed for long distance shipping. TWP are assumed to have 40% lower transportation costs per unit.[61] | |
| CIF prices | Topic Netherlands: Fluctuating APX-Endex prices, currently above €130 per tonne.[29] | Topic Sweden: upward 2010 Foex price level of about €135 per tonne pellet.[30] |
| | Note: Long-term (instead of short-term) contracts are most common, with purchases up to 3 years ahead of delivery. | Note: reported FOB prices Russia,[9,34] plus sea freight and handling[33,59] are just below CIF prices.[30] |
| Final use (energy conversion) of wood pellets | Topic Netherlands: Public supported feed-in tariffs, €0.05 to €0.07 per $kWh_e$ (€120 to135), will gradually disappear after 2012. | Topic Sweden: €10 per $GJ_{th}$ tax on $CO_2$ and sulphur emissions, equal to about €160 per tonne.[7] |
| Government subsidies | Topic Netherlands: new options proposed (e.g. min. biomass share cofiring).[67] | Topic Poland: share of agro residues of 100% in 2015 for >5 MW plants.[8] |
| | Topic UK: reduced ROC subsidies for cofiring, down to £45 per $MWh_e$,[31,68] equal to €100 per tonne pellet. | Topic UK: RHI for dedicated biomass use in heating plants. Tariff for large plants (>0.5 MW) are £16 to £25 per $MW_{th}$, equal to €85-€135 per tonne pellet.[69] |



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## Wood pellet specifications as proposed by IWPB (31.01.2012)

| WOOD PELLETS SPECIFICATIONS | 31/1/2012 - YR | CEN | ISO TC238 | Initiative Wood Pellets Buyers: Industrial wood pellets specifications | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| PARAMETERS AND REJECTION LIMITS [4] | Units | Standard | Reference | I1 industrial | | I2 industrial | | I3 industrial | | Check performed by |
| **Origin and source** | Only accepted | EN 14961-1 | | 1.1 Forest, plantation and other virgin wood, 1.2.1 chemically untreated wood residues | | 1.1 Forest, plantation and other virgin wood, 1.2.1 chemically untreated wood residues | | 1.1 Forest, plantation and other virgin wood, 1.2.1 chemically untreated wood residues | | insp & lab |
| sampling | | EN 14778 | | | | | | | | insp |
| Quality check | | | | | | | | | | insp |
| sample preparation | | EN 14780 | | | | | | | | insp |
| water damage | | | | | | | | | | insp |
| burned/charred pellets | | | | | | | | | | insp |
| **Additives (composition, mass )** | weight% ar | EN 14961 | | < 3% biomass only | | < 3% biomass only | | < 3% biomass only | | declared by seller |
| --> biomass defined according to Danish list | | DK/OFGEM | | sustainability proven for UK | | sustainability proven for UK | | sustainability proven for UK | | seller |
| **Physical parameters** | | | | Limit | Tolerance | Limit | Tolerance | Limit | Tolerance | |
| Diameter | mm | EN16127 | all 6 **or** 8 | 6 **to** 8 | 0,5 or dye size | 6 **to** 10 | 0,5 or dye size | 6 **to** 12 | 0,5 or dye size | insp & lab |
| Length | mm | EN16127 | same | ≤ 40 mm | within range | ≤ 40 mm | within range | ≤ 40 mm | within range | insp & lab |
| Water content | weight% ar | EN 14774 | same | ≤ 10 % | 0,5% absolute | ≤ 10 % | 0,5% absolute | ≤ 10 % | 0,5% absolute | insp & lab |
| Bulk (apparent) density | kg/m3 | EN 15103 | same | ≥ 600 | 2% of limit | ≥ 600 | 2% of limit | ≥ 600 | 2% of limit | insp & lab |
| Maximum bulk temperature | °C | EN15234-2 | NA | ≤ 60 | within range | ≤ 60 | within range | ≤ 60 | within range | insp |
| Net calorific value at constant pressure | GJ/ton ar | EN 14918 | I1 ≥ 17 | ≥ 16,5 | 0,3 GJ/ton | ≥ 16,5 | 0,3 GJ/ton | ≥ 16,5 | 0,3 GJ/ton | lab |
| Ash content | weight% DM | EN 14775 | 1,5%-same-5% | ≤ 1,0% | 10% of limit | ≤ 1,5% | 10% of limit | ≤ 3% | 10% of limit | lab |
| Melting temperature | °C | *EN 15370* | to be stated | ≥ *1200°C* | within range | ≥ *1150°C* | within range | ≥ *1000°C* | within range | *lab* |
| **Elementary composition** | | | | | | | | | | |
| Cl | weight% DM | EN 15289 | all ≤ 0,05 % | ≤ 0,03% | 0,01% absolute | ≤ 0,05 % | 0,01% absolute | ≤ 0,1 % | 20% of limit | lab |
| N | weight% DM | EN 15104 | same | ≤ 0,3% | 0,05% absolute | ≤ 0,5 % | 10% of limit | ≤ 1,5 % | 10% of limit | lab |
| S | weight% DM | EN 15289 | all ≤ 0,05 % | ≤ 0,05 % | 0,01% absolute | ≤ 0,2 % | 20% of limit | ≤ 0,4 % | 20% of limit | lab |
| **Trace elements** | | | | | | | | | | |
| As | mg/kg DM | EN 15297 | same | ≤ 2 | 0,064 absolute | ≤ 2 | 0,064 absolute | ≤ 2 | 0,064 absolute | lab |
| Cd | mg/kg DM | EN 15297 | same | ≤ 1 | 0,06 absolute | ≤ 1 | 0,06 absolute | ≤ 1 | 0,06 absolute | lab |
| Cr | mg/kg DM | EN 15297 | same | ≤ 15 | 0,032 absolute | ≤ 15 | 0,032 absolute | ≤ 15 | 0,032 absolute | lab |
| Cu | mg/kg DM | EN 15297 | same | ≤ 20 | 0,043 absolute | ≤ 20 | 0,043 absolute | ≤ 20 | 0,043 absolute | lab |
| Pb | mg/kg DM | EN 15297 | same | ≤ 20 | 0,033 absolute | ≤ 20 | 0,033 absolute | ≤ 20 | 0,033 absolute | lab |
| Hg | mg/kg DM | EN 15297 | same | ≤ 0,1 | 0,0046 absolute | ≤ 0,1 | 0,0046 absolute | ≤ 0,1 | 0,0046 absolute | lab |
| Zn | mg/kg DM | EN 15297 | same | ≤ 200 | 5,43 absolute | ≤ 200 | 5,43 absolute | ≤ 200 | 5,43 absolute | lab |
| **Fines ≤ 3,15 mm** | weight% ar | EN15149 | same | ≤ 4 % | 0,5% absolute | ≤ 5 % | 0,5% absolute | ≤ 6 % | 0,5% absolute | insp & lab |
| **Durability** | weight% ar | EN 15210 | same-97,5-96,0 | ≥97,5% | 0,5% absolute | ≥ 97% | 0,5% absolute | ≥ 96,5% | 0,5% absolute | lab |
| | | | | | | | | | | lab |
| **Particle size distribution** | | EN15149-2 | | | | | | | | |
| % < 3,15 mm | weight % | EN 16126 | NA | >99% | 1% absolute | >98% | 1% absolute | >97% | 1% absolute | lab |
| % < 2,0 mm | weight % | EN 16126 | NA | >95% | 2% absolute | >90% | 2% absolute | >85% | 2% absolute | lab |
| % < 1,0 mm | weight % | EN 16126 | NA | >60% | 5% absolute | >50% | 5% absolute | >40% | 5% absolute | lab |



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| |
|---|
| **1. Origin and source** |
| Raw material origin and source has to be stated according to table 1 in EN 14961-1 |
| **2. Temperature** |
| Bulk maximal temperature shall be checked when the pellets leave the final point of loading for delivery to the end-user. i.e leaving the final storage point or the factory: |
| This is the maximum temperature measured at any spot |
| If temperature is above limit, additional independent check must be organized by supplyer to convince the buyer that the pellets are safe. If not, pellets are rejected. |
| **3. Ash melting behaviour, voluntary in EN 14961-2.** |
| EN 14961-2 has ash melting informative (voluntary) and ENPlus DT temperature is requested and ashing temperature 815oC. Ash content is determinated in temperature 550oC. |
| NOTa rejection value |
| All characteristic temperatures (shrinkage starting temperature (SST), deformation temperature (DT), hemisphere temperature (HT) and flow temperature (FT) in oxidizing and reducing atmosphere should be stated. |
| **4. Tolerance** |
| All values are supposed to be rejection limits, except with explicit opposite mention |
| Values in red are proposals in absence of any mention in the EN standard |
| Tolerance is on the measurement between different laboratories as mentioned in the EN standards: in practice limit is increased with tolerance |
| Rejection limit is supposed to be the limit + tolerance if maximum and limit-tolerance if minimum |
| **5. Fines for industrial pellets** |
| The amount of fines shall be checked when the pellets leave the final point of loading for delivery to the end-user. i.e when loading at the harbour |
| **6. Inspection and labs** |
| Performed by: -Lab: analyses will be performed by the independent laboratory; - Insp: test will be performed by the inspection company; |
| -Insp & lab: means a field test will be performed by the inspection company, the final value will be analysed by the lab |
| **7. CEN Standard** |
| EN vs CEN TS: The latest version of the prescribed EN standard shall be used. |
| When the EN standard has not yet been published the prEN shall be used or the CEN/TS (in this order of availability) |
| [d] All characteristic temperatures (shrinkage starting temperature (SST), deformation temperature (DT), hemisphere temperature (HT) and flow temperature (FT) in oxidizing conditions should be stated. |
| **8. Fines ≤ 3.15 mm** |
| Round hole sieves |
| Limit for dust < 0,50 mm might be considered if appropriate according to statistics |
| **9 particle size distribution** |
| Square hole sieves |



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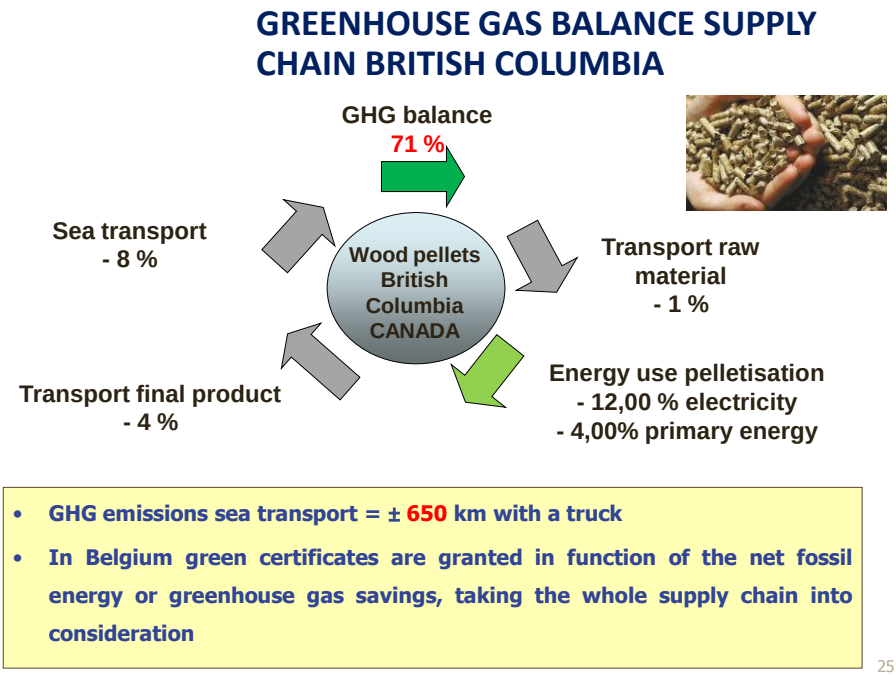
## Overview of pellet markets world wide

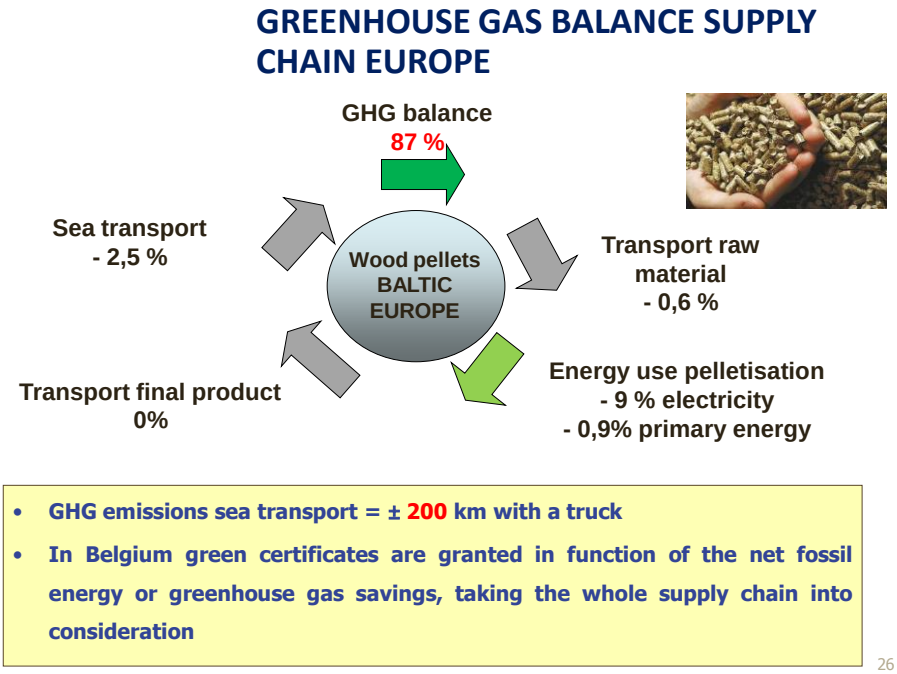
| Countries | Number Producers | Production | Consumption | Export (Import) | Nature of Markets |
|---|---|---|---|---|---|
| **Region: Europe** | | | | | |
| Austria | 25 | 626,000 | 509,000 | 117,000 | Heating |
| Belgium | 10 | 325,000 | 920,000 | (595,000) | Power/heating |
| Bulgaria | 17 | 27,200 | 3,000 | 24,200 | Heating |
| Cyprus | 0 | 0 | 0 | 0 | |
| Czech Rep | 12 | 27,000 | 3,000 | 24,000 | Heating |
| Denmark | 12 | 134,000 | 1,060,000 | (926,000) | Power/heating |
| Estonia | 6 | 338,000 | 0 | 338,000 | |
| Finland | 19 | 373,000 | 149,200 | 223,800 | Heating |
| France | 0 | 240,000 | 200,000 | 40,000 | Heating |
| Germany | 50 | 1,460,000 | 900,000 | 560,000 | Power/heating |
| Greece | 5 | 27,800 | 11,100 | 16,700 | Heating |
| Hungary | 7 | 5,000 | 10,000 | (5,000) | Heating |
| Ireland | 2 | 17,000 | 30,000 | (13,000) | Heating |
| Italy | 75 | 650,000 | 850,000 | (200,000) | Heating |
| Latvia | 15 | 379,000 | 39,000 | 340,000 | Heating |
| Lithuania | 6 | 120,000 | 20,000 | 100,000 | Heating |
| Luxemburg | 0 | 0 | 5,000 | (5,000) | Heating |
| Malta | 0 | 0 | 0 | 0 | |
| Netherlands | 2 | 120,000 | 913,500 | (793,500) | Power/heating |
| Norway | 8 | 35,100 | 39,800 | (4,700) | Heating |
| Poland | 21 | 340,200 | 120,000 | 220,200 | Heating |
| Portugal | 6 | 100,000 | 10,000 | 90,000 | Heating |
| Romania | 21 | 114,000 | 25,000 | 89,000 | Heating |
| Slovakia | 14 | 117,000 | 17,550 | 99,450 | Heating |
| Slovenia | 4 | 154,000 | 112,000 | 42,000 | Heating |
| Spain | 17 | 100,000 | 10,000 | 90,000 | Heating |
| Switzerland | 14 | 70,000 | 90,000 | (20,000) | Heating |
| Sweden | 94 | 1,405,000 | 1,850,000 | (445,000) | Power/heating |
| UK | 15 | 125,000 | 176,000 | (51,000) | Power/heating |
| | 477 | 7,429,300 | 8,073,150 | (643,850) | |
| **Region: North America** | | | | | |
| Canada | 31 | 1,200,000 | 200,000 | 1,000,000 | Heating |
| USA | 97 | 1,800,000 | 2,096,150 | (296,150) | Heating |
| | 128 | 3,000,000 | 2,296,150 | 703,850 | |
| **Region: Latin America and Asia** | | | | | |
| Brazil | 1 | 25,000 | 25,000 | 0 | Heating |
| Argentina | 1 | 7,000 | 7,000 | 0 | Heating |
| Chile | 1 | 20,000 | 20,000 | 0 | Heating |
| China | 1 | 50,000 | 50,000 | 0 | Power/heating |
| India | 0 | 0 | 0 | 0 | |
| Japan | 55 | 60,000 | 109,000 | (49,000) | Power/heating |
| Korea | 1 | 10,000 | 10,000 | 0 | |
| New Zealand | 5 | 20,000 | 20,000 | 0 | Heating |
| | 65 | 192,000 | 241,000 | (49,000) | |
| | 670 | 10,621,300 | 10,610,300 | 11,000 | |

Sources: pellet@las, IEA Bioenergy, FA/UNECE, USDA

### Results from the audits performed on the wood pellets supply chain

*The GreenHouse Gas balance of the wood pellets originating from British Columbia and from Europe (Baltic) is compared in the two next figures.*




The instability of support to green power in Belgium – which had some impacts on Max Green.

## MAX GREEN STABLE GREEN SUPPORT ?

| Value green certificates | |
|---|---|
| 2011 | 125 € |
| 2012 | 118 € |
| 2013 | 100 € |

| Green certificates % for co-firing | |
|---|---|
| Before 2010 | 100% |
| 100% firing MaxGreen | 89% |
| 100% firing after 2010 | 70% |
| Co-firing after 2010 | 50% |