

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF ENERGY AND ENVIRONMENTAL TECHNOLOGY

MASTER'S THESIS

WOOD PELLET MARKETS IN RUSSIA

Examiners: Professor, Tapio Ranta D.Sc., Vladimir Sidorenko D.Sc.

Lappeenranta 12.05.09

Dmitry Tarasov

ACKNOWLEDGEMENT

I wish to express my gratitude to Professor Tapio Ranta and to Professor Vladimir Sidorenko for their guidance and support. I also wish to thank my co-supervisor Ljubov Fedetskina for her invaluable help and assistance. I would like to thank all people from UPM-Kymmene, who helped me to complete this work.

My special thanks to all my friends and personally to: Pasha Matoshuk, Nikolai Nikolaich, Maria Dobrova, Ksusha Kalibernova and Eugenia Perkova.

Finally, I want to thank all my family for great support during my studies and all my life in whole. Special thank to my grandfather Boris Semenovich Besprosvanniy and to my grandmother Irina Zenonova Yachmovich for everything that I know, that I can.

ABSTRACT

Author: Dmitry Tarasov

Title: Wood pellet markets in Russia

Department: Energy and Environmental Technology

Year: 2009

Place: Lappeenranta

Thesis for the Degree of Master of Science in Technology

61 pages, 12 figures, 12 tables.

Examiners: Professor, Tapio Ranta D.Sc., Vladimir Sidorenko D.Sc.,

Keywords: wood pellets, market, Russia.

Bioenergy came to Russia through wood pellets. On account of prevalence of oil and gas in the Russian economy «bioenergy» has come with a great delay. Certainly, there were many woodworking enterprises and even municipal boiler-houses using wood waste and fire wood for energy reception, but this activity was not purposeful. More likely it was connected with necessity of waste recycling and with the organization of heat supply in the remote areas of the country. However, in 2001 was founded the first pellet plant in Russia.

The purpose of this work was to analyze wood pellets market in Russia, investigate current situation on the home and export market, evaluates supply and demand development, opportunities for wood pellets manufactures in Russia, the main manufactures in Russian market; cost and prices for wood pellets in Russia. Also the work was intended to give better understanding of the main problems of wood pellets industry in Russia. Besides, this work had updated information about Russian customs and logistic systems.

TABLE OF CONTENT

1	INTRODUCTION	9
2	PRODUCTION TECHNOLOGY.....	11
2.1	Coarse breaking	12
2.2	Drying	12
2.3	Fine breaking	13
2.4	Mixing, water conditioning, water preparation.....	13
2.5	Pressing	14
2.6	Cooling action	15
2.7	Packaging	15
2.7.1	In "loose kind" (scattering)	16
2.7.2	In bags "big-bag"	16
2.7.3	In bags on 10-20 kg	16
3	WOOD PELLETS RAW MATERIAL RESOURCES AND PRODUCTION GEOGRAPHY.....	17
4	WOOD PELLETS INDUSTRY DEVELOPMENT IN RUSSIA.....	20
5	THE EXPORT MARKET	23
5.1	The basic consumers on the export market	24
6	HOME MARKET	28
6.1	Demand	28
7	MANUFACTURING COST OF WOOD PELLETS	30
8	LOGISTICS.....	35
8.1	The logistics problems	35
8.2	Logistic optimization	36
8.2.1	Scattering type	36
8.2.2	"Big-bag" type	36
8.2.3	Paper and plastic bags.....	37
8.3	Transport types	37
8.3.1	Road transport	37
8.3.2	Sea transport.....	38
8.3.3	Railway service	39
8.4	Supply chain.....	39

8.4.1	Pellets delivery from plant to port	40
8.4.2	Freight handling in port	41
8.4.3	Receipt of goods by consumer in port	41
9	STANDARDS	42
9.1	Russian biofuel standard (GOST).....	43
9.2	CEN/TC 335 biomass standards.....	43
10	CUSTOMS DOCUMENTS	45
10.1	Fitosanitary certificate	46
10.2	Environmental declaration	47
10.3	Invoice.....	48
10.3.1	CMR.....	48
10.4	Customs fees for customs clearance of cargoes	49
10.4.1	Import customs duties for pellets equipment are canceling.....	50
11	FUTURE PROSPETS	51
12	CONCLUSION.....	54
13	REFERENCES	57

LIST OF TABLES

Table 1. Wood resources distribution among Russian Federation federal districts	17
Table 2. Using of wood resources in several Russian regions	18
Table 3. Wood pellets production in Russia	20
Table 4. Biggest Russian pellets producers.....	22
Table 5. The basic consumers on the export market	24
Table 6. Comparative cost of wood pellets depending on source of production	26
Table 7. Average prime cost of tone wood pellets in Russia	31
Table 8. Wood waste costs in Russia.....	33
Table 9. Pellets delivery from plant to port.....	40
Table 10. Freight handling in port	41
Table 11. Receipt of goods by consumer in port.....	41
Table 12. European wood-pellets standards	42

LIST OF FIGURES

Figure 1 Wood pellet production process flow diagram.....	11
Figure 2. Press with cylindrical matrix	14
Figure 3. Press with flat matrix.	14
Figure 4. Wood resources distribution in Russia.....	17
Figure 5. Wood pellet production in Russia 2003-2008 yrs	20
Figure 6. Quantity of wood pellets manufacture plants. Dynamics of growth.	21
Figure 7. Wood pellets export volume from Russia 2003-2007 yrs.....	23
Figure 8. Volumes of Russian pellets export	27
Figure 9. Allocation of costs on pellet manufacture in Austria.....	32
Figure 10. Percentage distribution of costs in the pellets production using wet and dry materials.	33
Figure 11. Wood pellets supply chain.....	39
Figure 12. CEN/TC 335 standards for biofuels.....	44

LIST OF ABBREVIATIONS

CPT	Carriage Paid To
CHP	Combined Heat and Power plant
CMR	Cargo Movement Requirement
DDP	Delivered Duty Paid(delivery term)
EN	European Norm
EUR	Euro
FCA	Free Carrier(delivery term)
FOB	Free On Board (delivery term)
GOST	State standard in Russian Federation
MW	Megawatt
RBA	Russian Biofuel Association
RUB	Russian ruble
TN VED	Harmonized System Codes
VAT	Value Added Tax
VDI	Verein Deutscher Ingenieure (Association of German Engineers)

1 INTRODUCTION

Countries with large forest resources always promote combustion technology of sawdust, wood chips, and old wood. However the process of direct use of waste sawn wood, wood processing and recycling has shown its imperfection. For efficient combustion sawdust and chips must be dry. This requires additional technological processes and investments. More than 20 years ago Rudi Gunnerman living in the United States was first who made pellets from wood waste. He used it for reduce waste of production and for shipping operations economy. Subsequently, in the United States wood pellets came into use on the heat stations. Thereupon the technology onrush received in Canada, Denmark, Austria, Holland, Finland, Norway, France, Italy and Germany.

The first wood pellets special-purpose manufacture in Russia was founded in the year 2001. It was named LLC «Biofuel» and located in the Leningrad region. It was a very small enterprise –in fact, it was an experimental workshop which hasn't run up to high level development (Ovsyanko 2008, 5). However, this enterprise has given start of wood pellets industry in Russia. In 2003, in Russia was operating 5 pellets manufactures. They were equipped with second-hand equipment and the total production of them was near 8 thousand tons in a year. In late 2006, there were about 50 pellets manufactures therewith they had at one's command good and high-quality equipment. At such rate growing number of manufacturers, wood pellets volume production in Russia in the subsequent years would be connumerate in hundreds thousands of tons.

However, in spite of the significant volume production, the Russian pellets market is still in its infancy. Nevertheless, the inevitable increase on power rates, costs of traditional fuel and The Kyoto Protocol norms all that will promote growth of demand on Russian biofuel market. Russia has one of the largest stocks of forest resources in the world. Also there are some substantial benefits related to costs production. Russia has a real chance to become a lead supplier of pellets to the growing market in Europe.

It was used many sources during different project phases. It's including: professional bioenergy Russian magazines and journals; wood industry Russian magazines and journals; Russian web-sites; interviews; books and learner's guide; personal contacts and other sources.

The purpose of this work is to analyze wood pellets market in Russia; investigate current situation on the home and export market; supply and demand development; opportunities for wood pellets manufactures in Russia; the main manufactures in Russian market, cost and prices for wood pellets in Russia. Also the work is intended to give better understanding of the main problems of wood pellets industry in Russia. Besides, this work contents information about Russian custom system and logistic system.

2 PRODUCTION TECHNOLOGY

«Wood pellets are a type of wood fuel, generally made from compacted sawdust. They are usually produced as a by-product of sawmilling and other wood transformation activities.» (Wikipedia, the free encyclopaedia. Wood pellet 2009) Classical wood pellet manufacturing process is presented in the diagram below. It consists of the following stages:

- coarse breaking
- drying
- fine breaking
- mixing, water conditioning, water preparation
- pressing
- cooling action
- packaging

Wood pellet production process flow diagram (Fig. 1):

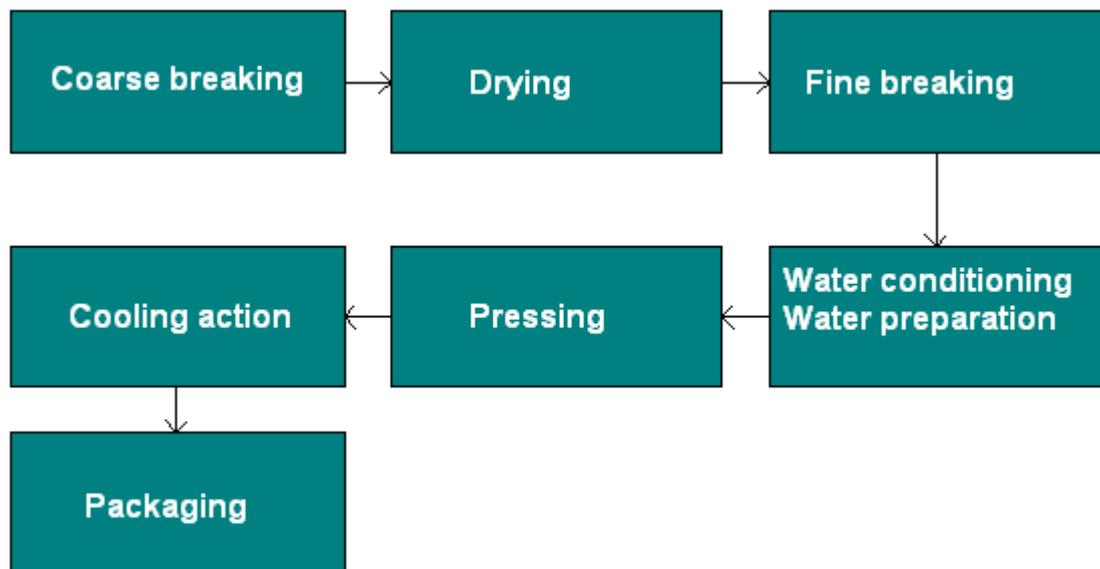


Figure 1 Wood pellet production process flow diagram

2.1 Coarse breaking

This is major stage of raw material preparation to pelletizing. This process is aimed at reduction of initial raw materials fraction in order to relieve pellet-press. The smaller the size of the particles getting into the pressing chamber is the less resistance of the engine and the roller knot is. Therefore, at first large-sized wood waste is crushed in hew-machine till wood chips size. Thus, it is very important to check wood moisture content, because crude fraction can stick to the hammer grinder.

Then large breaking machines crush raw materials for the further drying. Crushing should reach the size of particles no more than 25x25x2 mm. Coarse breaking allows quickly and qualitatively to dry up raw material and prepare it for the further crushing in a small breaking machine. Usually moisture-laden wood waste is stored on the concrete floor to avoid its' mixing with sand or stones. (Ecotechnology 2008)

2.2 Drying

The crushed wood sawdust moves to a dryer drum. Bleeding of excessive moisture is carried out by the hot air produced by a heat generator. Heat generator can work both on wood waste fuel and gas. Wood waste with the moisture content more than 15 % usually cannot be pressed properly, especially at press-machines with cylindrical matrices. Also press-machines with plane matrix are used in wood pellet production process. Besides, produced pellets with the increased moisture «content being not suitable for pots. » (Biofuel, 2007)

Therefore, before pressing the raw materials moisture content should be between 8% and 12 %. For a high-quality product moisture content should be 10 % + / - 1 %.

There are two types of dryers: drum-type and belt-type. «The choice of dryers is determined by the type of raw materials (wood chips, sawdust), quality requirements and the source of thermal energy received. In pellet production the drying is the most power-consuming process. For drying sawdust spending about 1 MW of power per ton of evaporated moisture or for the practical calculation it could be used that 1 ton of pellets required calorific value of 1 m³ of dense timber. » (Biofuel, 2007)

Further the dried up wood sawdust by jet transport arrives to cyclone cell system where the dried up material is separated from heat-carrier. The fulfilled air is released in atmosphere, and the dried up material arrives to repeat crushing. As a rule, the modern pellet-press machine is equipped with a humidification system, which allows leading raw material up to the necessary moisture content immediately before the pelletizing process. (Ecotechnologii 2008)

2.3 Fine breaking

The raw material should come into a small crusher with the maximum sizes of particles 25x25x2 mm. However, «the raw material must go to the press with the particle size of less than 4 mm. Therefore crusher grinds raw materials to the required sizes. For quality product bulk weight after crushing should be 150 kg/m³ + / - 5%, and particle size less than 1.5 mm. Hammer mills - the most suitable device for grinding fibrous chips, sawdust or wood chips.» (Biofuel, 2007)

2.4 Mixing, water conditioning, water preparation

The basic substance, which is render possible to make wood mass pasting in pellets is lignin, a part of wood. The lignin fusion temperature is near 140 °C, therefore raw material with temperature less than 100 ° C badly take to pasting during press process. Thus, the operational temperature of a press should be above lignin fusion temperature. Water condition or water preparation is performed for increasing operational efficiency of the press-machine and to bring raw material temperature up to operational temperature. Also, «raw material with moisture less than 8% is difficult to bonding during pressing" In order to increase moisture content water preparation is performed. In the same way it will be observed that "adding a hot steam recommended while pressing strong class wood (oak, beech). The best option is screw mixers, which are built entrances to the filing of water or steam.» (Biofuel, 2007) Some manufacturers utilize steam for softening old, dry, packed raw material. However, with such raw material it is not possible to produce high quality pellets.

2.5 Pressing

The pelletization process is the heart of all pellet manufacture process!

There are two types of press-machines:

- press with cylindrical matrix(Fig. 2)
- press with flat matrix(Fig. 3)

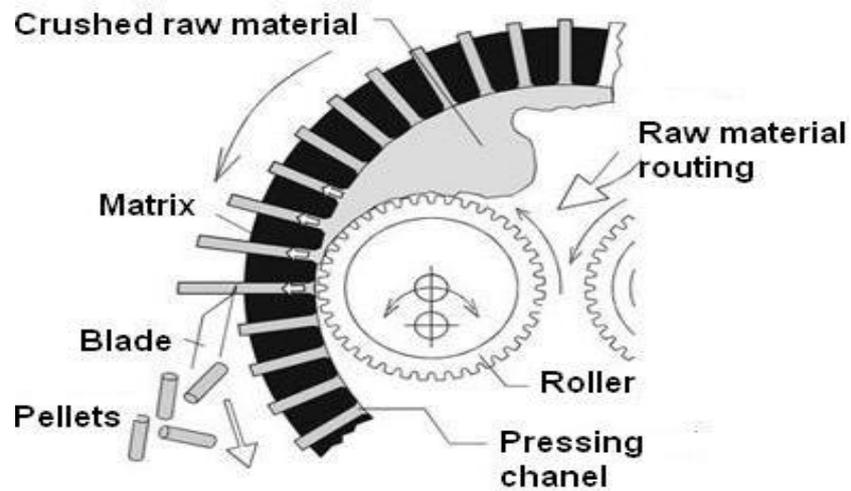


Figure 2. Press with cylindrical matrix (PPG 2006)

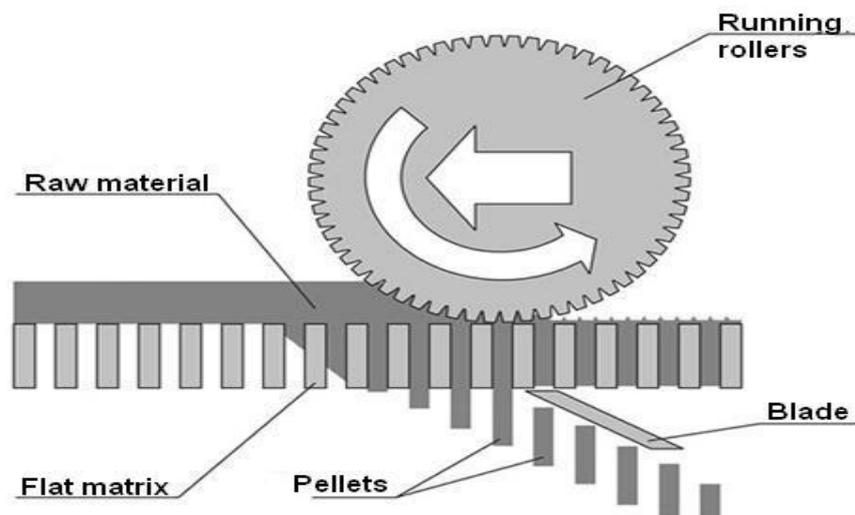


Figure 3. Press with flat matrix. (PPG 2006)

Currently, both press types used in pellet press process work by an identical principle. Running rollers rinks create contact deformation stress of raw material on a matrix, and through apertures in a matrix press through raw materials which are cut off by blades. «This diameter matrix can be more than a meter, and power of press can be up to 500 kW, depending on a prearranged performance. Also at the press performance in the range of 20% influence granule size, usually 6 mm for private consumption, and 10 mm for industrial.» (Biofuel, 2007)

The basic difference between two press types is the following: in press machines with a cylindrical matrix compulsory delivery of raw materials in a drum is necessary. The important problem is cleaning and changing matrixes and skating rinks. Flat matrixes in any service conditions can be cleaned by drilling and also polished up at deterioration. It is practically impossible to make these operations with other matrix configuration. Manufacture of flat matrixes is promptly developing. Despite, their manufacturing is much cheaper than round matrixes manufacturing, owners should renewal matrix every year, sometimes several times in a year. (PPG 2006)

2.6 Cooling action

Cooling action is «needed for drainage granules, after pressing heated to 70 °... 90 ° C.» (Biofuel, 2007) A more powerful pressing force of a press-machine and a higher temperature of raw material make pellets of better quality. Cooling is necessary for pellets cool drainage after pressing. To improve a general view and quality of production some manufacturers apply cyclones after cooling to clean up the final product from the dust. (PPG 2006)

2.7 Packaging

Wood pellet packaging is subdivided into three categories:

- in "loose kind" (scattering)
- in bags "big-bag"
- in bags on 10-20 kg

2.7.1 In "loose kind" (scattering)

The major part of the pellets consumed in the Western Europe is shipped from factories and is delivered to consumers unpacked in a scattering form. It provides the maximum flexibility of logistical operations at minimum expenses. By granules delivery in scattering form it is possible to save on charter of a ship.

(Ovsyanko 2006, 39) It is subdivided into two kinds. The first kind goes to the big CHP (Combined Heat and Power plant), quality requirements are low, and the price also differs and can be lowered down to 50 %. The second kind: high- quality product for small boilers, the quality requirement is high. Granules should be less than 50 mm in length, the price also is high and consumption increases. (PPG 2007)

2.7.2 In bags "big-bag"

Bags "big-bag" are useful for industrial transportation of loose products. These bags are made of strong polymer. The most commonly encountered "big-bags" have capacity of 1 cubic meter that is under standard packed density of a product (0,65 g/cc); they contain about 650 kg of pellets. This packing is quite convenient for transportation, provides protection of a product against physical influences. "Big-bag" packaging allows using primitive technology at handling operations (the crane, the automated lift truck). On many low-power boiler stations "big-bag" even can be used as fuel storehouses from which pellets are automatically moved into the fire chamber. (Ovsyanko 2006, 39)

2.7.3 In bags on 10-20 kg

Wood pellets in small packaging do not occupy so big share in the European market. As a rule, they are paper or plastic bags with the capacity of 10-20 kg., which can be sold through retail trade channels. For wholesale delivery such bags are usually stuck on pallets and delivered in containers or by truck transport. Usually manufactures uses these kinds of bags for packing the "first-class" pellets and sell them to private consumers to be burned in special furnaces and fireplaces.

(Ovsyanko 2006, 40)

3 WOOD PELETS RAW MATERIAL RESOURCES AND PRODUCTION GEOGRAPHY

Russia is one of the wood-richest countries in the world. At the Russian territories about 130 million tons of timbers are cut down annually, approximately it is about 30 million cubic metre of waste. (Panchava 2007) Wood resources distribution among Russian Federation federal districts are presented in table 1:

Table 1 Wood resources distribution among Russian Federation federal districts (Gukovskiy 2006, 109)

Central Federal District	5.2 %
Volga (Privolzhsky) Federal District	9,8 %
Southern Federal District	0,2 %
Northwestern Federal District	17,3 %
Urals Federal District	12,4 %
Siberian Federal District	37,5 %
Far Eastern Federal District	17,6 %

The Northwest contains 60 % of forests of the European part of the Russian Federation; 17 % of all Russian are concentrated in this region. As presented on fig. 4 Northwest district has 17% of all Russian wood resources.

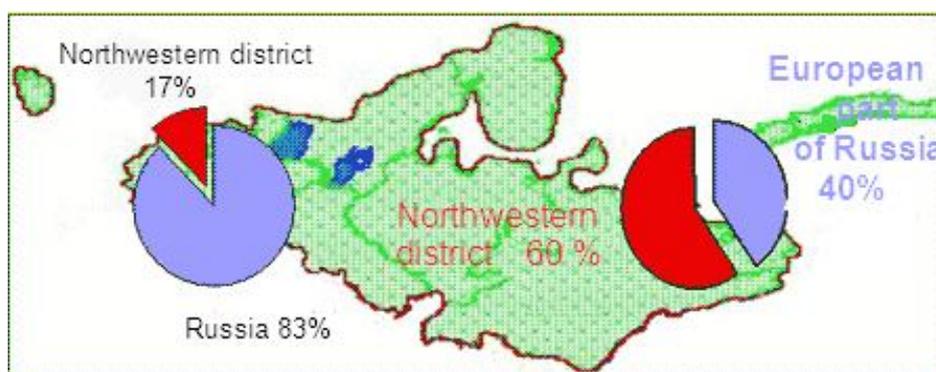


Figure 4. Wood resources distribution in Russia

In Russia more than 100 manufacturers are engaged in wood pellets manufacture; and half of them is located in the Northwest region. The undeniable advantages of placing pellets manufactures in the Northwest are:

- presence of rich wood resources
- closeness to the main European commodity markets and seaports

Today Vologodskaya area (Northwestern region) is the leader of pellets manufacture in Russia. In the town Velekii Ustug (Vologodskaya area) the biggest enterprise of wood pellets manufacture in Russia is located, its LLC «Vologdabioexport» started to work in May 2006th. In the table 2 is presented using of wood resources in several Russian regions:

Table 2. Using of wood resources in several Russian regions (Rakitova 2008, 19)

Region	Annual determinate wood-resources issue (thousand cubic meters)	Storage in fact(thousand cubic meters)	Rate (%)
Republic of Karelia	6481,1	5185,9	80
Repblic of Komi	8383,0	4300,0	51,3
Arhangelsk Region	12113,0	6992,5	57,7
Vologoda Region	8935,1	10142,7	113,5
Leningrad Region	6167,2	4324,1	70,1
Braynsk Region	670,3	437,9	65,3
Moskow Region	233,2	184,2	79,0

Wood resources of the Russian Federation are presented in three basic categories:

1. Coniferous (pine, cedar, spruce, fir, larch) (70, 8 %)
 2. Soft-wooded broadcasting (birch, aspen, linden, poplar) (16,7%)
 3. Hard-wooded broadcasting (birch stone, oak, beech, ash-tree) (2, 4 %).
- (Zemmarket, 2008)

Pellets are obtained from raw waste lumber, woodworking waste, agriculture waste. Pellets can be arboreal (from any breeds of wood), from sunflower husks, straw, dung, etc. For many companies pellets manufacture is the last stage of the major business: woodworking or lumbering. The percentage of wood waste at the timber processing complex enterprises fluctuates from 5% to 60 % depending on manufacture type. Part of a waste is utilized at the enterprises, another part is taken out and still another part is sold as wood chips or raw materials for pulp-and-paper manufacture or for plate complex. However, at a number of the enterprises some waste is not utilized at all which finally, brings many problems. According to experts of Russian Northwest Timber industry confederation it is possible to use at least half of a wood waste in North-West region for energy reception (Babkina 2007)

In the woodworking and pulp-and-paper production a considerable quantity of a bark is left as a waste product. It also can be used as power fuel. Resources of a wood bark in Russia constitute about 15 - 18 million m³. If one takes into account that in the bark stripping process timber wood is logged together with the bark, the total waste of bark stripping process will be amount to even greater volumes. Especially a lot of bark is wasted in larch bark stripping process. Larch bark volume thickness is about 25 % of the tree volume. There are good prospective of organization of industrial recycling of the bark at the pulp-and-paper enterprises, lumbering and plywood manufacture. (Babkina 2007)

According to Russian Northwest Timber industry confederation, timber cuttings waste makes 20 %, lumbering waste makes 33–35 % of volume production, plywood manufacture waste is 60 %, in the pulp-and-paper manufacture wood waste is 20 % of volume of delivered raw material, waste of wooden products and furniture manufacture is 50 % of volume production. (Reiter 2007) .Under specifications in Russia it is possible to cut down 550 million cubic metres per year, which can produced 220 million cubic metre or 110 million tons of waste. It is possible to obtain a fair quantity of pellets to the sum of almost 7000 MEUR. (Panchlava 2007)

4 WOOD PELLETS INDUSTRY DEVELOPMENT IN RUSSIA

The first wood pellets special-purpose manufacture in Russia was founded in the year 2001. It was named LLC "Biofuel» and located in the Leningrad region. It was a very small enterprise –in fact, it was an experimental workshop which hasn't run up to high level development (Ovsyanko 2008, 5). However, this enterprise has given development of industry in this branch, which constantly grows from 2001 year. Over last seven years wood pellets branches development has been very intensive. Figure 5 represents development of wood pellet production in Russia 2003-2008.

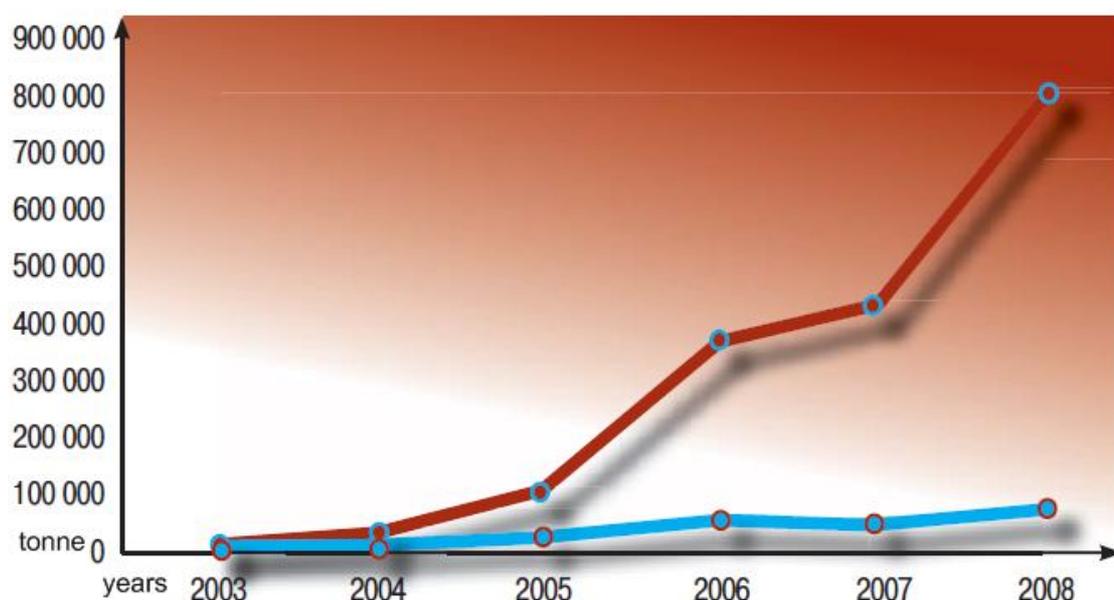


Figure 5. Wood pellet production in Russia 2003-2008 yrs. (Ovsyanko 2008, 5)

Note: red line- total volume of branch; blue line-average volume of every plant.

Table 3. Wood pellets production in Russia (Ovsyanko 2008, 5)

Year	2003	2004	2005	2006	2007	2008
On branch (tons in a year)(t/y)	8000	20 000	60 000	350 000	400 000	800 000
Every plant (t/y)	1 333	1 538	2 143	5 833	5 000	6 154

Starting from 2003 year number of factories has been annually doubled (Table 3).

Thus volume of wood pellets manufacturing annually increase in 2,5-5 times up to 2007 year.

Volume production of wood pellets in Russia, apparently from the schedule, is constantly enhancing. The very slow growth of wood pellet production in the years 2006-2007 can be caused by the crisis of the wood pellet industry in Western Europe. In January, 2007 the market price considerably decreased. This made an immediate effect on average and actual output of the plants. (Ovsyanko 2008,6)

A great number of the enterprises have been compelled to stop pellets manufacture because of their commercial impracticability. However, this crisis has not affected growth of number of wood pellets manufacture factories (Figure 6).

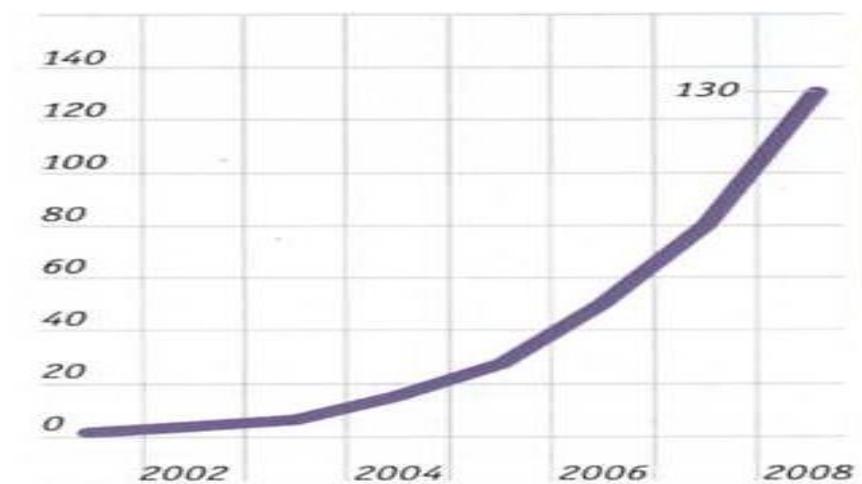


Figure 6. Quantity of wood pellets manufacture plants. Dynamics of growth. (Rakitova 2008, 3)

In the next table (Table 4) adduced the biggest pellets producers in Russia as of December 2008 year:

Table 4.Biggest Russian pellets producers («Bioenergy International» magazine № 35 -2008, 29)

Company Name/Location	Capacity ton/year	Production ton/year
Northwestern District		
Ecotech, Podporozhie, Leningrad Region	10 000	N/A
RosPolitechLes, St.Petersburg	25 000	25 000
Vologda Bioexport, Vologda	30 000	30 000
Biotop, Valday, Novgorod	20 000	N/A
Biom, Arhangelskaya Area	35 000	30 000
Vologdalesprom, Vologda	20 000	4 000
Lesprom, Cherepovez, Vologda	15 000	8 000
Algir Pellets, Noschul, Komi Republic	11 000	10 000
Euro Techno/ Pellemaks, Vologda	70 000	10 000
Ecopel, Kirovsk, Leningrad Region	60 000	N/A
Ecoenergy, Pskov Region	60 000	N/A
Biomag Ecotechnology, Petrozavodsk, Karelia Rebulic	10 000	10 000
Veek, Pskov Region	10 000	N/A
Plusky, Leningrad Region	10 000	6 000
Biogran, Karelia Republic	12 500	N/A
Green Power, Leningrad Region	20 000	20 000
VEEK + Salotti, Lodeinoe Pole	20 000	N/A
VEEK + Salotti, Leningrad Region, Lomonosov	10 000	5 000
Central Federal District		
Enbima, Vladimir Region	70 000	6 000
Topgan, Galich, Kostroma Region	10 000	N/A
Ecoles	25 000	20 000
Lesnye Technology, Tver Region	10 000	N/A
Stod, Tver Region	50 000	25 000
Granula, Moskow Region	20 000	2 000
EMC Dnepr, Smolensk	140 000	N/A
DOK № 5, Moskow Region	30 000	25 000
Volga (Privolzhsky) Federal District		
Kruglov CP, Nizny Novgorod	10 000	N/A
Murashinskiy Biofuel, Kirov Region	10 000	N/A
Rushimprom, Perm Region	20 000	6 000
Siberian Federal District		
KosmoEnterprise, Irkhutsk	10 000	N/A
Enisey, Krasnoyarsky Region	40 000	25 000
Bryansk Oblast		
DOK Salon Parketa, Bryansk	10 000	10 000

5 THE EXPORT MARKET

Nowadays, the bioenergy has begun to play a very important role in energy production in European countries. Thus, the European Union has set the goal to achieve the level of 20 percent of consumed fuel made from renewable energy sources by the year 2020. Therefore, wood pellets can be considered one of the prioritized types of fuel. In the year 2006 the price on pellets had strongly grown in all branches of the market, in this connection there were great expectation for the following cold season. However, unusually warm weather established in all European countries and it led to decrease of heat consumption, and consequently, wood granules consumption too. (Lesnaya Rossia magazine 2008, 37)

Nevertheless, approximately during the same time there was a rapid growth of number of fuel granules manufactures in Europe. In 2008 in Russia there were produced near 800 thousand tons of wood pellets. (Ovsyanko 2008, 5) According to some analysis about 80 percent of this volume had been directed for export, mainly to the countries of Western Europe. Despite the fact that quality of Russian pellets does not meet European standards; foreign customers are ready to reduce quality requirements of wood pellets. A particular interest has been expressed by Finnish, Italian, German, and French companies. They were interested in cooperation with regular suppliers and production development. Figure 7 shows growth of Russian wood pellets export. Over the period from 2003 to 2007 yrs. the wood pellets export volumes grew by factor of 30.

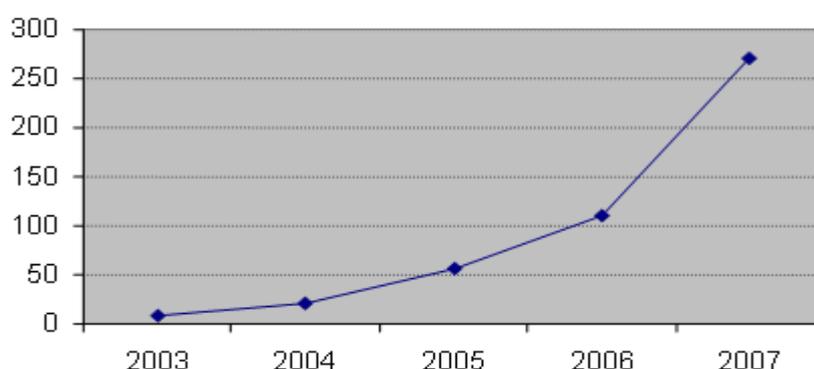


Figure 7. Wood pellets export volume from Russia 2003-2007 yrs. (Alexandrova 2008, 6)

5.1 The basic consumers on the export market

The demand for pellets has very different consumers segments, provided that different consumers have different requirements for product. It depends on consumption volume, ways of use and motivation for biofuel use. In the table 5 is mentioned the basic pellets consumers.

Table 5. The basic consumers on the export market (Ovsyanko 2007, 56)

Segment	Kinds of bought biofuel	Volume	Requirements to suppliers	Length of the distribution channel	Seasonality dependence of demand	Price level
Large power stations and thermal power station	Wood pellets, fuel briquettes, peat and peat granules(in some countries), wood chips	Large	Volume of party; the regularity of deliveries; calorific ability; ash content	Short channel. Direct contact between the manufacturer and the consumer is possible	Low or default	Average, stable
Regional and local boiler-houses and CHP small or average capacity	Wood pellets, fuel briquettes, peat and peat granules(in some countries)	Average	the regularity of deliveries; calorific ability; ash content;	Generally they prefer to work through intermediaries as a case with trade companies which guarantee a regularity of deliveries.	It is extended but is levelled by the intermediaries activity	Average or high. At low elasticity of demand.
Private consumers (house owners)	High-quality wood pellets and high-quality briquettes	Small	calorific ability; ash content; greatness (durability, dust presence); appearance	Multi-tier wholesale-retail sale channels. In the majority of cases deliveries are carried out terms of DDP (with delivery to a place and payment of all taxes).	High, but is levelled by the intermediaries activity	High. Elasticity is low. Level of demand is depending on season and weather terms.

The leader among of wood pellets regions-senders is the Northwest Federal district, it exports about 95 % Russian manufacture wood pellets. Share of Central Federal district is 2 % of export pellets; Southern Federal district is exporting only 1 %. The share of St.-Petersburg and Leningrad region makes 88 % of all wood pellets export volume. (Alexandrova 2008, 6)

By the current moment not less than 50 % of all Russian fuel granules go for export through the ports of Gulf of Finland, and the lion's share – through Seaport St.-Petersburg. Other volumes are delivered to the European buyers and consumers by cargo motor transport, or are shipped through the ports of the Baltic States which offer to suppliers more flexible conditions of cooperation and service by low rates. In the port of St.-Petersburg 3-4 channels constantly operate; through them Russian pellets are shipped to major industrial consumers in Western Europe. (Ovsyanko 2007, 113)

At the present moment on the Russian pellet market operates three main trade companies:

- S. Syr. Pedersen AS - Norwegian trader
- Lantmannen Agroenergi - a Swedish company, manufacturer and trader
- Russian Biofuel Association (RBA) – Russian trade company

According to the «Bioenergy International» magazine currently only S. Syr. Pedersen AS and RBA handle with large production volume. Lantmannen Agroenergi is currently working with small quantities of products. Traders have the capital to buy products from pellets plants for the determined price and under FOB (Freight On Board) or FCA (Free Carrier) conditions.

Then they resell pellets to major customers with whom they have established contact. S. Syr. Pedersen AS and Lantmannen Agroenergi are buying up high-quality pellets from Russian plants. Billing rates of these companies are the guideline for Russian pellets producers, as their purchasing price is the highest. In March-April 2008 purchase price of pellets at the St. Petersburg port was performed at a price of 90 euros per tonne. Payment is performed on actual basis tracks with pellets arrived to the port. However, the plants that are more than 400 km from are set higher prices - 110 euro per tonne of pellets. This is conditional by transport expenses. (Rakitova 2008, 4)

The new trade-companies, who come to the Russian pellet market usually, offer superior prices. The difference is approximately 5-10 euro. However, they are not always able to offer prompt payment or they pay by installments. This is repellent factor for manufacturers, because they need the money as soon as possible. The Russian trade-company (RBA) usually has deals with small producers and buys up small quantities of pellets, about 200-300 tons. The purchase price for pellets in the March-April (2008) has wobble near 75-80 euros per tonne of industrial pellets, including VAT (Value Added Tax). Further RBA is accumulating pellets in the port of St. Petersburg. Per month RBA is exported 1-2 steamers. Thus, the RBA sells 3000-5000 tons of pellets per month. (Rakitova 2008, 3)

In the table 6 is shown comparative analysis of comparative cost of wood pellets depending on source of production. For example, delivery from St.Petersburg to Germany:

Table 6. Comparative cost of wood pellets depending on source of production (Ovsyanko, 2007, 112)

Plant	Variant of trade channel	Contracted price euro per tonne	Delivery cost euro per tonne	Actual price ex factory, euro per tonne
A	Direct supply in Germany	180	100	80
	CPT delivery; port St.Petersburg (2500 km.)	110	26	84
B	Direct supply in Germany	180	119	61
	CPT delivery; port St.Petersburg (1500 km.)	110	32	78
C	Direct supply in Germany	180	62	118
	CPT delivery; port St.Petersburg (1000 km.)	110	15	95

Note: Terms of CPT delivery means that the seller CPT – Carriage Paid To (named place of destination). «The seller pays for carriage to the named point of destination, but risk passes when the goods are handed over to the first carrier.» (Wikipedia, the free encyclopaedia. Incoterms 2009)

In the Far East the basic countries-buyers of Russian-made wood pellets and biofuel, as a whole, are Japanese companies. In countries of the Mediterranean Basin, such as Italy, Greece, Spain deliveries of granules carried out through the Black Sea ports. Russian export channels shows on figure 8:

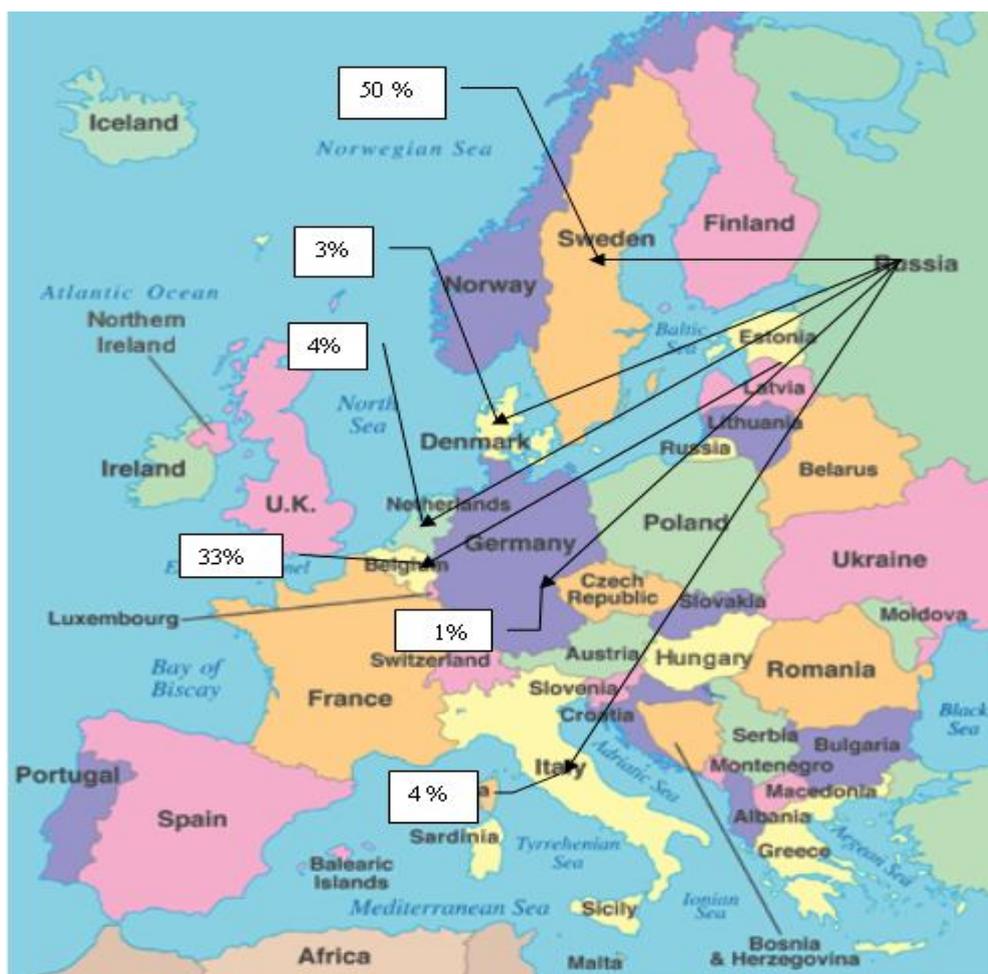


Figure 8. Volumes of Russian pellets export (percentage wise of all manufacture volume)
Note: Created by the author based on the data from (Alexandrova 2008, 6)

6 HOME MARKET

Russian home market of wood pellets is very poorly developed, in comparison with home and export markets of other European countries. The average share of biofuel in overall power production over the country is less than 1 percent; for the Northwestern Federal District it is 3 percent. In a number of regions, such as Republic of Komi, Kareliya, the Arkhangelsk region biofuel is used more actively and even exceeds 10 - 15 % in the general fuel balance in some areas it is conditioned by low internal prices for fossil energy sources. (Babkina 2007)

6.1 Demand

The basic consumers of wood pellets in internal Russian market are owners of municipal and private boiler-houses with capacity of 0,5–5 MW. According to the data of «Vologdabioeksport» (Velikiy Ustyug) factory (in November 2007) internal orders for fuel granules usually do not exceed 150 tons in a year, this volume is produced by factory per day. There are about 36 thousand municipal boiler-houses works on liquid fuel in the country. At list 2/3 from them are located in regions where it would be possible to use a waste of the wood industry. If to switch them on biofuel it's possible to save 85 million tons of oil. (Reiter 2007)

In connection with plan of increasing of export duty for round wood from Russia (from 1 January 2010), exit of deep woodworking offal will be considerably increased. It will inevitably lead to increase of condensed fuel production. From the total pellets volume produced in Russia around 10-15% (on different data) stays inside country. Pellets consumed in the home market, as a rule, are extra-class pellets. Not all manufactures work directly with consumers. (Rakitova 2008, 3) Therefore, the problem of establishing direct contacts between manufactures and consumer is vital.

There are several criteria for this task solution:

- High quality product (ash content, color, packaging)
- Convenient location of warehouses
- Low retail prices
- Transport availability (for delivery), unloading possibility
- Willing to work with retail customers (Rakitova 2008,3)

Pellets come to supermarkets or to small boiler rooms, which consume high-quality product. Manufactures, who operate on the home market, feel themselves rather comfortable. For example, «Biogran Alexandrov» company delivers pellets to the municipal boiler room in the Vladimir region and in the same time they work with private consumers. Municipal boiler rooms don't pay very high price for pellets (45-55 euro per ton). However, private consumers are willing to pay 65-85 euro per ton.

Though, not all high-quality pellets are in great demand in Russia. In connection with this fact huge number of high quality pellets (about 60-70% of the total export-volume from Russia) leaves mixed with industrial pellets (the ash content of industrial pellets is higher) to the heating boilers in Europe. (Rakitova 2008,3)

Inevitable growth of tariffs for energy and the traditional fuel resources connected with the further integration of Russia into world economic community and ratification of the Kyoto Protocol by Russia will promote growth of internal demand for fuel granules and biofuel in whole. Thereupon Russia possessing the world's largest stock of wood resources has real chance to become one of the largest suppliers of biofuel.

7 MANUFACTURING COST OF WOOD PELLETS

The calculations of manufacturing costs of pellets are recommended to be made in accordance with the Guidelines VDI (Association of German Engineers) 2067.

Under this method, all the different types of costs are divided into four main groups:

- capital costs (the cost of acquisition targets, equipment depreciation, and the cost of interest payments)
- costs associated with the consumption (fuel, materials such as lubricants)
- operating costs (maintenance costs)
- other costs (administrative costs, insurance).

The following parameters should be considered during the detailed calculation of wood pellets production cost:

- Investment expenditures in all areas of production (buildings, offices, marketing, planning, expenses for equipment maintenance during the service.)
- Raw material costs and moisture content.
- Power generation costs, power consumption.
- The scheduled (maintenance) and unscheduled downtime of equipment.
- In the case of drying use - the cost and consumption of thermal energy.
- In the case of bio-additives application - their costs.
- Cost of storage (take into account the costs of area for storage or silos storage).
- Number of shifts worked per day
- The labour cost, marketing costs and administrative expenses.
- Annual production volume and moisture content in the finished product.
- Other expenses (Alligno Maschinenexport GmbH 2006, 5)

In the next table (table 7) is represented information about average prime cost of tonne of wood pellets in Russia.

Table 7. Average prime cost of tone wood pellets in Russia (Novoedelo 2009):

Component of cost	Expenses(euro)
raw-material	11,00
electrical energy	11,00
labor costs	9,00
maintenance charges for basic equipment	3,04
depreciation of equipment	5,00
miscellaneous expenses	2,00
packaging and transport expenses	5,4
Total	46,8

Note: Prime cost was calculated in euro at the rate of 1 euro = 45 rubbles

Raw-material moisture content	55,00%
Pellets moisture content	10,00%
Mass of 1 compact cubic meter, kg	800,00
Scaling factor of raw-material compact cubic meter of raw-material in tones of pellets	2,27

The production process has been divided into the total cost, the cost of storage, the cost of support equipment, personnel costs and raw-material costs. Comparison of calculation results for Austria is presented in the following diagram (Fig.9):

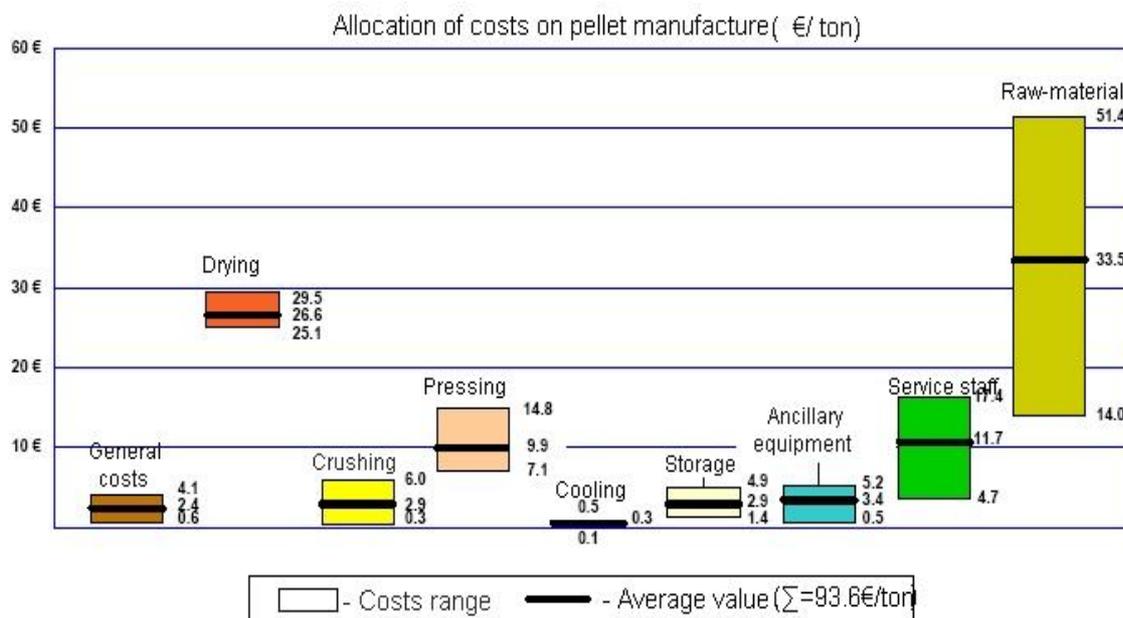


Figure 9. Allocation of costs on pellet manufacture in Austria (Alligno Maschinenexport GmbH 2006, 5)

In the result the average prime cost of ton wood pellets in Austria is near 93 euro and at the time in Russia this is near 46 euro. Raw materials expenses are constitute the most significant cost factor during wood pellet cost calculating. The greatest impact exert by the type of raw-material: dry or wet. Dry raw-material is more expensive. At the same time the use of dry material allows waive from expenses associated with drying and can substantially reduce the cost of production. The cost of sawdust and shavings in Russia can range from negative values (when the owner of this raw material, in the absence of the market, have to landfill it on their own expense), till 25-30 euro/m³, as a raw material for pellets extra class (at a rate of 1 EUR = 45 RUB). (Larin 2006, 45)

In the table 8 is mentioned wood waste costs in Russia.

Table 8. Wood waste costs in Russia.2006 year (Ovsyanko 2006, 17)

Wood waste types	Price (average data)
Sawdust, shaving, dust	0-1,5 EUR (0 – 70 RUB)/m3 (poured)
Chips	5,5-20 EUR (250-900 RUB)/m3 (compact)
Stick, pulpwood	0-33,5 EUR (0-1500 RUB)/m3 (compact)
Fire- wood, tech. material, forest thinners	2-11 EUR (100-500) RUB/m3 (compact)
Lump wastes, slab	0-5.5 EUR (0-250) RUB/m3 (compact)
Bark	0-0.5 EUR (0-20) RUB/m3 (compact)

Review of pellets production cost for dry and wet raw-material is illustrated at the following diagrams on the figure 10. In the case of wet raw-materials using of drying and raw-material may be 2 / 3 of total pellets cost. If dry raw is used production cost of pellets is mainly determined by the value of the raw material, which in some cases amounts to more than 1 / 2 of production expenses. (Alligno Maschinenexport GmbH 2006)

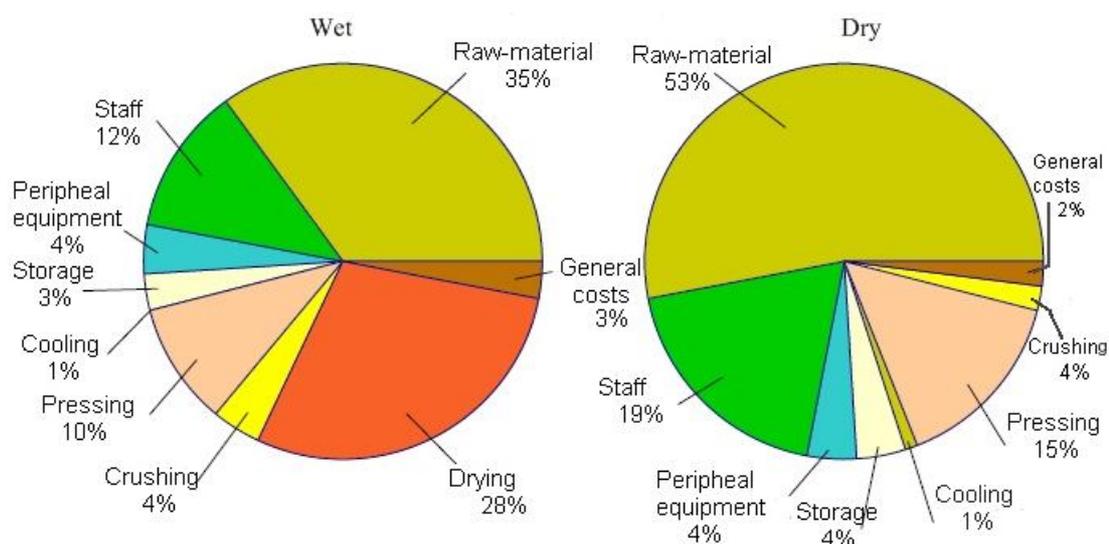


Figure 10. Percentage distribution of costs in the pellets production using wet and dry materials. (Alligno Maschinenexport GmbH 2006, 19)

The proportion of the drying expenses is the significant part of total pellets prime cost. The lowest drying expenses can be achieved with sawmill waste production use (such as bark, sawdust) in the process of energy generation. Mills usually use drum crusher and hammer type crusher. If a homogeneous raw material is used (waste sawn wood) sifting machine can be used instead of crushers. In this case, a small fraction is used

directly in the pellets production. Coarser fraction is used as fuel or come in a smaller breaker. The crushing cost influence on the overall production costs is low. Pellet-pressing expenses also include the cost of vapour treatment and cost of bio additives if it is applicable. The relatively high cost of pellet-pressing mainly accounts for the low-bandwidth of press. Pressing is one of the main factors influencing pellets cost, following drying and the raw-material cost. The main factor influencing the cost of pressing is the consumption of electricity and, of course, the cost of press acquisition. Cooling is usually done by counter flow cooler.

Impact of cooling cost at the total pellets cost is very low. At the storage cost is more influenced by the type of storage and its capacity. Placement capacity of major pellets producers is less than 10% of the annual productivity and mostly this is storage silo type. Expenses for support equipment include the equipment expenses itself and its usage (the cost of electricity for feeding devices, ventilators, sifting machine, etc.).(Alligno Maschinenexport GmbH 2006, 20)

Amount of work hours per year and machine utilization are the following factors which impact on production costs. At least 3 SHIFTS and 5 working days per week are needed for income-generating production. The optimal treatment would be 7 days per a week. For the income-generating production it is necessary to maintain the machine utilization rate not less than 0, 85. (Alligno Maschinenexport GmbH 2006, 20)

8 LOGISTICS

Well-organized logistic is one of the most important detail in pellet production management.

8.1 The logistics problems

In spite of the logistical advantages of wood pellets such as a high apparent density, uniform consistency, low shattering, etc., large amounts transportation of the product for export is not an easy task. First of all, the problem is related to the pattern of demand. European traders and large consumers, because of their business, prefer to work with suppliers on long-term contracts for the supply of large-scale installment of pellets on a monthly basis.

Moreover, virtually all consumers want to get pellets in bulk, without packing. In addition popular in Russia 650 kg big-bags make delivery of goods extremely slow and expensive. It results to a problem to organize pellets delivery from the factory to the port and transfer it into the ships. There are several ways to solve this problem but they all require investment in accessory equipment or the expenses for expensive consumables. (Ovsyanko 2005)

Currently, the major exporters of fuel pellets into Europe market are Canada and USA. Market participants attribute this state of affairs by established logistics system. Delivery to Europe is organized by using the 50- thousandth tons ships and the loading takes approximately same time as 3 thousand tons ship in the Big Port of St. Petersburg. (Neginskaya 2009). From North America pellets are delivered to the port in bulk, and then using special hoses is pumped over into the ship hold. In Russia, the cargo arrives in port packaged in «big bags» and is manually transferred into the vessel holds. In fact, this circumstance enhances pellets value to the almost uncompetitive level. For the expert's opinion from the Massachusetts Bioenergy Research Center (Biomass Energy Resource Center), delivery of prepackaged pellets most appropriate for a distance up to 50 miles. (Neginskaya 2009)

8.2 Logistic optimization

Retail price of pellets is not exceeding 160-180 euros per tone, while the prime cost of production is like 40-60 euros per tone. Therefore transport and logistics are very important factors of production profitability. If it possibly can succeed to save at least 1 euro from one tone of transported product it could make an annual profit of several thousand euros and that will require smaller expenses to logistics operations.

As described above, in the chapter «2.7», there are various options for pellets packing. Packaging methods depend on which way they are being assumed to be transported and used. There are three kinds of packaging:

- in "loose kind" (scattering)
- in bags "big-bag"
- in bags on 10-20 kg(paper bags)

From logistics and transportation vision all this kinds have benefits and imperfections. (Ovsyanko 2006, 39)

8.2.1 «Loose kind»

When the supply of goods is produced in bulk processing can be relatively easily automated. Traders can pack the products in accordance with the requirements of customers. Handling of bulk goods in Russia is complicated by poor transport infrastructure and lack of compliant facilities available to biofuel producers.

8.2.2 "Big-bag" type

The most commonly encountered "big-bags" have capacity of 1 cubic meter that is under standard packed density of a product (0, 65 g /cc); they contain about 650 kg of pellets. This packing is quite convenient for transportation; it provides protection of a product against physical influences. "Big-bag" packaging allows using primitive technology at handling operations (the crane, the automated lift truck) (Ovsyanko 2006, 40).

8.2.3 Paper and plastic bags

Small proportions of the pellets European markets use pellets in small packages. Typically, pellets are packed in paper or plastic bags, with a capacity of 10-20 kg. For wholesale suppliers these bags are usually put on pallets and are supplied in containers or by cargo transport. Often, manufactures use these kinds of bags for packing the "first-class" pellets (Ovsyanko 2006, 40).

8.3 Transport types

There are three main types of pellets transportation:

- Road transport
- Sea transport
- Railway service

Current chapter will describe these types in detail.

8.3.1 Road transport

Road transport is the most expensive, but the simplest and the most flexible way to deliver pellets to consumers. Wagons are usually used when owners need to delivery pellets to short distances. Loading pre-packaged pellet (bags or «big-bags») in the truck does not require special equipment. Only autoloader is required to greatly facilitate the «big-bags» loading, containing pallets. Road transport is not tied to rail or waterways. Sometimes, in cases when suppliers carry out delivery of high quality pellets, which is very expensive, it may be profitable to deliver them over long distances. However, considering the fact that the pellets are usually transferred together with other goods the delivery of large shipments to Europe by road may be difficult. (Ovsyanko 2006, 41)

8.3.2 Sea transport

The most economical type of pellets transports over long distances. «Depending on customer requirements and logistics capabilities of plant pellets can be embark to a ship in bulk, in «big-bags» or in consumer packaging.» (Ovsyanko 2006, 41) Talking about large shipment export, the overwhelming majority of buyers and consumers in Western Europe prefer to receive it in bulk and by regular lot of 2 - 6 thousand tons per month.

Usually, major buyers have specialized terminals and systems, to receive goods, dispatch it and load. This system provides flexibility and efficiency of logistics operations. The received pellets are overloading that from holds to a special warehouse. Then the shipment, if it necessary can be pre-packaged in «bigbags» or in bags of 10-20 kg., depending on the customer wishes.

However, recently in Russia was opened the first specialized port for pellets handling. «In the port of Ust-Luga (Leningrad region), on the 6 June 2008 was opened the first stage of a multi-cargo complex« Ug-2». The complex is designed to overload rolling goods, especially, for new import vehicles, containers and general goods as well as wood-fuel pellets» (VertiKalnet.ru 2009)

If the buyer in Western Europe is ready to take pellets in «bigbags» or in another packaging, the product can be delivered by sea - on pallets. This makes logistics in Russia simpler and cheaper. However, this packaging is usually used for small lots delivery and European importers are often don't like to work with it, because it is not profitable. If the plant is located near navigable rivers or lakes, it is also possible to use inland waterways to reduce transport costs. The main problem with this is that the majority of inland waterways are frozen in the winter – in «high season» time on the market of biofuels.

8.3.3 Railway service

Railway transport is profitable to use for the pellets delivery in the package or in scattering type beyond the pale of Russian Federation. Cost of transportation by railway is lower than by truck. Transportation of packed pellet is implemented in a covered wagon. For scattering type pellet transportation is implemented by special wagons- «hopper». However, there are some imperfections in railway service. This type of transport is circumscription availability of the approach road at the plant. Secondly the uploading «bigbags» to covered wagon takes a lot of time while uploading in a bulk requires special equipment. (Bio Technology Development, 2007)

8.4 Supply chain

Let us consider an example: pellet production plant located in North-West district in Russia has approach road at the plant; product delivery to consumers will be carried out by sea through the seaport of St. Petersburg. The supply chain would look something like this (Fig.11):

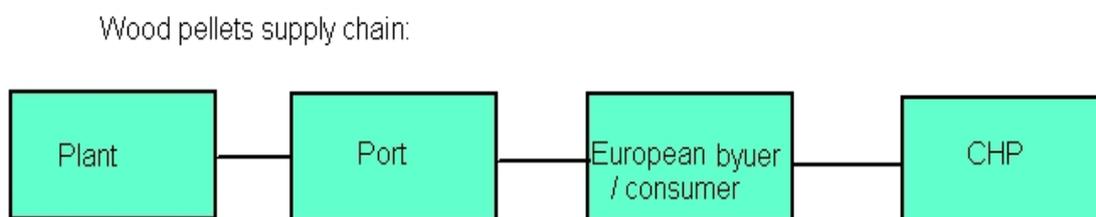


Figure 11. Wood pellets supply chain.

8.4.1 Pellets delivery from plant to port

Table 9. Pellets delivery from plant to port (Ovsyanko 2006, 41)

Variant	Features and costs	Conditions
In «bigbags» by truck	Expenses for package (like 6-8 euro per ton.) The trip cost at a rate of 20-25 tones of product per one trip.	Filling can be made by simple auto-loader.
Shipment in «bigbags» by railway service.	Expenses for package (like 6-8 euro per ton.); railway expenses.	Local railway.
Shipment in bulk by railway in hopper-wagons.	Expenses for railway transport. Hopper-wagons cheaper then cover wagons.	Local railway; special equipment for scattering type pellet filling in wagons.
Pellets prepacking in 10-20 kg bags at plant.	Cost of packing; The trip cost at a rate of 20-25 tones of product per one trip.	Equipment for packaging; auto-loader.

8.4.2 Freight handling in port

Table 10. Freight handling in port (Ovsyanko 2006, 41)

Variant	Features	Conditions	Expenses
Pellets transshipment in package on trays.	The most economical choice if consumer ready to accept pellets in «bigbags» in big lots. When pellets importing by trucks it can take extra expenses connected with long-term accumulation of shipload lot in port.	Does not require special conditions.	Appraisal cost of transshipment in port Saint-Petersburg: 12-13 euro per one gross ton.
Pellets transshipment, supplied from plant in «bigbags»; «bigbags» unpack to ship's hold.	This type of pellets transshipment is taking much time and high labour cost.	Does not require special conditions.	Expenses for transshipment are near 14 euro per one gross ton. When pellets importing by trucks it can take extra expenses connected with long-term accumulation of shipload lot in port
Pellets transshipment, supplied from plant in bulk by hopper-wagons.	Assisted by floating crane.	Necessitate the crane equipment; railroad tracks on the port terminal.	The cheapest way to make pellets transshipment in port. Expenses for transshipment are near 12 euro per one gross ton.
Special-purpose terminal	In Russia there is only one special-purpose terminal «UG-2» in Ust-Luga port (Leningradskaya area)	Requires a site with a moorage wall at the port and specialized terminal equipment.	Very economical and effective method. (Expenses data not available)

8.4.3 Receipt of goods by consumer in port

Table 11. Receipt of goods by consumer in port (Ovsyanko 2006, 42)

Variant	Features and costs	Conditions
Pellets receipt in bulk	The most widespread variant, which provides to pellet's recipient lowest expenses and maximal flexibility.	Special-purpose equipment for unloading; there is enough in European ports.
Pellets receipt in «bigbags»	Unloading in realizing in common sequence. This operations is labour-intensive.	No special requirements.

9 STANDARDS

Single European standard for pellets in the short run will be determined. It should be CEN/TC 335 standards. So below are some existing national standards for pellets (Table 12):

- Austria - ONORM M 7135 Austrian Association pellets (briquettes and pellets);
- The United Kingdom - The British BioGen Code of Practice for biofuel (pellets);
- Germany - DIN 51731 (briquettes and pellets);
- Switzerland - SN 166000 (briquettes and pellets);
- Sweden - SS 187120 (pellets). (Pelleta.com.ua. 2008)

Table 12. European wood-pellets standards (Bio Technology Development 2008)

	DIN 51731	O-NORM M 7135	DIN plus	SS 187120
	Germany	Austria	Germany	Sweden
Diameter(mm)	4-10	4-10		less 25
Length (mm)	less 50	less 5 x d	less 5 x d	less 5 x d
Density (kg/dm³)	more 1,0 – 1,4	more 1,12	more 1,12	*
Moisture content (%)	less 12	less 10	less 10	less 10
Bulk weight (kg/m³)	650	650	650	more 500
Briquette dust (%)	*	less 2,3%	less 2,3%	*
Ash content (%)	less 1,5	less 0,5	less 0,5	less 1,5
Calorific value (MJ/kg)	17,5-19,5	more 18	more 18	more 16,9
Sulphur content (%)	less 0,08	less 0,04	less 0,04	less 0,08
Nitrogen content (%)	less 0,3	less 0,3	less 0,3	*
Chlorine content(%)	less 0,03	less 0,02	less 0,02	less 0,03

*- quantity is not defined

Conformance to standard is verified in specialized laboratories, but should be borne in mind that it is voluntary and usually the manufacturer receives a certificate at the beginning of production, that does not always guarantee that the next lot will be the same quality. Certificates for pellets in Russia are issued by various organizations.

If a manufacturer wish to sell pellets abroad, it would be logical to get the certificate from accredited laboratories Incolab and SGS. However, for internal purposes a certificate can be issued in domestic research institutes. The difference in price between SGS or Incolab and Russian domestic laboratories is more than essential.

Typically, in local laboratories, all tests are done according to GOST, while in Incolab and SGS are done according to ISO, ASTM, SS, etc. and on imported equipment.

9.1 Russian biofuel standard (GOST)

On the 1 January 2009 In Russia was introduced standard GOST R 52808-2007 «Untraditional Technologies. Biowaste energy. Terms and definitions. »

According to information from the National Bioenergy Union this Standard was developed by Renewable Energy Laboratory, Faculty of Geography, Moscow State University. The standard establishes the terms and definitions for basic concepts in the biofuels area, with a focus on liquid and gaseous fuels. This standard contains the terms of Orders of the European Parliament and the Council of the European Union from 8 May 2003, № 30 Measures to stimulate use of biological fuels in transport sector.

(National Bioenergy Union 2008)

In the GOST introduces the biofuel concept. Under biofuel are implied bioethanol, biogas and biodiesel. Which means that pellets are not officially consider as biofuel in Russia yet. (National Bioenergy Union 2008)

9.2 CEN/TC 335 biomass standards

«CEN/TC 335 is the technical committee developing the draft standard to describe all forms of solid biofuels within Europe, including wood chips, wood pellets and briquettes, logs, sawdust and straw bales. CEN/TC 335 allows all relevant properties of the fuel to be described, and includes both normative information that must be provided about the fuel, and informative information that can be included but is not required. As well as the physical and chemical characteristics of the fuel as it is, CEN/TC 335 also provides information on the source of the material.»(BioMass Energy Centre 2008)

«Fuel specification and classes for solid biofuels (CEN/TS 14961) was published in year 2005 and now it will be upgraded to the first full European Norm (EN) for solid biofuels in 2008. Some modifications of existing thresholds were needed but also the

extension of the prEN 14961 to multi-part standard, in which concrete fuel quality requirements for different solid biofuel products used in small-scale can be seen as a result of the feedback analysis of companies and several associations and in collaboration with the CEN/TC 335 WG 2. Also combustion tests with small-scale boilers (< 50 kW) by using the most traded solid biomass fuels (pellets, briquettes, wood logs, wood chips and olive residues).» (BioNorm II – project № 038664, 2008,7)

Figure 12 shows CEN/TC 335 standards for biofuels:

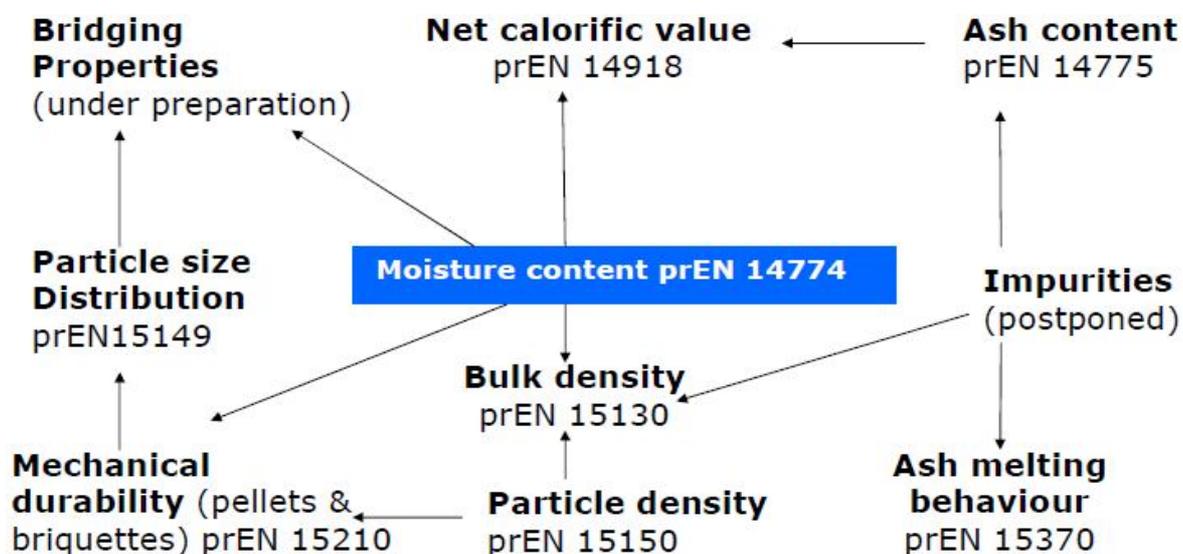


Figure 12. CEN/TC 335 standards for biofuels(Alakagas 2008,3)

Most important technical specifications:

- «prEN 14961 Fuel specifications and classes
 1. Part 1- General requirements
 2. Part 2,3,4,5,6 Product standards for non-industrial use
- prEn 15234 Quality assurance(upgrading started)
- prEn 15210-1 Mechanical durability of pellets
- prEn 15149 Particle size
- prEn 15103 Bulk density
- Determination of length and diameter of pellets»(Alakangas 2008, 2)

10 CUSTOMS DOCUMENTS

Constantly there are a lot of talks in Russia about export dues increasing on raw timber, which is the raw material for many European wood mills. It will decrease the volume of pellets produced in Europe, their price will increase too. (Businessinternet. Business ideas 2008)

However, the due for pellets export from Russia does not exist. In Russian customs documents for pellets export from Russia are placed on code TN VED (analogous with Harmonized Commodity Description and Coding System HS) of Russia to the category: «4401301000- Sawdust, agglomerate or non-agglomerate in briquette-type, pellet-type (granule) or in analogous type. »(TN VED of Russia 2006)

As it mentioned in the TN VED № 4401301000 of Russia:

- export duty - free
- licensing for export - free

So, for pellets export from Russia, it will be necessary to execute following documentation:

1. Fitosanitary certificate
2. Environmental declaration
3. Goods transport documentation
 - CMR
 - Invoice

Likewise it will be necessary to pay customs fees for customs clearance of cargoes.

10.1 Fitosanitary certificate

Fitosanitary certificate is the international document, read-out by the Authority of Quarantine and / or protection of plant-exporting countries confirming sanitary condition of the goods. Certificate should be attached to the transport documents accompanying the goods. (Kachalina 2008, 85)

Goods export from Russian Federation is made, accompanied by a Fitosanitary certificate in form required by the International Convention FAO (Food and Agriculture Organization), certified original triangular stamp and signature of Plant Quarantine State Inspector. Fitosanitary certificate is issued by the State Inspectorate of Plant Quarantine under phytosanitary inspection in the timber harvesting area or in accordance with timber quarantine examination before dispatch.(Kachalina 2008, 86)
In order to receive certificate, declarant obliged to appeal to inspection with demand no later than 15 days before goods dispatch. In demand should be noted:

- name and number, intended for export;
- the name of the country in which the timber is sent;
- recipient and their address;
- departure dates;
- border crossing points (ports, landing stages, railway stations, airports, etc);
- presented by importer additional phytosanitary requirements (a copy of the contract, agreement or an excerpt from it).(Kachalina 2008, 86)

The following range of goods is subject to quarantine phytosanitary control:

- Wood fuel in logs , boughs, bundle of wood brushwood or similar types
- Chips or wood shavings (conifers)
- Chips or wood shavings (deciduous)
- Sawdust and wood waste and scrap non-agglomerate (Governmental regulation of Russia № 718, 2006).

The range of wrapping, subject to quarantine phytosanitary control:

- Casegoods, boxes, packaging baskets, similar containers made of wood
- pallets, trays and other loading desks wood made;
- Another wood-packaging material (Governmental regulation of Russia № 718, 2006).

Consequently, it is necessary to execute Fitosanitary certificate for pellets and for trays and another packaging material.

10.2 Environmental declaration

For European Union border intersection it is necessary to have document entitled "Environmental Declaration", which demonstrates, that wastes for transferring are safety or may be danger. Wood pellets in essence are wood waste. So, if producer want to transfer pellets in EU they must have this papers.

Environmental certificate and declaration are documents that:

- provide documentary evidence of high class level of evidence object;
- instate the establishment of pricing and promotional allowances for environmentally safe products(Volokovinskiy 2005).

The holders of the environmental certificate or declaration have a right to advertise in the media their products as environmentally friendly or safe. In the Environmental Certificate and in the Environmental Declaration are pointed out all requirements (environmental rules and regulations, hygienic conclusions, veterinary certificates, fire safety certificates, permission of Russian Federal Service for Ecological, Technical and Atomic Supervision (RosTekhNadzor)) constitute a ground for issuance certificate or declaration. Environmental Certification and declaration of products conformity are conducted in accordance with the regulations, including international standards of ISO and IEC, EU Directives, Euro standards, national standards instituted by the established order. In voluntary form of Environmental Certification is permitted to conduct certification on compliance with the requirements of the documents, not introduced in Russia. (Volokovinskiy 2005)

10.3 Invoice

«An invoice or bill is a commercial document issued by a seller to the buyer, indicating the products, quantities, and agreed prices for products or services the seller has provided the buyer. An invoice indicates the buyer must pay the seller, according to the payment terms. In the rental industry an invoice must include a specific reference to the duration of the time being billed, so rather than quantity, price and discount the invoicing amount is based on quantity, price, discount and duration. Generally speaking each line of a rental invoice will refer to the actual hours, days, weeks, months etc being billed. From the point of view of a seller, an invoice is a sales invoice. From the point of view of a buyer, an invoice is a purchase invoice. The document indicates the buyer and seller, but the term invoice indicates money is owed or owing. In English, the context of the term invoice is usually used to clarify its meaning, such as "We sent them an invoice" (they owe us money) or "We received an invoice from them" (we owe them money). » (Wikipedia, the free encyclopaedia. Invoice 2009)

10.3.1 CMR

CMR (Cargo Movement Requirement) this is typical form of international transport consignment note.

In CMR should specify (Ardens Moskow 2007):

- company - sender, ; company complete address;
- company-recipient, company complete address;
- address of final unloading;
- address of uploading and date;
- invoice numbers, TIR number, certificate numbers (veterinary, Fitosanitary certificate, etc.)
- name of goods, packaging type, TN VED codes, weight;
- names of customs;
- registration numbers of cars;

10.4 Customs fees for customs clearance of cargoes

Customs fees for customs clearance of cargoes are subject to payment by declare goods, before customs declaration submission or in same time with this.

Costs of fees:

500 RUB (11.1 EUR) – for customs clearance of cargoes, customs commodity cost not exceed than 200 000 RUB (4 450 EUR) inclusive;

1 000 RUB (22 EUR) - for customs clearance of cargoes, customs commodity cost is amount more than 200 000 RUB (4 450 EUR), but not exceed 450 000 RUB (10 000 EUR) inclusive;

2 000 RUB (44 EUR) - for customs clearance of cargoes, customs commodity cost is amount more than 450 000 RUB (10 000 EUR), but not exceed 1 200 000 RUB (26 600 EUR) inclusive;

5 500 RUB (122 EUR) - for customs clearance of cargoes, customs commodity cost is amount more than 1 200 000 RUB (26 600 EUR), but not exceed 2 500 000 RUB (55 550 EUR) inclusive;

7 500 RUB (165 EUR) - for customs clearance of cargoes, customs commodity cost is amount more than 2 500 000 RUB (55 550 EUR), but not exceed 5 000 000 RUB (111 110 EUR) inclusive;

20 000 RUB (445 EUR) - for customs clearance of cargoes, customs commodity cost is amount more than 5 000 000 RUB (111 110 EUR), but not exceed 10 000 000 RUB (222 220 EUR) inclusive;

50 000 RUB (1 110 EUR) - for customs clearance of cargoes, customs commodity cost is amount more than 10 000 000 RUB (222 220 EUR), but not 30 000 000 RUB (668 150 EUR) exceed inclusive;

100 000 RUB (2 200 EUR) - for customs clearance of cargoes, customs commodity cost is amount more than 30 000 000 RUB (668 150 EUR);

(Russian Federation Customs Code. Charter 33.1. 2009)

According to unofficial data (forum) cost of execution of all this documents will be about 70-80 euro per vehicle weight 21120kg. Concerning to packaging, the tray must be EURO Standard 800x1200mm. Also trays should be packed in stretch film and here shall be two polypropylene ties with scrids. It is very important to execute correctly all

these documents, as if the track or the goods will be transmit to customs fine-parking or fine-warehouse, the amount that will need to pay will be determined:"at the rate of 3500 roubles (80 EUR) per one square meter of useful area, or 1000 roubles (22 EUR) per one cubic meter of storage capacity, if used as a customs warehouse space. (Russian Federation Customs Code. Article 227, 2009)

10.4.1 Import customs duties for pellets equipment are cancelled

According to the National Bioenergy Union from 1 July 2007 duties on import of equipment for granulation and briquetting are cancelled on permanent basis. This means that the equipment for granulation and briquetting will not be liable to customs duties not within a short period of time (several years) as it was before, but consistently. This decision demonstrates that Russian Government is promoting development of timber high-level processing, specifically the panels production and biofuel production. (National Bioenergy Union 2007)

11 FUTURE PROSPECTS

Certainly, in general it is necessary to take into account the availability of objective limiting factors on the way toward to biofuels market development in Russia. First of all, unconditionally, is the availability of huge gas reserves, with the state price policy for this type of fuel. Especially after 1998, growth of internal prices for natural gas is clampdown substantially. As a result, it appears that natural gas prices are lower, than economic price of gas, which is determined by gas production cost plus transportation cost.

Naturally, such price advantage of gas makes it out of competition compared with other fuel types. Surely, in this present circumstance, it is difficult for biofuel manufactures to rival with gas in the home market, but it turns out competition in comparison with other traditional types of fuel like heavy oil and coal. Certainly, most important problem is the lack of sterling home market of biofuel, which would stimulate the creation of appropriate infrastructure. Biofuel will have limited demand at the home market. Consequently, its production should be orientated, in the first place for export. (Alexeeva 2006, 8)

In March-April 2008 purchase price of pellets at the St. Petersburg port of was performed at a price of 90 euro's per tonne. Payment is performed on actual basis tracks with pellets arrived to the port. However, the plants that are more than 400 km from are set higher prices - 110 euro per tonne of pellets. This is conditional by transport expenses. Furthermore, the price which foreign buyers are ready to pay is near 90 euro per tonne. (Rakitova 2008, 4)

So, raises a logical question: why Russian producers are continuing their production, when breakeven point is already exceeding? This is refer by means of many producers are took credits when they start manufacturing and they must to pay out it. Besides that some major producers, nevertheless, have reliance that situation is looking up soon and prices coming up. Therewith, it is dark hour for pellets producers. For example, with this FOB-price, payback for pellet plant in Russia is range up to 10-12 years. Major part of manufactures was prepared to 3-5 years payback period.

Nowadays, more and more pellets plants are put up for sale. Practically, every plant with capacity less than 800 tonne per month is looking for investor. In the other words this is the same selling. If prices doesn't come down it could prompt insolvency series among Russian wood pellets manufactures. (Rakitova 2008, 5)

However, currently there are no conditions for the sustainable biofuel production in Russia. Emerging sometimes small-scale producers cannot provide for the growing demands of western importers. For this branch development it is necessary to make investments, primarily in the development of appropriate infrastructure, which would include, among other things, special logistics centers. It is helpful to locate such centers in the field, which should be involved syndicated capital schemes using public-private partnership. (Alexeeva 2006, 9)

The logistics issue is very relevant in the recent time. Through the Maritime Commercial Port of St. Petersburg sent about 80% of pellets produced in Russia. However, due today's level of transshipment the perspective of specialized terminal construction is economically disadvantageous for the port. Indeed, the basic goods that are transshipment in the port is metal, scrap metal, round logs, container cargo. Pellets transshipment port give to port only small economic benefit. In the Port of St. Petersburg by railway supplied 70-80% of pellets. That is necessary to have railway for successful trans-entrances. However, alternative sites considered for the construction of the terminal doesn't have receipt siding. (Yarmchuk 2009, 5)

Anyway, the home market will gradually organize and become more transparent. This will lead to « sifting» ineffective intermediaries who seek to maximize short-term profits and to increase average profitability of production. In the branch identifies processes of volume production growth by buying the most efficient production and by increment of average scale of production and increasing the number of plants belonging to the same owner. However, this process does not go too far. It is unlikely that the share of the largest manufacturers exceeds 15-20% of total production. (Ovsyanko, 2007, 118)

The Russian home market is still small, so the European market remains the most attractive area for manufacturers. Until there are snow and cold in Russia itself, it is early to think that in Russia all pellet producers should come out of business because of warm European winters. According to calculations and practice of some municipal boiler houses, pellets is more profitable fuel compared to heavy oil, diesel oil and even coal.(Rakitova 2008, 5)

12 CONCLUSION

Today in Russia are about 130 enterprises that are producing wood pellets. Geographical location of plants is quite extensive. However, the most advanced companies are mainly located in Northwestern Federal District. This can be explained by two factors: proximity to Europe and rather large forest resources of the region. The production volume of these plants is small, compared with Europe. The average annual production of the ordinary Russian factory is 10-15 thousand tons per year. About 80% of pellets produced in Russia are exported to various countries of the domestic gas prices.

Natheless, it is suspected that Russian home market of pellets will grow in coming years as Russia has ratified the Kyoto Protocol and its need to reduce emissions of harmful gases, and pellets are ideal for this target and some huge investors start to invest money in pellets plants in Russia. Russia is the most promising country for the western manufacturers as they can produce pellets in Russia and sell the product in Europe without intermediaries. The average pellets prime cost in Russia is 50 euro per tonne. For example in Austria the prime cost of pellets is 90 euro per tonne.

So, from all the foregoing, it can be concluded that the pellets production in Russia, up to date is prospective and profitable, but under fulfilling several conditions:

1. You have an enormous wood production or other reliable source of quality raw materials for pellets production in strong volume, which is located in the transportation node.
2. Location of the plant. The production should be located relatively close to ports or railway routes.
3. And most importantly: the availability of direct contact with consumers.

Consider these conditions in detail. Large volumes, good logistics, and work without intermediaries this is the secret of success in the wood pellets industry! To produce 1 ton of pellets it is required 6-10 cubic meters of sawdust (depending on quality, technology, etc.). If manufacturer has a good raw material base it will have the opportunity to provide itself with raw materials for large volumes and it, in turn, will allow entering into lucrative annual contracts with Western consumers, and have deals with resellers.

As a second point it is necessary to have a good logistic scheme. Pellets are very uncomfortable product for the transportation point of view. Wagon holds about 20 tons of pellets, or in monetary terms, about 3200 euros (with a contract price of 160 euro per tonne). The delivery cost, for example in Germany ranges 60 to 100 euro per tonne, i.e. from 1300 to 2000 euros per car trip. Of course, it's necessary to take into account the prime cost of pellets production which is about 50 euros per tonne. Thus, the location of production around the port or on the extreme case near some railway is greatly increases the chances of enterprise success.

However, the most important factor is a direct contract with the customer. As if the work will be carried out through traders, a ton of pellets can be sold at a price not more than 90 euros per tonne. With direct contact with the consumer price can reach up to 180 euro per tonne. Natheless, very small proportion of Russian pellets producers have such direct contact, because of that reason many companies are forced to work through traders at a sacrifice.

Today, for the plant construction with capacity of 2 tons / hour (800-1000 kg. in mouth) it is necessary to invest in average about 1,300,000 euro. This amount consists of the equipment cost - 600,000 euro; special transport for raw material harvesting, and other equipment - 350,000 euro; capital investment in the acquisition and renovation of buildings and communication - 350,000 euros. (Portal Novoe Delo.com 2009)

Last year Russian government introduced project: «The biotechnology development in Russian Federation in 2008-2020 years». This project aims to establish in Russia the new high-tech biofuel industry for the clean energy sources production. This project is controlled by «Rostehnologii» corporation with the support of various public and environmental organizations. It's giving one more opportunity for wood pellets market development in Russia.

13 REFERENCES

1. Alakangas, Y 2008, «Fuel specification and classes», p.3, VTT.
Available from:
http://p29596.typo3server.info/fileadmin/Files/Documents/05_Workshops_Training_Events/1_Fuel_specif__case_pellets_27112008.pdf [7 April 2009]
2. Alakangas, Y 2008, «Fuel specification and classes», p.2, VTT.
Available from:
http://p29596.typo3server.info/fileadmin/Files/Documents/05_Workshops_Training_Events/1_Fuel_specif__case_pellets_27112008.pdf [7 April 2009]
3. Alexeeva, Y 2006, «Development of biofuel market in Russia», Bioenergetics magazine, no.1, pp 8-10. In Russian. Available from:
http://www.bioenergo.spb.ru/state/Bio_06_01/Bio_06_01.pdf [8 May 2009]
4. Alexandrova, Y 2008, «Opportunities for Wood fuel granules production in Russia», Institute of Economics and Industrial Engineering, Krasnoyarsk. In Russian.
Available from: econom.nsc.ru/conf08/info/Doklad/Alexand.doc [5 December 2008]
5. ALLIGNO Maschinenexport GmbH., Y 2006, «Practical guidance for pellets production management», p.5. In Russian. Available from: <http://www.alligno-pellets.ru/Pellets.pdf>
[12 February 2009]
6. ALLIGNO Maschinenexport GmbH., Y 2006, «Practical guidance for pellets production management», p.19. In Russian. Available from:
<http://www.alligno-pellets.ru/Pellets.pdf> [12 February 2009]
7. ALLIGNO Maschinenexport GmbH., Y 2006, «Practical guidance for pellets production management», p.20. In Russian. Available from:
<http://www.alligno-pellets.ru/Pellets.pdf>
[12 February 2009]
8. Babkina, Y 2007, «Biofuel is problem solution for XXI century» , Lesnoy Expert magazine, vol.40, no.3. In Russian. Available from:

- <http://www.lesnoyexpert.ru/index.php?p=article&id=view&n=19&a=1> [15
January 2009]
9. Biofuel, Y 2007, «Production methods». In Russian.
Available from: <http://biofuel.by/en/pellets/tehnology/data/tpl-print/> [10
February 2009]
10. Bio Technology Development, Y 2008, «Wood pellets: standards ». In Russian.
Available from:
http://www.biotechnology.net.ua/section/subsection/define/bio/id_section/14/id/25 [6 March 2009]
11. BioMass Energy Centre, Y 2008, «CEN/TC 335 biomass standards».
Available from:
http://www.biomassenergycentre.org.uk/portal/page?_pageid=77,19836&_dad=portal&_schema=PORTAL [5 April 2009]
12. BioNorm II – project № 038664, Y 2008, «Pre-normative research on solid biofuels for improved biofuel standards», pp. 7.
Available from: <http://www.bionorm2.eu/downloads/DIV.6-2008-05-05.pdf>
[7 April 2009]
13. Business ideas, business internet, Y 2008, «Pellets production is profitable business on the biofuel market». In Russian. Available from:
<http://www.businessinternet.ru/ideab121.htm> [22 March 2009]
14. Company grouping Ardens-Moscow, Y 2007, «CMR». In Russian.
Available from: <http://ardens-moscow.ru/cmr> [4 April 2009]
15. Commodity Nomenclature for Foreign Economic Activities of Russia (TN VED of Russia), Y 2009, TN VED no. 4401301000. In Russian.
Available from: <http://www.tks.ru/db/tnved/tree/c4401301000/print> [2 April 2009]
16. Ecotechnologii, Y 2008, «Wood granulation». In Russian. Available from:
<http://ecogran.ru/art.php?id=46> [16 December 2008]
17. Governmental regulation of Russia № 718, Y 2006, « Commodity classification is subject to phytosanitary control », p. 4. In Russian.
Available from: <http://www.tks.ru/files/other/fito.doc> [30 March 2009]

18. Gukovskiy, Saraev, Chernih, Y 2006, «Decent life- adequate accommodation», Economic strategy magazine, no.7, pp. 102-109. In Russian. Available from: http://www.inesnet.ru/magazine/mag_archive/free/2006_07/saraev.htm
[10 January 2009]
19. Kachalina, Darmagapova, Zandanova, 2006 «Customs expert examination of goods and raw-material quality», pp. 85-86, Ulan-Ude. In Russian. Available from: http://window.edu.ru/window_catalog/files/r48561/mtd_mlk58.pdf
[7 April 2009]
20. Larin, Y 2006, « Opportunities and obstacles application renewable energy sources in Russian regions. Analysis of the characteristics and features renewable energy in Murmansk, Yaroslavl' and Altay regions », p.45, Moskow. In Russian. Available from: <http://www.reeep.ru/files/In%20Russian.pdf>
[5 February 2009]
21. Lesnaya Rossiya Magazine, Y 2008, «Europe «got addicted» to wood pellets», Lesnaya Rossiya Magazine, no. 4, pp. 36-37. In Russian. Available from: http://www.rosleshoz.gov.ru/media/publication/0/Lesnaya_Rossiya__4.pdf
[2 December 2008]
22. National Bioenergy Union, Y 2008, «Non-traditional technologies. Biowaste energetic. Terms and adjectives». In Russian. Available from: <http://www.wood.ru/ru/lonewsid-25073.html> [16 March 2009]
23. National Bioenergy Union, Y 2007, « Import duties abolition for granulation equipment and for briquetting equipment from 1 July 2007 on a permanent basis.» In Russian. Available from: http://www.wood-pellets.com/cgi-in/cms/index.cgi?ext=news&lang=1&nid=97&sub=show_news [28 March 2009]
24. Neginskaya, Y 2009, «Wood pellets logistics-does Canada have business rivals?», Informational portal RGD Partner. In Russian. Available from: <http://rzd-partner.ru/comments/2009/03/03/337621.html> [10 March 2009]

25. Ovsyanko, Y 2008, «Wood bioenergy in Russia: history and current trends», Lesnaya Rossiya Magazine, no. 4, pp. 4-7. In Russian.
Available from:
http://www.rosleshoz.gov.ru/media/publication/0/Lesnaya_Rossiya_4.pdf
[2 December 2008]
26. Ovsyanko, Y 2007, «How much are granules for people? », Lesprom Inform magazine, vol.42, no.1, pp. 54-57. In Russian. Available from:
http://www.lesprominform.ru/arhiv/LPI_41.pdf [23 December 2008]
27. Ovsyanko, Y 2007, «How much are granules for people? », Lesprom Inform magazine, vol.42, no.2, pp. 112-118. In Russian. Available from:
http://www.lesprominform.ru/arhiv/LPI_42.pdf [30 November 2008]
28. Ovsyanko, Y 2006, «Gentlemen, let's show hand!», Bioenergetics magazine, no.1, pp. 38-42. In Russian. Available from:
http://www.bioenergo.spb.ru/state/Bio_06_01/Bio_06_01.pdf [2 March 2009]
29. Ovsyanko, Y 2005, «Forming peculiarities of biofuel branch in Russia». In Russian. Available from: <http://www.drevesina.com/materials.htm/a7/b260/>
[11 March 2009]
30. Ovsyanko, Y 2006, «Raw material base evaluation», Guide: Wood pellets. Russia. Ukraine. Belorussia, pp. 17-22. In Russian. Available from:
<http://www.wood-pellets.com/cgi-bin/cms/index.cgi?ext=content&pid=1348&lang=1> [23 March 2009]
31. Panchlava, Gordeev, Vaisberg, Teplyakov, R 2007, «Panel discussion: Integrated use of wastes and recyclable resources in Russian Federation», Science and technology in Russia. In Russian. Available from:
http://www.strf.ru/material.aspx?CatalogId=351&d_no=13357 [15 December 2008]
32. Pellets Partner Group, Y 2006, «Press and matrix». In Russian.
Available from:
http://www.pellets.ru/op-module_show/id-370/oborud.html [30 January 2009]
33. Portal VertiKalnet.ru, Y 2009, «In the Ust-Luga was opened the first queue of «Ug-2» complex». In Russian. Available from:
<http://www.vertikalnet.ru/novosti/novosti-rynka/novosti-kompaniy/detail.php?ID=6661> [14 March 2009]

34. Portal Pelleta.com.ua., Y 2008, «Laboratory analysis of pellets quality. »
In Russian.
Available from: <http://pelleta.com.ua/page-o640.html> [6 March 2009]
35. Portal Novoe Delo.com., Y 2009, «Wood pellets production», Institute of Economic Security. In Russian.
Available from: http://www.novoedelo.com/news_details.shtml?id=254
[2 May 2009]
36. Rakitova, DW 2008, «The mysterious trading», The Bioenergy International magazine, no.2, pp.2-5
37. Reiter, Y 2007, «Wasteless timber» , The Industry-Building review, no.105. In Russian. Available from: <http://spbpromstroy.ru/105/04.php>
[15 December 2008]
38. Russian Federation Customs Code. Charter 33.1., Y 2009, «Customs fees for customs clearance of cargoes». In Russian. Available from: <http://www.tamognia.ru/payments/gathering/> [7 April 2009]
39. Russian Federation Customs Code.Article 227., Y 2009, «Terms of inclusion in the owners Register of customs warehouses ». In Russian. Available from: <http://www.tamognia.ru/code/sec2/subsec2/chap19/part5.html> [7 April 2009]
40. Volokovinskiy, Y 2005, «Ecological product certification», Saint-Petersburg Ecological Union. In Russian. Available from: <http://www.ecounion.ru/ru/site.php?content=detailcontent.php&blockType=151&blockID=548> [27 March 2009]
41. Wikipedia, the free encyclopedia, Art. Invoice, Y 2009.Available from: <http://en.wikipedia.org/wiki/Invoice> [27 March 2009]
42. Wikipedia,the free encyclopedia, Art. Invoice, Y 2009.Available from: http://en.wikipedia.org/wiki/Delivered_Duty_Paid#Delivered_Duty_Paid
[11 May 2009]
43. Wikipedia,the free encyclopedia, Art. Wood pellet, Y 2009.Available from: http://en.wikipedia.org/wiki/Wood_pellet [11 May 2009]
44. Yarmchuk, DW 2008, «Trader is producer's friend.», The Bioenergy International magazine, no.2, p.5