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МОНИТОРИНГ НЕЛИКВИДНЫХ ЗАПАСОВ ДРЕВЕСНОГО СЫРЬЯ ЦЕНТРАЛНО-ЧЕРНОЗЁМНОЙ ОБЛАСТИ

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В статье рассматриваются вопросы экономии энергии и топлива, а также проблема их замены возобновляемыми источниками. В настоящее время наиболее актуальной является задача эффективного использования древесного топлива, в первую очередь низкосортной древесины, а также отходов лесозаготовок. В статье отражены региональные особенности и преимущества заготовки древесной биомассы в Воронежской области

Ключевые слова: АЛЬТЕРНАТИВНАЯ ЭНЕРГИЯ, ТОПЛИВО, ВОЗОБНОВЛЯЕМЫЕ ИСТОЧНИКИ, НИЗКОКАЧЕСТВЕННАЯ ДРЕВЕСИНА, АНАЛИЗ ЗАПАСОВ ДРЕВЕСИНЫ, ВОРОНЕЕЖСКАЯ ОБЛАСТЬ, ДОСТУПНОСТЬ, НАСАЖДЕНИЯ, ПОРОДЫ

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WOOD BIOMASS RESOURCE ASSESSMENT ACCORDING TO DATA SOURCES FOR CENTRAL CHERNOZYOM ZONE

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The questions of energy and fuel saving as well as the problem of their substitute with renewable sources are in the focus of the scientists all over the world. At present, the most actual task is the efficient use of fuel wood, especially low-grade invaluable wood and wood wastes. The article considers the regional characteristics and opportunities for wood biomass harvesting in the Voronezh region

Keywords: ALTERNATIVE ENERGY, FUEL, RENEWABLE SOURCES, LOW-GRADE WOOD, MONITORING OF TIMBER RESERVES, VORONEZH REGION, ACCESSIBILITY, STANDS, SPECIES

Today, the questions of energy and fuel saving as well as the problem of their substitution by renewable energy (RE) are in the focus of scientists all over the world. Environment conservation and ecology safety are the main reasons of fast development of RE. Woody biomass application for energy production is considered as a priority alternative to conventional fuels (coal, natural gas, fuel oil). This is due to the fact that the wood in the process of its burning turns out to be environmentally friendly because of its low-sulfur content and CO_2-neutrality. In the main timber producing countries like Finland, Sweden, Germany, Canada, USA and others there has been a steady increase in the production of bioenergy and woody biomass as an important part of energy

supply. The share of bioenergy in Finland and Sweden constitutes more than 20% of all energy consumption.

Possessing more than 25% of the world's timber supply, Russia is considerably logging behind the world leaders in utilization of wood raw materials. Figure 1 demonstrates the utilization of woody biomass in different countries. The diagram proves that Russian usage of woody energy resources is inadequate to its woody volumes. In reality, until recently the wood wastes have not been used as an energy resource in our country. The absence of adequate wood utilization technologies made the price of wood chip very high. However, in the end of this decade the Russian logging companies started to implement new technologies of wood harvesting and deep wood utilization more persistently. It has inevitably positively affected the price of wood chip. The inevitable rise in prices for fossil fuels also raises interest in biomass energy.

At the same time, the volume of processed woody biomass in Russia is constantly increasing. Thus, in 2011, according to Russian Federal State Statistics Service data, (Information and Analytical Agency "Infobio"), wood fuel pellets production has reached one million tons, which is 40 % higher than in 2008. In the first half of 2012 the production growth has increased up to 10.2% in comparison with the first half of 2011.

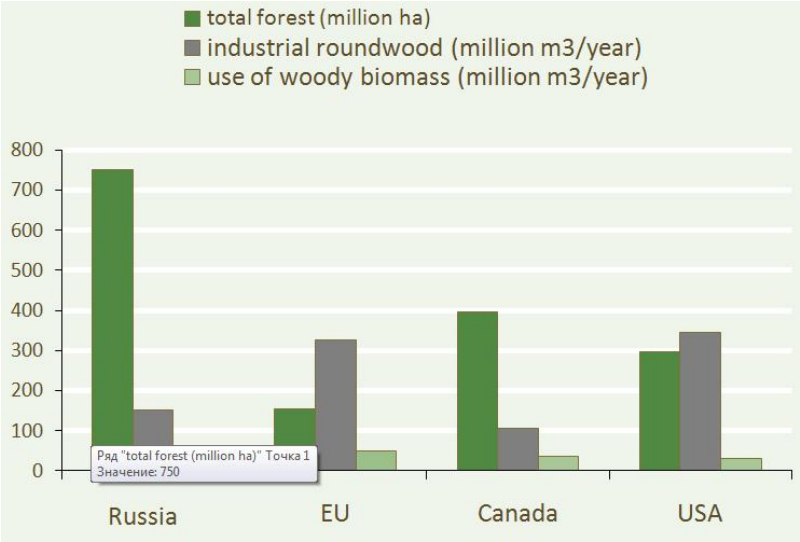

Figure 1 – Actual wood harvesting and use of woody biomass related to total forest area.

The Central Black Earth Zone (CBEZ), being the sparsely wooded area, occupies a special place on the map of Russian forests. The total area of CBEZ is 167.7 thousand km^2, its forest fund area is 1499.7 thousand hectares (Table 1) and the average percentage of forest cover in the region equals 8.9%.The zone is located in the European part of Russia and includes five regions: Belgorod, Voronezh, Kursk, Lipetsk and Tambov (Figure 2).

Today, the development of forestry resources of CBEZ is carried out on the principles of continuous and inexhaustible forest usage, which means that only voluntary-selective, sanitary cuttings and thinning are permitted: thus, in 2009 roundwood harvesting constituted 804 900 m3 (Rosleskhoz 2010). At the moment, most of the forest resources and deciduous species in particular are not used in the local industry.

Table 1 – Characteristics of forest resources for five regions of the Central Black Earth Zone

Regions	forest cover / total forest area thousand ha	total forest reserve thousand m^3	Timber reserve thousand m^3
Belgorod	228,6/232,3	36077,4	6542,4
Voronezh	387,3/416.1	71324,6	9877,8
Kursk	203,1/270,5	32039.2	5652,7
Lipetsk	154,9/200,9	28761,2	4664,7
Tambov	341,0/365,6	61015,3	12035,3

At the same time the zone has a considerable potential for energy wood harvesting. The sources of energy wood we see in:

- unvaluable and low-grade wood. The output of low-grade wood can be 20–80% of the total volume of wood harvesting (depending on the species and age of the forest stands).
- logging residues (branches and tops of the trees) – their share is 8-23% of the whole tree biomass (Filipchuk 2003).
- stumps and stemwood damaged by logging operations, their proportion may reach up to 25% of the total tree biomass.
- waste wood of processing companies. The amount of waste wood collected from mechanical wood processing is on the average 50-60% of the total volume. These wastes have become a real headache for many wood-processing companies because the waste utilization requires additional expenses negatively affecting the cost of production.

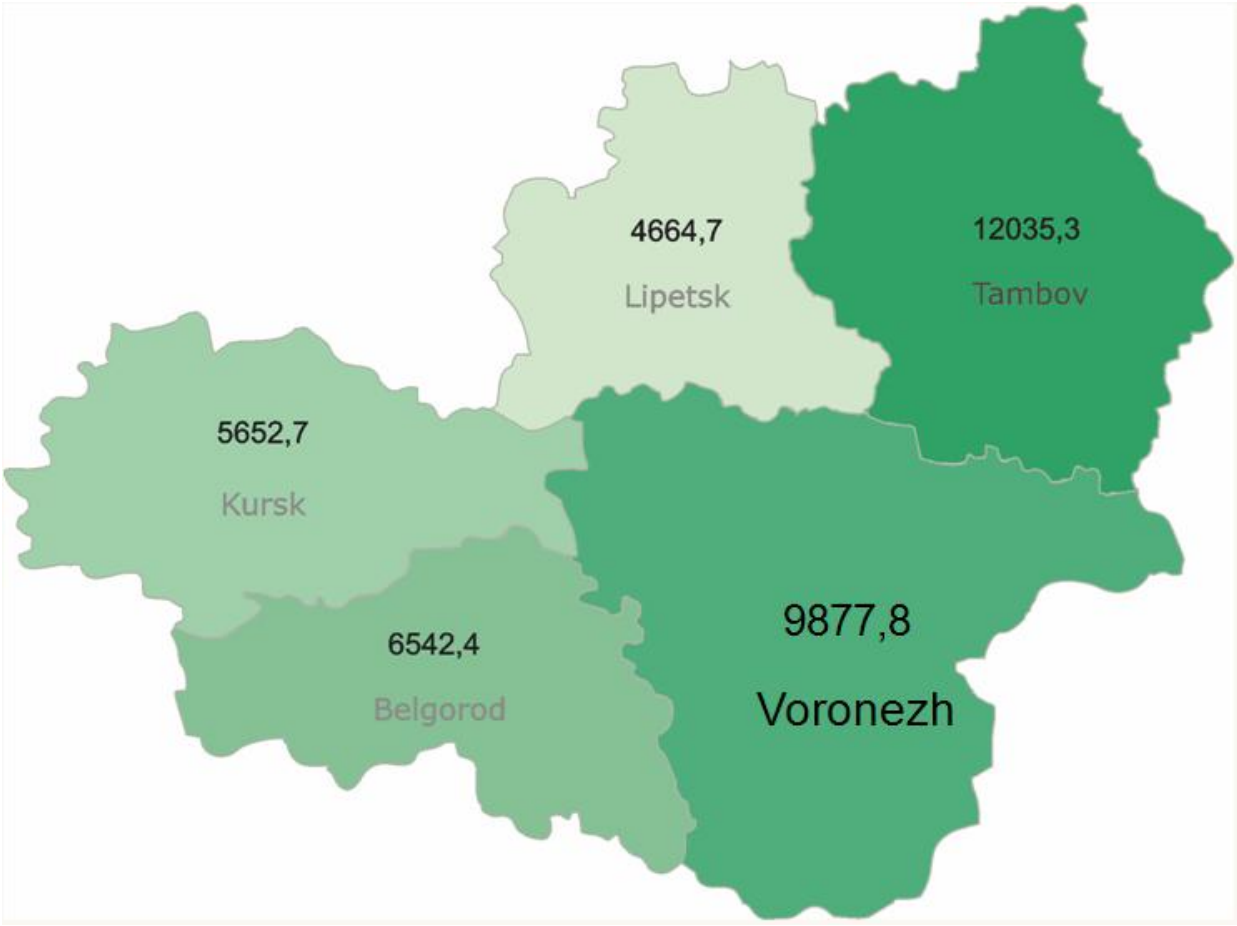

Figure 2 – Timber reserve in the Central Black Earth Zone , 1000m3

Monitoring of timber supply in different regions of this Zone proves that Voronezh region has the largest area of forest cover in the Central Black Earth Zone (387.3 thousand hectares, with total forest area 416.1 thousand hectares) (Table 1). In 2011, timber resources were estimated as 71.3 million m^3. Forest stands are located in forest-steppe (72.6%) and steppe (27.4%) areas of European part of Russia. The distribution of forests on the territory of the Voronezh region is not homogeneous. The highest concentration of operating reserves (about 35%) is observed in the central Buturlinovsky, Vorontsovsky and Kalacheevsky forest districts, bordereding with each other (Figure 3). In terms of forest species composition in the region, the group of hardwoods (52.6% of total forest area) is dominating, while the share of coniferous and softwood stands constitutes accordingly only 28.5% and 17.6% (Figure 4). It should be noted that the intensity of forest usage for wood harvesting is well below its potential capabilities, because only selective sanitary cuttings are carried out in the stands. In particular, in 2010 the volume of harvested timber was 305,6 thousand $m^{3,}$ where 70% or 207 800 m^3 accounted for low-grade wood. Such timber volumes were observed with a growing stock of 990 m^3 and the estimated allowable cut of 547.7 thousand m^3. This low harvesting efficiency causes accumulation of overmature low-grade stands, with inadequate protective properties.

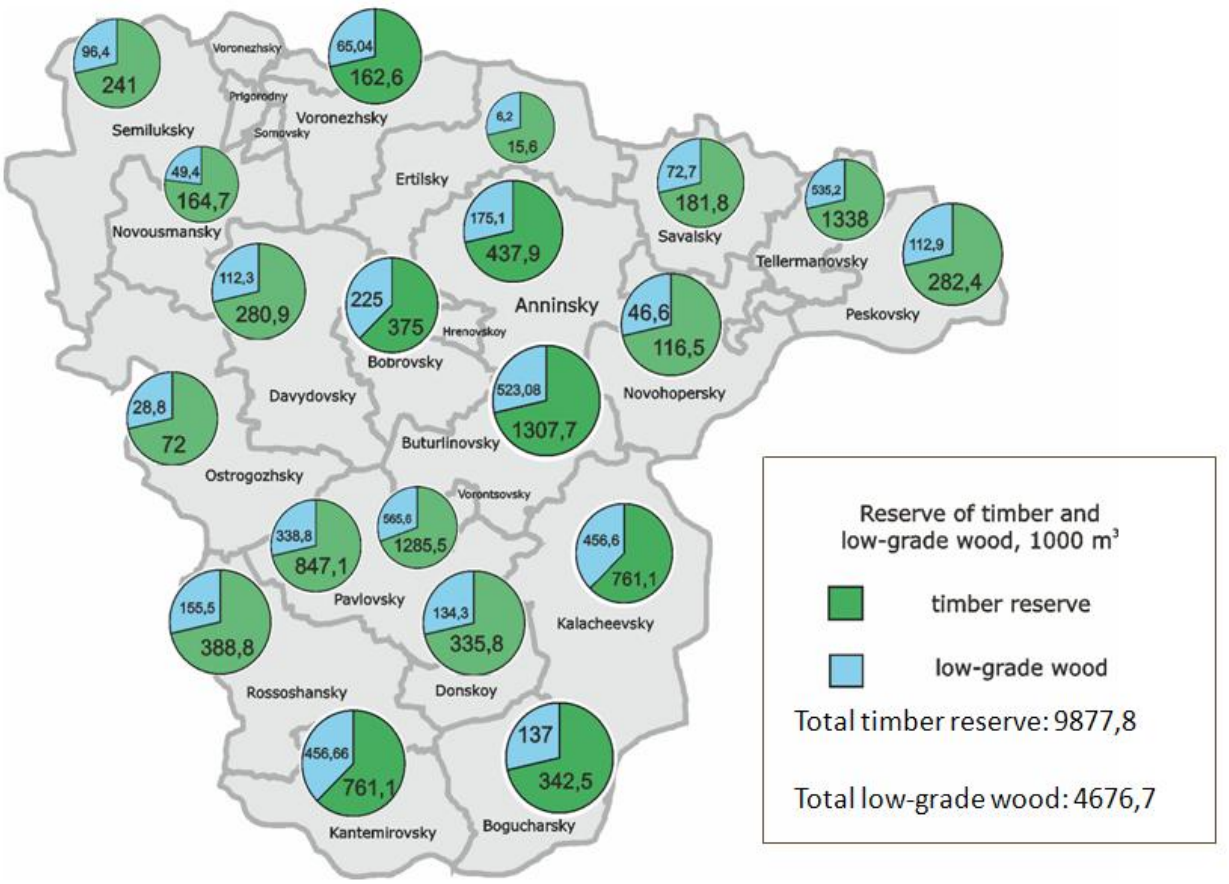

Figure 3 – Distribution of timber reserve and potential energy wood (low-grade wood) in Voronezh region

At the moment, private specialized firms concluding lease or concession contracts with forest district administration, carry out commercial activity associated with industrial harvesting and processing on these forest lands. Further development of timber industry complex of sparsely wooded region is aimed at strengthening of timber companies and firms, as well as on the innovative development of the industrial wood processing.

Timber supply analysis as well as brief description of the forest complex and low level of rural areas gasification alongside with their consumption of coal and fuel oil (618 000 t) allows us to conclude that the wood potential of Voronezh region can make the wood waste utilization a highly profitable business.

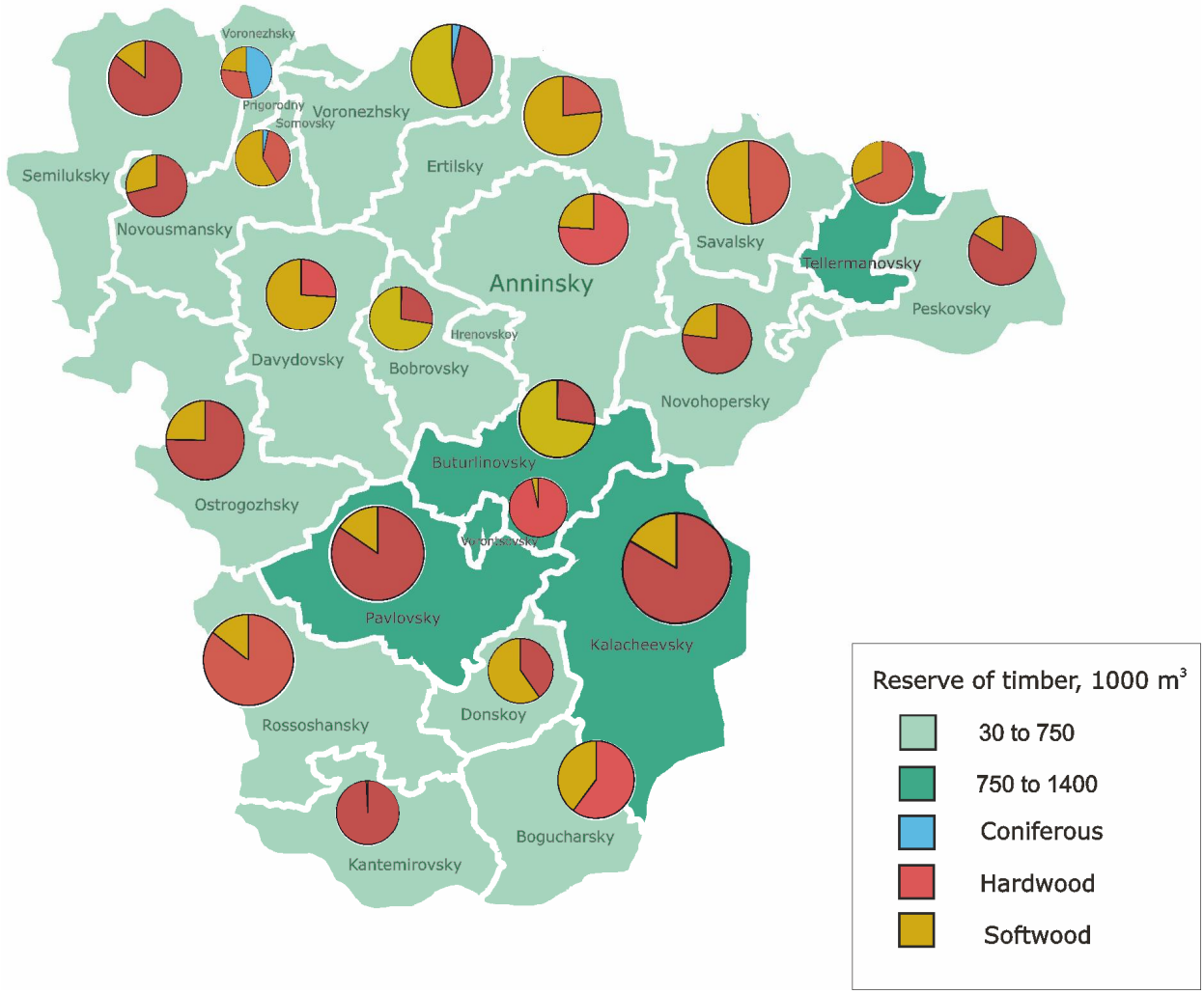

Figure 4 – Specific forest districts and distribution of coniferous and deciduous stands in Voronezh Region

In 2010 Voronezh region happened to be among those several regions, which suffered dramatically from the forest fires. Forest stands on the territory of 20 thousand ha were completely burnt out. In this critical situation the region government had to make special amendments into the regional plan of forestry development. These amendments are aimed at the forest sanitary state improvement as well as its rapid reconstruction. In the result of these measures, both the volumes of wood harvesting and the terms of leasing have considerably increased.

The forest fires have produced an additional source of biomass. In the places of burnt forest the intensive cleaning of dead trees is being carried out. The aim of

these activities is to liquidate the consequences of forest fires in the shortest possible period of time, to prevent the fires repetition and to avoid the mass pests reproduction.

At present the forestries are giving into leasing the forest stands for their further harvesting on very favorable conditions. The destroyed forest plots are cleaned from the damaged trees by partial logging, while the major part of timber biomass is being utilized by primitive burning on the cutting area.

Figure 5 – Liquidate the consequences of forest fires

The problem of rational and complete utilization of wood-residues as secondary technological raw material acquires great importance in timber industry. At the moment only 65% of wood is processed into lumber, while 35% are turned into such residues as croakers (14%), sawdust (12%) and trifles (9%). The further processing of lumber into building components like window and door blocks, furniture etc. gives 40% of residues in the form of sawdust, shaving and trifles.

The insignificant quantity of sawdust is utilized in manufacturing of bricks and gypsum-sawdust plates, while the remaining volume of wood-residues is burnt as a fuel or is transported into a earthboard. The scientists formulate the following causes of inefficient usage of wood-residues: 1) lack of debarking on the pre- sawing stage; 2) retarded location of sources of residues from main consumers of technological wood chips the pulp-and-paper as well as hydrolytic enterprises; 3) out-dated machinery applied in chemical conversion of wood-

residues. Thus, the adequate utilization of wood-residues would both significantly improve the country supply with lumber products and reduce the annual volumes of wood cuttings.

The existing wood-residues conversion technology presupposes the application of sawdust in production of wall and heat-insulating building materials implementing cement, lime, plaster (gypsum) and other binding components. Significant volumes of sawdust can be used in manufacturing of partition and finishing plaster plates; it can also be a good filler providing better burning in brick production.[1]

Every year big volumes of wood are lumbered and directed mainly into construction of our country. However the more pulpwood is being produced, the more residues are received from timber cuttings as well as of processing stem wood. By now the technological progress has mostly touched mechanized production of joiner's and wood-fiber plates, wood-concrete, wood particle plates, shields, etc., which are received from practically any sized residues. These residues alongside with other materials of the same type, vary in their properties, do not jar on or dry out; besides like other semi-finished products they are used for manufacturing of textured doors, built-in-furniture, facing panels, partitions, heat-insulating products, wall blocks and panels, as well as parquet and roof, etc. Nevertheless large heaps of residues keep accumulating on cutting areas and factory back yards.

Meanwhile such countries as Finland, Sweden, Norway and Canada demonstrate wonderful examples of further utilization of wood-residues.

Such products as glued panels, parquet shields, plates, door boxes, roofing and plaster lath, roofing tiles and shingles, prefabricated joiner successfully substitute the pulp-wood-based products; besides modern construction industry widely applies wall blocks, wall panels, wood-fiber and wood-shaving plates.[2]

Sawdust- and shavings-based materials are manufactured either with the help of bonding component (sawdust-based concrete, gypsum-sawdust blocks, etc.), or without application special binding component.

It is good to note that bark- and twig-based materials are received both on the basis of binding component and without it; in particular, such unique material as carolit, is produced without any special additional binding component.

Wood sawdust can be good filler for light concrete in regions with wood-working enterprises. Our industry offers a sawdust-based-cement – warm and fire-resistant wall material which is a mixture of sawdust and binding component. It is more efficient than a solid brick in its heat-shielding qualities; its sanitary-and-hygienic indexes making it one of the most comfortable of all cement materials applied in construction of apartment houses.[3]

The opportunity of producing sawdust-cemented blocks with given characteristics makes it possible to use this material for construction of practically any type of general purpose buildings.

Besides, sawdust-based-cement is an excellent material for building bordering constructions, it can be used both as additional walls insulation of already erected buildings, and for making of poles and fences.

Coniferous sawdust is the best filler for blocks, being less subjected to biological disintegrations. Cement is known to be the best binding component of sawdust-cement mixture; however, it is sometimes replaced by lime or clay to reduce the cost of finished product.

Thus, the best qualities of sawdust-cement components: ecological safety of wood as well as durability and longevity of concrete are incorporated by the manufacturers in its production.

Sawdust-based-cement application in construction processes has great potential, as sawdust-based-cemented products have some advantages in comparison with their wooden analogues. On the one hand, they are fire-resistant, and not exposed to rotting as well as fungi attacks mold, on the other hand, they are

microorganisms protective. Fire resistance of this material is higher, than that of other popular modern building materials (like sawdust concrete and woodcrete). It also has high sound insulation and heat insulation indexes. Besides, wooden origin of sawdust-based-cement makes it very ecology friendly both for the human health and for the environment. Sawdust-based-cement, like a tree, regulates interior humidity level. Sanitary-and-hygienic characteristics provide a good microclimate inside premises made of sawdust-cemented blocks.[4]

All above mentioned qualities make sawdust-based-cement successfully applied in low-rise housing construction in present day Russia.

This material:

- reduces the cost of construction;

-cuts down the construction terms;

-improves the quality of life due to ecologically safe sawdust-cement production technologies.

However the sawdust-cement is not deprived of certain limitations, in particular, binder component consumption exceeds the mass of wood in 1.5 - 1.6 times. The strength of this material is more than 15 times lower than the corresponding indicators of the initial components. Sugar and water-soluble substances contained in the wood hinder the processes of cement hydration, especially when the fresh wood of deciduous species is used. And finally, the non-uniform anisotropic shrinkage of wood in the process of removing bound moisture leads to irreversible damage in the bordering cement stone layer. Taking into consideration all above mentioned remarks, the outer layer of the enclosing structures needs additional finishing to protect sawdust-cement from dampening.

Thus, the importance of efficient utilization of timber biomass as well as the application of innovative technologies providing complete timber processing is turning into a necessity. We believe that the usage of timber biomass as a source of energy alongside with the realization of regional energetic programs will

stimulate the extensive projects of forest reproduction. If will also help to improve both forest stands quality and their market and ecological value.

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