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UNIVERSITY of OULU
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Pellet industry

A driving force for the Karelian Region

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FOREWORD

This paper aims to provide an outline of the pellet industry with its best practices, and a brief market overview supported by case studies. It is not intended to be a technical reference paper, rather to provide the parties involved in the project with the basic knowledge about the pellet industry.

PELLETS IN BRIEF

As defined by the International Energy Agency (IEA) “pellets are a solid biofuel with consistent quality – low moisture content, high energy density and homogenous size and shape” [18].

Pellets may be produced from different raw materials. In this paper, raw materials are organic based and are primary used as fuel for heating purposes. The first and most common raw material is wood. Two types of wood have been identified: softwood and hardwood. Softwood is the name used for any coniferous trees, while hardwood represents all the others. In the North-West part of Russia, softwood species are mostly composed by spruce, pine and larch, and hardwood is mostly found as birch, aspen and alder [13]. Other types of raw material that be used are bark, energy crops (any kind of agricultural crops) and herbaceous plants. Herbaceous plants are a family of biomass compounds that include straw and whole crops and thus can also be considered as energy crops. Note that other potential biomass sources such as peat have not been considered in this study because the target of the project was to focus on the utilization of waste from forest industry. Once the raw material has been selected, it is possible to process it and produce pellets. The pellet production phase will be described in the next section. Pellets usually have a diameter size between 6 mm to 10 mm[1] and a length of 3.5 mm to 40 mm (PrEN 14961-2).

FABRICATION PROCESS

The fabrication process can be divided into three main steps where the raw materials will be prepared, processed and conditioned in order to be sold on the market.

PRE-TREATMENT

First of all, the raw material has to be pre-treated: it includes the size reduction of the raw material, the drying and the conditioning of the raw material. It has to be remembered that in order to obtain a 6 mm diameter pellet, the raw material size entering the pellet mill cannot be higher than the requested pellet diameter. Indeed, the raw material can enter the pellet factory under different forms such as wood logs, wood shaving or sawdust. Furthermore, if high quality pellets want to be reached, bark should be separated from the raw material (see the quality section for more information). Thus, the wood has to be processed in a hammer mill where its size will be reduced to the requested size.

Once all the raw material has been reduced, the processed raw material is collected into one big tank where it will enter a drying machine; it thus enters the drying process. The drying process is a very important part of the pelletization process when considering the commercialization of the wood pellet as an end product. Indeed, with the expenditure of the pellet technology throughout Europe, the standard

[1] According to PrEN 14961-2, the maximum allowed pellet diameter is to be 8 mm for non-industrial use

pellet quality set by the end-users tends to increase. Thus, certification of the wood pellet, based on European standard, will increase the quality requirement for the whole industry and then quality wood pellet will require a high control on the moisture content (among other) of the raw material.

Drying process can be achieved following two main principles: the natural drying process where the material is dried up only by laying off the material. Using this technique does not give the control over the moisture content of the material. Thus, when commercial pellet has to be manufactured, the forced drying process has to be used and the natural drying process becomes some sort of pre-treatment of the forced drying process. Thek & Obernberger (2010) have identified five different forced drying processes that is used by the wood industry: the tube bundle dryier, the drum dryer, the belt dryer, the low temperature dryer and the superheated steam dryer.

TUBE BUNDLE DRYER

The tube bundle dryer (Figure 1) is a common technology where the heating medium (e.g. Steam, thermal oil, hot water) and the raw material are not in direct contact. The average drying temperature is around 90°C which minimize the emissions of organic and odorous substances.

FIGURE 1 TUBE BUNDLE DRYER [11]

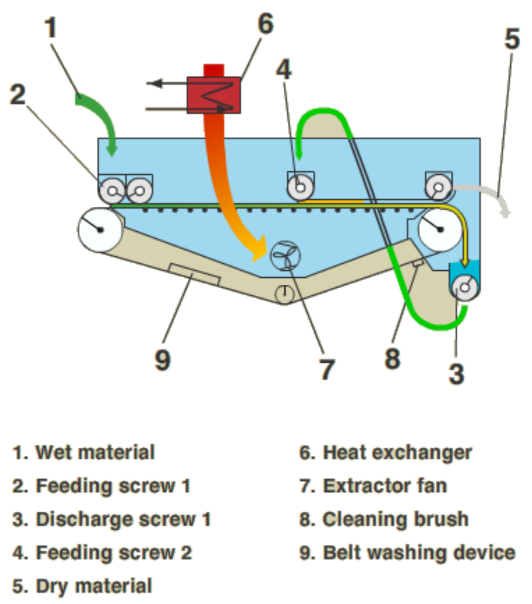
DRUM DRYER

In the drum dryer (Figure 2), the operating temperature may be between 300°C up to 600°C. Two types of drying methods can be used: the direct and the indirect drying method. The direct drying method can rather use the exhaust gases or the processed air directly to dry up the material. The indirect drying method will use a heat exchanger to heat up air in a close loop. The heat exchanger may use in the primary loop steam, flue gases or any kind of heat recovery system.

It is common that the drying process ends up in a cyclone in order to remove the dust that may fly with the drying medium. This recovery method allows increasing the overall efficiency and minimizing the waste. Many types of drum dryer may be found such as the atmospheric single and double drum dryer, atmospheric twin drum dryer, enclosed drum dryer and vacuum double drum dryer [9].

FIGURE 2 DRUM DRYER [1]

BELT DRYER



Belt dryer, or conveyer dryer is a very basic system to dry up any kind of raw material, however sawdust remains to be the traditional material to be dried using belt dryer.

The drying time will vary much depending on the moisture content of the raw material. As detailed in the above section, belt conveyor dryers may use both direct and indirect drying method. The drying temperature is rather low compared to other methods (~90 – 110°C).

Figure 3 Belt Dryer – process [17] **Error! Reference source not ound.** shows the basic principle of a belt dryer. The drying medium crosses the belt vertically (from up to downwards the belt or vice versa) in order to dry the raw material. Multiple types of belt dryer can be found such as the single pass/single stage, single pass/multiple stages, and multiple pass belt dryers [9]

LOW TEMPERATURE DRYER (LTD)

The low temperature dryer (Figure 4) is a quite new technology on the market. It can be used for drying sawdust, woodchip or bark. It has usually two stages in the drying process. The LTD always uses the indirect drying method, thus heat exchangers are in the loop, one on each stage. First of all, the ambient air is brought in the system, cross the first heat exchanger to reach a temperature between 50 to 100°C. The air then enters the second stage of the raw material circuit (the driest part). The air goes through a second heat exchanger where it will be warmed up. Then the air enters the first stage of the drying circuit (the wettest part) to dry up the raw material. After the drying process, the air is brought to an air filter to clean the exhaust air stream [18].

Figure 4 Low Temperature Dryer. Source: [7]

Super-heated steam (SHS) dryer

As the name of this type of drying system suggest, super-heated steam dryers use super-heated steam in order to remove the water content from the wood. This technology works in a close loop system where it is always the same air that is used and re-used to dry the wood. Thus, the drying process takes place through direct contact between the matters that have to be dried up and the steam. This technique has many advantages, for instance it is not necessary to have fresh steam coming in the system because it re-uses the moisture from the wood [19]. One of the factors that should be controlled for this process to work properly is the water content in the steam, thus the extra water must be removed from the cycle. This extra water can be first reprocessed in a heat exchanger to produce hot water for the heating system for instance before the handling of the condensate in order to remove the particle content. Before getting into the dryer, the steam has to be heated up to the dewpoint temperature (usually 100°C). Once the steam reaches this temperature, the saturated steam becomes super-heated steam. The SHS dryer will deliver heat to the wood and the moisture contained in the wood will start to boil and evaporate [15]. It is important to mention that SHS systems do not represent any fire or explosion hazards neither oxidation of the product despite the fact that most of those systems have a pressure above the atmospheric pressure and a steam temperature above 100°C [15]. Finally, the SHS principle can be adapted on different existing technology such as drum dryers or belt conveyor dryer, and many designs can be imagined in order to carry out an optimised drying system.

Pelletization

The pelletization process is the actual part where the raw material will be turned into a compact and small sized end-material. It usually consists of a ring or a flat die pellet mill. Flat plate die is not usually used for commercial applications. It consists of a flat circular plate filled with holes. The raw material enters from the top and a hammer push the raw material into the holes where it is compressed. On the other hand, ring dies are most commonly used for commercial use. Ring dies consist of a ring plate filled with holes in which hammers are fit in (Figure 5). The ring will turn vertically and the hammer will push the material into the holes. It allows a greater surface for pelletizing and is thus more time efficient.

FIGURE 5 RING DIE [20]

Before selecting the pellet mill, the type of raw material and the share of the different raw material that can be used must be detailed in order to select the right thickness of the die, channel length but also the quantity of holes on the die and so on. Indeed, when selecting the pellet mill, influent factors such as the press ratio (ratio between the diameter of the hole and the length of the channel) must be defined.

POST-TREATMENT

Figure 6 represents the complete diagram that the raw material has to take in order to produce quality pellets.

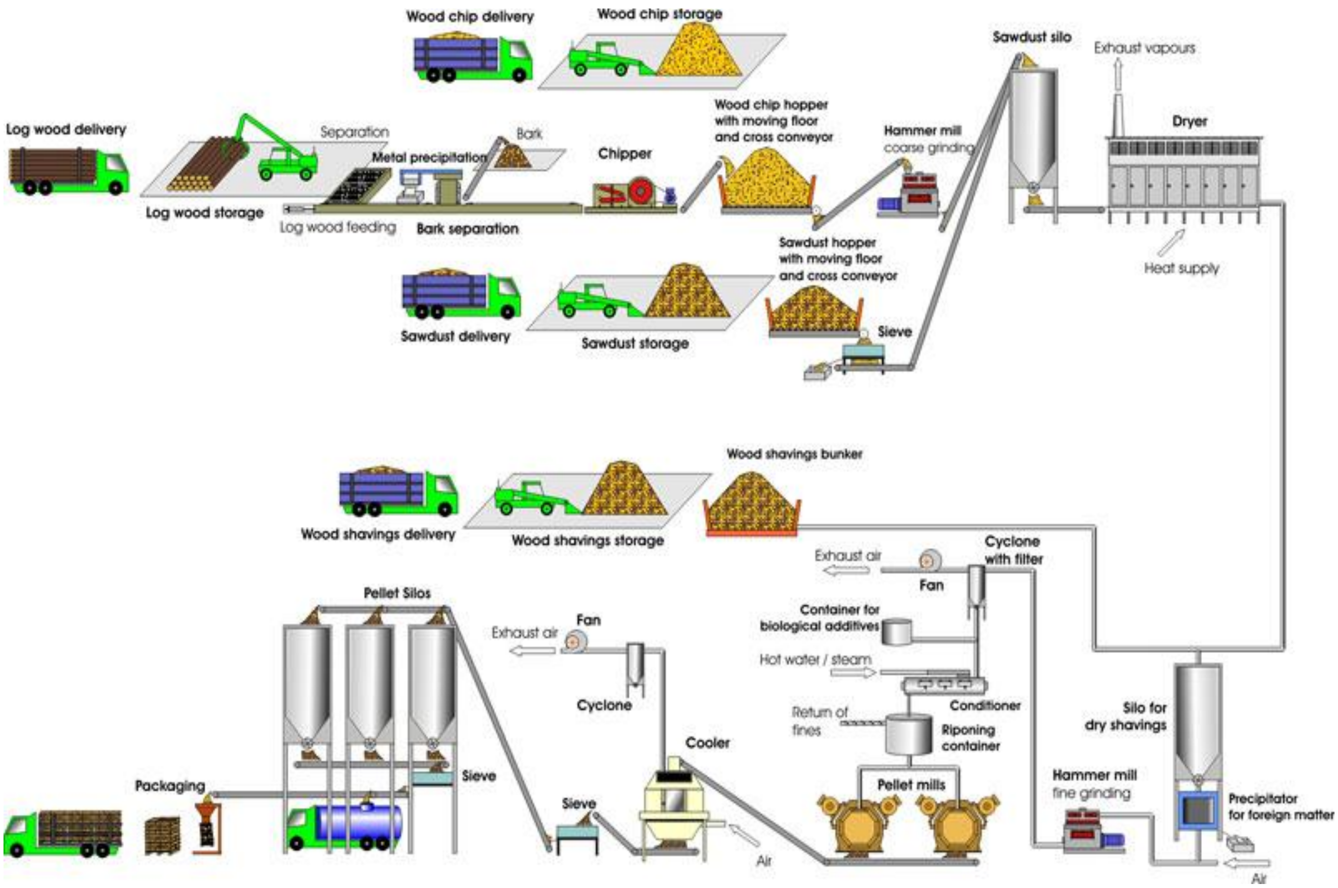


FIGURE 6 PELLET FABRICATION PROCESS [2]

The post treatment process consists of cooling the pellets and packaging. Usually, pellets can reach a temperature between 80 to 130°C after the pelletization process. Thus, pellets must be cooled down before packaging. Also, cooling will contribute to the reduction of the humidity content of the pellet. It has to be remembered that the air used in the different steps should be processed in order to remove as much dust as possible through cyclones. After cooling, the pellets will be packed in different bag size depending on how it has to be delivered. Bags may be small or middle size. Pellets may also be transported as bulk.

PELLETS QUALITY

As mentioned earlier, the quality of pellets is a key issue when speaking about the commercialization of wood pellets. In order to prove that a product has the required quality targeted, when designing the manufacturing process producers should go through the certification process. Russian companies ought to comply with the European certification system if they want to maintain their 90 % share of their production going on the European market. As it will be explain later, the European market is suffering from a lack of pellets and, thus, countries with a great forest industry should be on the front line to answer this need.

So far in Europe, there is only one certification system to attest to the quality of pellets, and is handled by the European Pellet Council (EPC). As most certifications, the ENplus certification for pellet aims to certify the quality system of the company as well as the product, which implies that pellet manufacturers must have a quality system that records every steps of the pellet manufacturing process, including sampling, in order to guarantee the quality of the end product manufactured. Then, as most of the certification for products in Europe, the ENplus certification has based its quality product certification on a set of European standards that deals with quality product: EN 14961. So far, the EN 14961 series has five parts where the first one set the general requirement for every solid biofuels (EN 14961-1), the second part will deal with wood pellet for non-industrial use (EN 14961-2), the third part will deal with wood briquettes for non-industrial use (EN 14961-3), the fourth part will deal with wood chips for non-industrial use (EN 14961-4) and the fifth part already deal with firewood for non-industrial use (EN 14961-5). Table 1 is an extraction of the EN 14961-1 where the different sources of wood are detailed[2] and Table 2 details the minimum requirements that pellet must have in order to be classified in the different quality categories.

The EN 14961-2 sets requirements for the chemical contents of each pellets e.g. Sulphur, Chlorine as well as moisture content, ash content, Net Calorific Value (NVC), mechanical durability, additives, geometrical specificities of the pellet e.g. length, diameter and the bulk density. Quality of pellets can be spread into three different categories between A1, A2 and B – A1 being the high quality and B the low quality. For many of the requirements set in this standard there are many common limits for the three categories (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and zinc content as well as the minimum moisture content, the geometrical requirements, the bulk density and the use of additives). The difference between the A1 and the A2 quality will rely on the ash content of the product, the NCV and the Nitrogen content while the difference between the categories A1 and B will rely on the same set of property than A1/A2 but also the mechanical durability, the sulphur content and the chlorine content.

[2] Note that demolition wood does not enter the scope of this standard series neither does aquatic biomass

***TABLE 1** CLASSIFICATION OF WOODY BIOMASS ACCORDING TO EN 14961-1[4]*

1.1 Forest, plantation and other virgin wood	**1.1.1 Whole trees without roots**	1.1.1.1 Broad-leaf
		1.1.1.2 Coniferous
		1.1.1.3 Short rotation coppice
		1.1.1.4 Blends and mixtures
	1.1.2 Whole trees with roots	1.1.2.1 Broad-leaf
		1.1.2.2 Coniferous
		1.1.2.3 Short rotation coppice
		1.1.2.4 Bushes
		1.1.2.5 Blends and mixtures
	1.1.3 Stemwood	1.1.3.1 Broad-leaf
		1.1.3.2 Coniferous
		1.1.3.3 Blends and mixtures
	1.1.4 Logging residues	1.1.4.1 Fresh/Green, Coniferous (including leaves)
		1.1.4.2 Fresh/Green, Coniferous (including needles)
		1.1.4.3 Stored, Broad-leaf
		1.1.4.4 Stored, Coniferous
		1.1.4.5 Blends and mixtures
	1.1.5 Stumps/roots	1.1.5.1 Broad-leaf
		1.1.5.2 Coniferous
		1.1.5.3 Short rotation coppice
		1.1.5.4 Bushes
		1.1.5.5 Blends and mixtures
	1.1.6 Bark (from forestry operations)	
	1.1.7 Segregated wood from gardens, parks, roadside maintenance, vineyards and fruit orchards	
	1.1.8 Blends and mixtures	
1.2 By products and residues from wood processing industry	**1.2.1 Chemically untreated wood residues**	1.2.1.1 Without bark, broad-leaf
		1.2.1.2 Without bark, Coniferous
		1.2.1.3 With bark, Broad-Leaf
		1.2.1.4 With Bark, Coniferous
		1.2.1.5 Bark (from industry operations)
	1.2.2 Chemically treated wood residues, fibers and wood constituents	1.2.2.1 Without Bark
		1.2.2.2 With Bark
		1.2.2.3 Bark (from industry operations)
		1.2.2.4 Fibers and wood constituent
	1.2.3 Blends and mixtures	
1.3 Used wood	**1.3.1 Chemically untreated wood**	1.3.1.1 Without bark
		1.3.1.2 With bark
		1.3.1.3 Bark
	1.3.2 Chemically treated wood	1.3.2.1 Without bark
		1.3.2.2 With bark
		1.3.2.3 Bark
	1.3.3 Blends and mixtures	
1.4 Blends and mixtures		

***TABLE 2** SPECIFICATION OF WOOD PELLETS FOR NON-INDUSTRIAL USE ACCORDING TO EN 14961-2 [4]*

Property class/Analysis method	Unit	A1	A2	B
Origin and source EN 14961-1	N/A	1.1.3 1.2.1	1.1.1 1.1.3 1.1.4 1.1.6 1.2.1	1.1 1.2 1.3
Diameter D, Length L, PrEN 16127	mm	D06, 6±1; 3,15≤L≤40 D08, 8±1; 3,15≤L≤40	D06, 6±1; 3,15≤L≤40 D08, 8±1; 3,15≤L≤40	D06, 6±1; 3,15≤L≤40 D08, 8±1; 3,15≤L≤40
Moisture M (EN 14774-1 and EN 14774-2)	as received, w-% wet basis (wb)	M10≤10	M10≤10	M10≤10
Ash A (EN 14775)	w-% dry	A0.7≤0.7	A1.5≤1.5	A3.0≤3.0
Mechanical Durability DU, EN 15210-1	as received, w-% (wb)	DU97.5≤97.5	DU97.5≤97.5	DU96.5≤96.5
Additives	w-% dry	≤2w-% Types and amount to be stated	≤2w-% Types and amount to be stated	≤2w-% Types and amount to be stated
Net Calorific Value Q, EN 14918	as received, MJ/kg or kWh/kg	Q16.5 → 16.5≤Q≤19 or Q4.6 → 4.6≤Q≤5.3	Q16.3 → 16.3≤Q≤19 or Q4.5 → 4.5≤Q≤5.3	Q16.0 → 16.0≤Q≤19 or Q4.4 → 4.4≤Q≤5.3
Bulk Density BD, EN 15103	kg/m3	BD600≥600	BD600≥600	BD600≥600
Nitrogen N, PrEN 15104	w-% dry	N0.3≤0.3	N0.5≤0.5	N1.0≤1.0
Sulphur S, PrEN 15289	w-% dry	S0.03≤0.03	S0.03≤0.03	S0.04≤0.04
Chlorine Cl, PrEN 15289	w-% dry	Cl0.02≤0.02	Cl0.02≤0.02	Cl0.03≤0.03
Arsenic As, PrEN 15297	mg/kg dry	≤1	≤1	≤1
Cadmium Cd, PrEN 15297	mg/kg dry	≤0.5	≤0.5	≤0.5
Chromium Cr, PrEN 15297	mg/kg dry	≤10	≤10	≤10
Copper Cu, PrEN 15297	mg/kg dry	≤10	≤10	≤10
Lead Pb, PrEN 15297	mg/kg dry	≤10	≤10	≤10
Mercury Hg, PrEN 15297	mg/kg dry	≤0.1	≤0.1	≤0.1
Nickel Ni, PrEN 15297	mg/kg dry	≤10	≤10	≤10
Zinc Zn, PrEN 15297	mg/kg dry	≤100	≤100	≤100

Despite these requirements, it is quite difficult to figure out what kind of raw material could be classified as A1, A2 or B. It will strongly depend on the manufacturing process and the chemical content of the original raw material. It has to be remembered that, in the real life, there are much chances that the different raw materials will be mixed up together, considering their source in the case of the Green Cities and Settlements project, which is residues and sawmill by-products. It is possible to find in the literature some figures about the pellet quality coming from different raw material. Lehtikangas (2001) has carried out this study for three different raw material that will be most probably used (or already in used) in the Kostomuksha city: Sawdust, logging residues and bark. The interesting point is the results of the quality of pellets manufactured from those different raw materials but also the quality of the raw material itself before the pelletization process. The tests seem to suggest that only sawdust could be used to produce A1 quality pellet, while bark and logging residues had very high ash content or chlorine/sulphur content.

While fresh sawdust has moisture content of 54 %, fresh bark has 60 % and fresh logging residues around 49 %. For the same materials, the ash content is around 0.26 % (w-% dry) for fresh sawdust, 2.65 % (w-% dry) for fresh bark and 2.36 % (w-% dry) for fresh logging residues. It enforces the argument that the raw material has to be dried before pelletization but also that the ash content of the raw material is too high to start with. The three mentioned raw materials had been pelletized with no treatment to decrease the ash content, and the moisture content, ash content, chlorine and sulphur content in the end-product was evaluated. Fresh sawdust was the only raw material that fully complied with the limits given by the standards for all three categories. Fresh bark has a relatively high ash content (in the experiment around 3.7 w-% dry) which was above every limits given in the standards and barely acceptable for a B-category quality pellet, the moisture content was in the limitation but the chlorine and sulphur content was only acceptable for the B-category but not for the A1 or A2-categories. Regarding fresh logging residues, the moisture content was in the limits for every category while the ash content was still too high to enter the A-category but fulfilled the B-category requirements. On the other hand, the chlorine and sulphur content was higher than any limitations given in the standards.

Technology Review

A wide range of manufacturers co-exist in Europe. It has to be remembered that pellet technology was primarily used by the food industry for cattle feeding. Thus, those industries have changed their technology in order to be compatible with wood industry. After the signing of the Kyoto protocol by the European Union, different regulations and directives were enforced to promote the use of renewable energy. Among others, the PelletAtlas project started, to provide key data on the pellet European market and to provide project manager with a database of pellets manufacturers across Europe, and to help end-users finding pellet retailers. Most of the manufacturers in the database are spare parts manufacturers for pellet mills. Indeed, most of the companies do not have "all ready" solutions mostly because every project is specific and needs a special attention to adapt and use the right machinery in order to achieve the best efficiency (production and environmentally speaking). However, some companies such as Promill with their Compact Unit of Pelletizing (CUP) or Nazzareno in Italy are offering such installation-ready solutions. The different projects that have been implemented in Russian sawmills, sawmills factories tended to make their project in partnership with design offices that have direct relations with the manufacturers.

PELLET MARKET

In order to fully understand and justify the opportunity of having pellet industry in the Karelian region, the European as well as the Russian pellet market has to be outlined.

EUROPE

Pellet is a very interesting and new market which is mostly developed in Central and Northern Europe. The pellet market can be divided between the producers and the consumers. The European pellet production was around seven million tons of pellets in 2008 where over 60 % of the production was A1-quality pellets. Concerning the consumers market, the two leading countries in this matter are Sweden and Austria. However, the European market could be shared into five different markets as shown in Table 3 the industrial market, the medium scale market, the small scale bulk wood pellet market, the bagged wood pellet market and the export market – being more an explicative market rather than a real market by itself [16].

TABLE 3 *EUROPEAN MARKET OVERVIEW. BASED ON [5]*

Targeted market	Country
1. Industrial market	e.g. United Kingdom, The Netherlands, Belgium
2. Medium scale bulk wood pellet market	e.g. Sweden
3. Small scale bulk wood pellet market	e.g. Austria, Germany
4. Bagged wood pellet market	e.g. France, Italy and most of the southern European countries
5. Export market	e.g. Finland

INDUSTRIAL MARKET

The industrial market is composed of heat producers from co-firing machinery (usually coal plus biomass). Three main countries have been identified in the consumption of wood pellets for industrial use: Belgium, the Netherlands, and the United Kingdom. Some common pattern could be drawn between these three countries regarding their own market. First of all, the use of wood pellet for the residential sector in the Netherlands and in the United Kingdom is fairly low; however the reasons behind this low market may be different. While the Netherlands face an immature policy support for promoting the use of wood pellets in households and cheap prices of gas, the United Kingdom does not have specific reasons. Although the pellet market tends to increase in the United Kingdom or in Belgium, it does not seem very promising for the Netherlands where on the one hand the pellet market is seen to be declining by 2013 (for legislation reasons) even though on the other hand having Rotterdam as the main port for transporting wood pellets around western Europe could increase their national market. It is also explained because of the lack of raw material that the Netherlands is facing. Whereas Belgium can almost satisfy its own need, completing their production with the importation of wood pellet from Germany and Australia, and the United Kingdom have a balance between their production of high quality pellets and their importation of industrial pellets from Germany, the Baltic states or even north America, the Netherlands does not produce much any kind of pellets and rely mostly on the importation of industrial wood pellets from eastern Europe and north America.

MEDIUM SCALE BULK WOOD PELLET MARKET

Medium scale bulk wood pellet is mostly led by Sweden. Sweden is a major actor in the European pellet market. The position of Sweden on this market is probably due to the fact that Sweden is a large consumer of wood pellet for household and for group of family dwellings that have a common heating system. Also, district heating that was usually using oil as a primary source of energy, switched to coal in the 90s to change to biofuel in the same decade. Thus, all the existing installations can accept the use of wood pellets more easily and medium scale bulk wood pellet use makes sense in a financial way.

SMALL SCALE BULK WOOD PELLET MARKET

This market is mostly led by two similar countries: Germany and Austria. The small scale bulk wood pellet market seems to target mostly the residential sector due to the high use of pellets as the main source of energy in households, meaning use of pellet boiler instead of pellet stove. Consequently, bulk wood pellet make more sense in order to feed the pellet boiler at any time and not refilling the pellet tank every day. As mentioned earlier, Austria, with its 63 000 pellet boilers for an overall population above 8 000 000 makes it the biggest pellet user in the whole Europe.

BAGGED WOOD PELLET MARKET

This market is mostly led by Italy and France. Italy is probably the biggest European market for wood stove (~700 000 units in 2009). The market is supported by a local production where $^2/_3$rd of their production relies on the sawmill industry. Italy is now facing a lack of raw materials, combined with the expenditure of their market, they have to import bagged wood pellet from other places such as Austria some Balkan countries. France, on the other hand, is a lot smaller market where the development of the pellet industry is growing slowly. However, France can provide enough pellets for its need. France also reflects the south European pellet market pattern in a way that, similarly to some French region, southern European countries may not have a strong heating demand for the building but mostly for the domestic hot water. Also, southern European countries do not have so much wood resources, thus, if this market wants to be developed, it will have to rely on importation of bagged wood pellet.

RUSSIA

Russia has a huge potential for pelletizing owing to its large wood resources. Wood industry is mostly located in the northwest of Russia with some exception in the Ural area, thus it explains why the pellet industry started in West Russia before conquering the Ural region.

	2007	2009	2011
Production Capacity (Tons/year)	1 200 000	1 700 000	3 – 4 000 000
Actual Production (Tons/year)	550 000	800 000	???

Table 4 *Russian pellet production*

In Northwest of Russia, seven species of wood have been detected. Those species can be categorised into the two main family of wood: the softwood and the hardwood. Softwood is made up with spruce, pine and larch while hardwood is made up with birch, aspen, alder and lime [13].

The Russian pellet market was born in 2001 as waste recovery from sawmill. Since then, the production has increased significantly to reach around 200 registered producers with an overall capacity of three to four million tons of pellets [12].

Table 4 shows the evolution of the wood pellet production in Russia from 2007 to 2011. From this table it is clear that the wood industry is willing to increase significantly their production of pellets but this is mostly due to the fact that the existing pelletization factory increases their own capacity. The Russian domestic market is very low, thus most of the production goes on the export market. It was assumed that, in 2008, only 10 to 15 % of the pellets production was actually used in the domestic market. The remaining production was going to the export market, mostly Europe. A survey carried out by Rakitova & Ovsyanko from different Russian pellet manufacturers shows that their production goes in priority to the northern european countries such as Sweden, the Great Britain or Denmark.

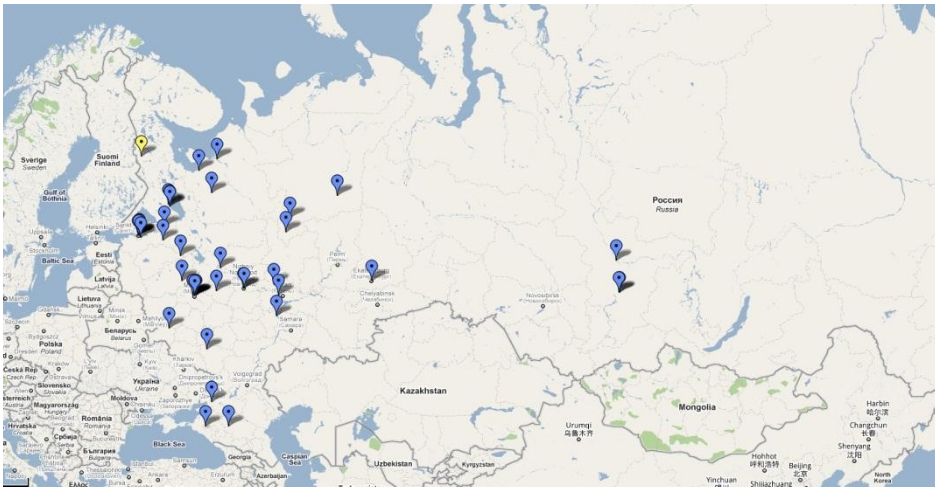


FIGURE 7 *OVERVIEW OF THE PELLET MANUFACTURER THROUGHOUT RUSSIA*
(HTTP://WWW.WEBCITATION.ORG/5ZQKOPQUN)

The transportation aspect might be critical for companies based in the middle of Russia. Concerning Northwest Russia, unless consumers come from Finland, the easiest way stays to use the Saint-Petersburg harbour. Saint-Petersburg harbour is handling 70 % of the Russian export market for pellets. However, many case scenarios could be drawn using train or trucks as an alternative.

CASE STUDIES

This section is based on existing installations of re-use by product of wood industry. Accurate and detailed data is limited due to the fact that the listed industries are rather small-scale and their media coverage is low.

VARAŽDIN – CROATIA

In its task 29, the International Energy Agency [6] has created an educative internet platform where biomass and its possible use are explained. Part of the project had led them to explore the ITC Company in Varaždin. By the time this company was founded in 1962, there was an energy company that provided the heat for the factory until 1997. At that time, the factory was giving away their wood waste to the common heat company. Once this energy company was shut down, ITC built their own boiler where they were utilizing the wood waste material without any processing. When they realised they had more wood waste at their disposal than they needed, they started to build the factory to produce pellets. This factory is processing 35 000 m^3 of wood per year (which could represent an average of 22 000 tons of wood). There is a non-variable use of wood for producing the necessary amount of energy needed for drying the wood, producing domestic hot water and the necessary energy for heating up the place during the cold period which represent roughly 6 000 tons per year (using a 5 MW boiler). Out of the remaining waste, ITC was able to produce still 8 000 tons of wood pellets that they were exclusively selling on the Austrian market.

Financially speaking, the profit made from 1 kg of pellets produced is around 0.015 € which gave a total gain of 120 000 € with their 8 000 tons of pellets produced. The saving of oil can be added to the profit as non-spent money. They have recorded the use of 1 545 000 litres of heating oil per year which represents a saving of 819 000 € per year.

Finally, their environmental impacts have decreased since the use of wood-based solid fuel instead of heating oil, and the greenhouse gas saving has been calculated to be around 14 700 tons of CO_2 equivalent per year.

NOVO-LHK – RUSSIA [10]

The Novo-Lhk Company, located in Lesosibirsk, Krasnoyarsk region, in the centre of Russia, where a fibreboard manufacturer is located which had transformed its activity to produce pellets as by-product of their waste. They use different type of raw material such as shavings, sawdust and woodchips of softwood – which in this region is characterized by pine angora, Siberian stone pine, spruce and fir. The typical process of grinding-drying-pelletizing-packaging is used and the average monthly pellet production is around 3 300 tons of pellets per month.

DOK ENISEY – RUSSIA [3]

DOK Enisey Company is located in the same area as the NOVO-Lhk Company. It has primarily a timber process industry, which started to transform their wood waste to fuel the wood pellet industry. They have implemented in the company two lines in 2007 and a third line afterwards. So far, the hourly production is around 7 tons of pellets which make DOK Enisey one of the leaders on the Russian pellet market.

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