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## **PREREQUISITES FOR INCREASING PELLET PRODUCTION IN BELARUS**

The problem of using low-grade wood, sawmill and woodworking wastes is being solved in Belarus through the construction of pellet plants. The introduction of new production facilities made it possible to make a good profit, and to direct the received proceeds to the further expansion of production.

In the Republic of Belarus, forests are one of the main renewable natural resources and the most important national wealth. Forests and forest resources are of great importance for the sustainable socio-economic development of the country, ensuring its economic, environmental, energy and food security. According to a number of key indicators characterizing the forest fund (forested area, forest area and stock of growing wood in terms of one inhabitant), Belarus is among the top ten forest states in Europe.

The depletion of world reserves and the increase in the cost of fossil fuel and energy resources, the increasing environmental requirements for emissions from fuel combustion, the development of emissions trading – all these served as an impetus for the development of forest bioenergy, including for increasing the production and use of wood fuel in power plants.

Full and comprehensive use of wood biomass allows not only to meet the needs of the national economy in the products of mechanical and chemical processing of wood and wood substances, but also to make a significant contribution to the production of heat and electricity on a national scale [1].

Wood processing enterprises leave behind secondary raw materials in the form of sawdust, bark, shavings, wood waste, which is of value to other producers. Particleboard (chipboard) and other products can be made from chopped wood. There are three real areas where low-quality wood is in demand – the production of chipboards, fuel chips and fuel pellets.

Today, the factories of the Republic of Belarus for the production of chipboard are loaded at 100 percent. Large funds are needed to expand their capacities. Wood

chips are a really demanded type of fuel, besides, the cost of its production is minimal. But there is one big «but»: it is a product of primary woodworking, and therefore has no added value. Taking into account the costs of its logistics (often transportation is more expensive than the cost of the product itself), it is unprofitable to send wood chips for export. But with fuel pellets, the situation is completely different.

Raw materials (sawdust, bark, shavings, etc.) enter the crusher, where they are crushed to the state of flour. The resulting mass enters the dryer, from it – to the pellet press, where the wood flour is compressed into granules. Compression during pressing increases the temperature of the material, the lignin contained in the wood softens and sticks the particles together into dense cylinders. The production of one ton of pellets takes about 2.3–2.6 cubic meters of wood waste, plus 0.6 cubic meters of sawdust is burned for each ton of products produced.

The finished granules are cooled, packed in various packages – from small bags (2–20 kg) to big bags (large industrial packaging) weighing up to 1 ton, or delivered to the consumer in bulk.

One of the most important advantages of fuel pellets is their high and constant bulk density, which makes it relatively easy to transport this bulk product over long distances. Due to the correct shape, small size and uniform consistency of the product, the granules can be poured through special sleeves, which makes it possible to automate the processes of loading and unloading, and also the combustion of this type of fuel.

Fuel pellets are environmentally friendly fuel with an ash content, as a rule, under 3 %. Granules differ from ordinary wood in their high dryness (humidity is only 8–12 %, and the moisture content of raw firewood is 30–50 %) and about 1.5 times higher density than firewood. These qualities provide a high calorific value. Compared to firewood, when burning a ton of pellets, approximately 3.5 thousand kW·h of heat is released, about the same (almost two times less) as when burning a ton of hard coal, one and a half times more than ordinary firewood, and only two times less than when using gas, fuel oil or diesel fuel.

The quality and type of granules depend on the raw materials and production. Wood pellets with a high bark content are usually dark in color, while debarked wood pellets are usually light in color. During the production process, for example, during drying, the granules can «burn» a little and then they turn from white to gray. But this does not always affect such consumer qualities of pellets as calorific value or ash content. It should be understood that the higher the content of bark and other impurities, the ash content increases and these products are considered low-grade.

According to STB 2027–2010 «Wood fuel pellets» must comply with the requirements of this standard [2]. According to the quality indicators, the granules produced at the factories of the Republic of Belarus are divided into three groups:

- humidity not more than: 1 group – 10 %; group 2 – 12 %; group 3 – 12 %;
- ash content not more than: 1 group 0.7 %; 2 group 1.5 %; 3 group 2.5 %;
- mechanical strength (wood dust content during abrasion of granules), not more than: 1 group – 0.8 %; group 2 – 2.3 %; group 3 – 6.5 %.

For the manufacture of granules, the main materials should be used:

- wood sawdust;
- chips;
- wood shavings;
- wood waste for fuel production;
- technical lignin;
- milling peat;
- low-quality wood, logging residues.

Depending on the materials used, the granules are divided into grades:

- GDT 1 – from coniferous wood;
- GDT 2 – from hardwood;
- GDT 3 – from a mixture of coniferous and hardwood;
- GDT 4 – from a mixture of coniferous and hardwood with the addition of technical lignins;
- GDT 5 – from a mixture of coniferous and hardwood with the addition of milled peat;

– GDT 6 – from a mixture of coniferous and deciduous wood with the addition of plant waste from agricultural production (straw).

The system of the Ministry of Forestry of Belarus has all the conditions for the production of pellets in compliance with the current standard.

The first pellet production appeared about 15 years ago, at the beginning of the modernization of woodworking industries. In 2007, rather tough decisions were made: weak shops were closed, and considerable funds were invested in the most promising ones, trying to make them as modern and functional as possible. At the same time, the task of processing sawmill waste was solved, that is, involving into circulation all the wood processed in the workshops. The created productions in the amount of five factories were small and were able to produce about 14 thousand tons of fuel pellets per year. The production of pellets in the republic became quite a cost-effective measure, since the equipment of workshops on the secondary market was inexpensive, sawdust was practically free, and their drying was carried out with the same unused woodworking waste. The profit received from the sale of pellets made it possible to purchase new, more efficient and reliable equipment.

Since that period, the industry has taken a more active course towards waste-free production. Recycling woodworking and sawmill waste is not just a necessity, but one of the ways to increase the profitability of an enterprise.

In 2021, 180.6 thousand tons of pellets were exported, 6.7 thousand tons were sold on the domestic market. Pellets were shipped to almost all EU countries (Poland, Lithuania, Slovenia, etc.). Fuel pellets were exported under various conditions – «departure station», «to the border», «destination station», «end consumer» at various prices – from 75 euros to 110 per ton.

The demand for pellets in large volumes, especially in the foreign market, has led to the need to increase pellet production.

There is a resource base in the republic. The total stock of wood in the republic is about 1.43 billion m. Every year, about half of the annual increase is cut. Thus, the produced pellets that Belarus supplies to Europe are obtained from sawmill and woodworking waste.

Waste from logging operations, the so-called logging residues, which are practically not used, remain a reserve for the production of pellets. The use of tree and shrub vegetation, which has been naturally renewed by low-value soft-leaved species, has great prospects. One of the priority areas for increasing the volume of harvesting of wood fuel raw materials for the production of pellets is the use of low-value plantations of gray alder, which grows on an area of 184 thousand hectares with a timber reserve of 22.6 million m<sup>3</sup>. In total, about 7 million cubic meters of wood waste is generated annually in the republic, the use of which is hampered due to the lack of effective technologies for their processing. The demand for pellets in large volumes, especially in the foreign market, has led to the need to increase pellet production. Today, there are 16 pellet plants with a capacity of 20–30 thousand tons/year each.

According to the Deputy Minister of Forestry of Belarus, if in 2018 the industry produced about 19 thousand tons of pellets, then over the past year and a half, only 162 thousand tons of fuel pellets were obtained at new production facilities built as part of the implementation of the pellet production development program [3].

The creation of new pellet plants has made it possible to ensure the reduction of firewood residues. Only in the forestry enterprises, on the basis of which production facilities for the production of industrial pellets (gray with bark) were put into operation, the balance of firewood at the beginning of the current year was significantly reduced. For example, in the Pruzhany forestry enterprise, in the presence of 35.8 thousand m<sup>3</sup> of firewood residues as of 01.04.2020, their level as of 01.01.2021 amounted to 16.3 thousand m<sup>3</sup> (decreased by 19.5 thousand m<sup>3</sup>, or by 1.5 times), for Mozyr experimental forestry – by 7.1 thousand m<sup>3</sup> (1.6 times), for Klichev forestry – by 7.2 thousand m<sup>3</sup> (1.2 times), for Kopyl experimental forestry – by 6.2 thousand m<sup>3</sup> (by 2.3 times).

Thus, the construction of new factories for the production of fuel pellets made it possible to fully use low-grade wood, sawdust, and sawmill waste. «Today we are operating at the maximum of our production capacity. Our pellets are one of the most environmentally friendly fuels in the world. All resources should serve the country and the people with maximum effect. Wood processing is a strategic direction of the

forestry industry and foreign exchange earnings for the country»: said the Deputy Minister of Forestry of Belarus on January 12, 2022, during the opening of a new plant for the production of fuel pellets in the Starodorozhsky Experimental Forestry [3].

## ЛИТЕРАТУРА

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