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METHODOLOGICAL PRINCIPLES OF ENERGY MANAGEMENT IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT OF WOODWORKING INDUSTRY ENTERPRISES

In this article, we consider the issue of working out energy efficiency strategy at woodworking enterprises as a constituent part of energy management. The role it plays and the place it occupies in the global strategy of sustainable development of enterprises have been defined; also characterized here are the main stages of shaping energy conservation policy as well as energy management in terms of integrated approach to environmental management.

Keywords: energy management, sustainable development, wood waste, energy efficiency, wood-fired energy, heat energy balance.

For many decades, the main task of the department of energy in the woodworking companies was provision of reliable and uninterrupted power supply. Costprice, quality and environmental performance of energy were considered of minor importance and were settled only in the case of special aggravation. The first were the necessary resources of energy and generating capacity. Today, the state seeks to provide primarily high social standards and safe environment for its citizens. Therefore, in the foreground is reliable and environmentally friendly meeting the needs of energy products at reasonable, economically reasonable and balanced cost. Clearly enough, that using in the production morally and physically obsolete equipment, conducting passive policy of modernization, makes impossible and contrary to the main preconditions of the concept of energy management, sustainable development at wood processing enterprises as a whole [1-15].

The development of energy strategy has prominent place in the energy management system. Unfortunately, researching of the energy strategy formation in the woodworking industry, despite its importancis, at the in fant stage of development. Until now, we have not had even terminology that applies to this problem, have not resolved issues related to the definition of its place in the overall development strategy, principles of construction, development stages, etc.

The problems of energy strategy of woodworking enterprises should be considered based on the fact that wood waste, generated in the production of any wood products is a raw material for heat and, in the future, electric power for meeting their energy needs. Of course, the energy strategy of woodworking enterprises must meet specific key areas of energy policy at the state level, due to primarily monopolistic nature of all power and lack of competition in the electricity market. Under these conditions, becouse of limited measures woodworking enterprice, usually try to find additional cost savings to reduce the energy costs. The process of developing the energy strategy of woodworking companies can be divided into several stages. In the first stage, which premised on technological analysis (waste balance), should be assessed wood waste, generated during the production as wel as it distribution. On the basis of the analysis, the ability of wood waste in annual heat energy should be calculated. In the second stage we have to prove the needs of the enterprise for thermal and electric energy. It is reasonable to classify heat energy needs according to in the areas of its using: – drying department; – technological needs; – heating and ventilation needs; – household needs, and then to develop a schedule of consumption during the year, given the overall strategy of the enterprise. In the third stage the enterprise directly or through third-party experts conducts an energy audit to reveal internal reserves to reducing energy costs. The main purpose of this is to evaluate the efficiency of all types of energy resources, heat and electric energy, compressed air, water to determine the energy saving potential, to make a choice of boiler, ventilation equipment for own using of thermal energy.

The fourth stage involves identifying areas of wood waste using, which generated after the enterprise satisfying in heat energy needs. The number of it is based on heat balance as the results of calculations of thermal energy in the first and second stages. The selection of direction is based on impact assessment of macro environment and the enterprise location. Analysis of macro environment requires using information on forecasts of the country's and region economy, including the development prospects of the energy sector. To analyze the immediate environment and evaluate its impact on the formation of production costs of certain products may be involved information obtained through the studying of actual and potential market demand, expert opinions on various aspects of the competitors' works, and so on. In the fifth stage a system of indicators should be formed for economic evaluation of the effectiveness of and justification for selecting the most appropriate options for energy saving measures.

An economic assessment of expected effectiveness of the proposed measures should be carried out. The final sixth stage provides the implementation of actions under enterprise energy strategy, it monitoring and adjustment. Theoretical research of energy capacity of woodworking enterprises, using the above methodology, allowed the authors to develop the nomogram of heat energy balance, which depend on the company specialization. For example, (Fig. 1) presents the nomogram to define thermal balance of glulam beams manufacturing enterprise. To use this nomogram should be asked specific volume value of roundwood processing now (year or quarter), and type of waste that will be burnt to obtain thermal energy (including their fractional status and humidity). However, the use of nomogram helps us to determine not only the necessary amount of heat energy for the operation of enterprises, the volume of wastes that must be taken (for burning) to receive it, but also the number of "surplus" of wood waste – in this order of the above operations should be carried out in the opposite direction.

The results obtained by using the graph method of nomogram shows, that direct combustion of wood waste generated during the manufacture of products, fully enables the production of thermal energy for technological purposes (drying lumber),for heating production and administrative and domestic premises during the heating period and other requirements. In addition, during the burning of the entire volume of waste for a year, excess of thermal energy will be about 20-65%, depending on specialization, which enables to realize the surplus of dry wood waste in many ways – to organize production line for fuel pellets or briquettes, or to supply thermal energy to other consumers in the area range of economic efficiency. Using proposed methodological approach to the energy management problem of woodworking companies, as the process of control of using primary resource and energy: planning, organization, coordination, accounting and control for consumption of all types and forms of energy with minimal environmental impact, optimal use of capacities, including level of current costs and future costs, – is an objective for building sustainable development strategy of woodworking enterprises, guidelines for each of which are reorganization of the power supply system and rethinking the principles of immense squandering, that generally promote providing competitive advantages for domestic woodworking enterprises, enhance their competitiveness and improve state's economic and energy security as a whole.

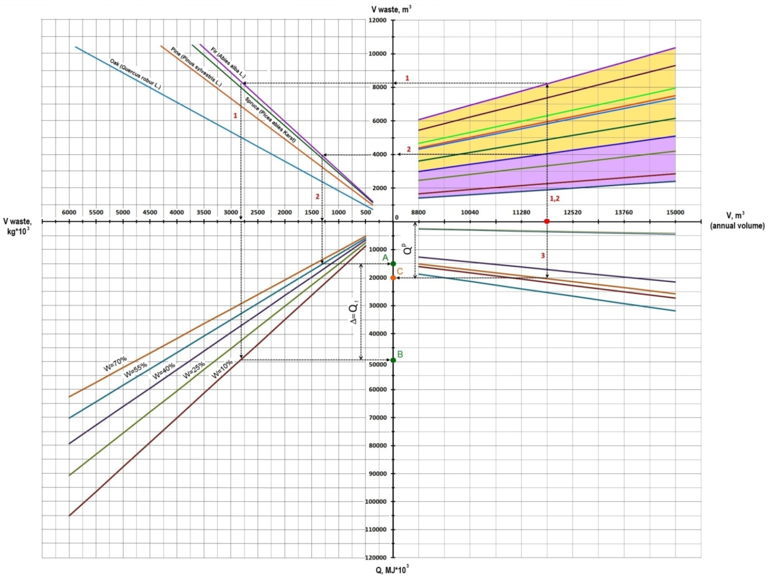

Fig. 1. Nomogram of definition heat energy balance

Fig. 1 – shows a method of using the nomogram; "1" – curve to determine the maximum amount of heat (point A), when burning the entire volume of wood waste with moisture adopted by 10 %; "2" – curve to determine the amount of heat (point B), which is released during combustion of the entire volume of raw wood waste. Value Δ (Δ = Q_t) shows the maximum of heat energy formed during the combustion of total volume of wood waste with regard to their moisture, factionalism and wood species. The curve "3" is used to determine the total heat capacity of the enterprise (point C).

Conclusions. The article discusses the formation of energy strategy of woodworking enterprises, as part of energy management. Defines its role and place in the overall strategy of the company, described the main stages of development of energy conservation and energy management.

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Методологічні принципи енергоменеджменту в аспекті проблем сталого розвитку підприємств деревообробної галузі

Розглянуто питання формування енергетичної стратегії деревообробного підприємства як складової частини системи енергетичного менеджменту. Визначено її роль і місце в загальній стратегії сталого розвитку підприємства, охарактеризовано основні етапи розробки енергозбереження та енергетичного менеджменту з точки зору комплексного підходу до природокористування.
Ключові слова: енергоменеджмент, сталий розвиток, відходи деревини, енергоефективність, баланс теплової енергії.

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METHOD OF CALCULATION OF DRYING TIME IN SOLAR PLANTS

Provided analytical equation calculation of the drying in the 1st and 2nd periods of drying.
Ключові слова: solar plant, grafically-criterial methods, nusselt criterion.

It is known [1, 2] that in engineering practice, to calculate the duration of drying grafically-criterial and analytical (tabular) methods are used. Thus the total duration of drying includes drying time in the periods of constant and slowing drying rates [3-7].

Note that the grafically-criterial method is based on analytical formulas that are derived from studies of the kinetics and dynamics of the drying process, as well as principles of the general theory of drying. For the analytical calculations of the drying time Initial data should be known or taken into account: species *(ρ_b)*; thickness of material $S_1(R=S_1/2)$ which is dried, width of lumber stacks, direction of moisture flow(tangential, radial), operating conditions $(t_s, t_m, \Delta t, \varphi)$ i and air circulation speed (drying agent) on stacks v. The sequence of calculating the duration of drying is. Depending on operating conditions, species and average humidity of wood with appropriate diagrams define the coefficients of specific heat and thermal conductivity of wood at the actual humidity of the material and define the magnitude of the coefficient of thermal diffusivity a ($a = \frac{\lambda}{\rho \cdot c}$, m^2/s).

According to the formulas given below [3] set the value of the coefficients of thermal conductivity of air (drying agent) λ and kinematic viscosity υ, that is

$$\lambda = [4,67-(4,16+2,45\cdot\varphi]\ 10^{-2}+[7,14+4,46\ \varphi]\ T_1\cdot 10^{-5}, \tag{1}$$

where T_1 – absolute temperature of the dry thermometer, K; φ – relative humidity.

$$\upsilon = [0,113\cdot T_1-(18,24+7\cdot\varphi)]\ 10^{-6} m^2/s \tag{2}$$

Set mode of heat motion (drying agent) with the Reynolds criterion, that is

$$\mathrm{Re}_f = \frac{v \cdot b}{\upsilon} \text{ for air} \tag{3}$$