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Energy management in wood pellets production

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Abstract

The objective of Directive 2012/27/EU of the European Parliament and Council on energy efficiency is to reach 20 % energy efficiency increase by 2020; in order to achieve that, solutions must be found on how to efficiently use energy by reducing energy losses and at the same time not affecting its efficiency. The main goal of the energy management model is to increase the volume of produce depending on energy consumption. There are different and also similar models in the world that have been developed and introduced with the aim to improve energy management systems in different sectors. Several sectors may use one particular management model that has been adapted to the sector`s specificities. The developed model provides information and helps to evaluate the operation of pellets production unit and the possibilities for improvement. Management model with the respective indicators of the wood pellets production unit have been integrated in this model. Evaluation of indicators has been based on the energy flows of particular production units and their influence on the produce. The introduction and evaluation of such model in a production unit allows to better determine the optimization of production stages and energy consumption. The model has been tested with the data provided by concrete production units about changes in indicators depending on their mutual correlation and production processes in general. Introduction of such energy management systems will facilitate the optimization of energy consumption, which directly influences and allows evaluation of the produce.

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Keywords: energy efficiency; energy consumption; energy management model; wood pellets production unit; improvement of production management; energy audit

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1. Introduction

Energy production has become an important factor, which, when managed correctly, can provide significant competitive advantage to a company and strategically active possibility to react to changes in development [1]. According to the International Organization for Standardization (ISO), energy management is a set of measures that facilitate the development of industrial objects [2] ISO 50001:2011 standard allows companies to determine energy management processes that are necessary for the improvement of energy efficiency with the aim to reduce energy costs, greenhouse gas emissions and other impacts on the environment. There are also other similar standards but ISO 50001:2011 precisely defines requirements for a company to develop, maintain and constantly improve its energy management system. Many other models have been developed in a way that does not allow the company to evaluate the existing situation when integrated in the previous periods of operation. Most models only envisage a system that would implement a management system starting from the moment of its introduction [3, 4].

Pellet production plants have the potential for growth and there is demand for the product on the market. An energy management system provides many advantages, for example, the reduction of energy resources consumption, efficient use of energy, and cost reduction in relation to the energy produced and used. The introduction of an energy management system could also improve the overall image of the company for cooperation partners and reduce negative environmental impact. When developing an energy management system its main task is to reduce energy losses, as well as manage energy consumption by using guidelines and monitoring actual data; it would ensure a systematic action plan that would include a comparison of energy consumption, which, in turn, would allow evaluating and finding solutions for the system`s optimization.

However, there are still many companies that do not have an independent energy management system [8]. Costs that are associated with the introduction of a energy management system, for example, instruction of workers, purchasing of measuring instruments, creation of additional budgetary structure, often deter companies from the introduction of a system [9].

Nomenclature

EEI	energy efficiency indicator, kWh/t
P_Pellet	amount of produce versus one hour, t/h
C_P_Pellet	consumed electricity versus one tonne of produce per hour, kWh
W	installed capacity of equipment, kW
E	monthly electricity consumption, kWh/month
P	monthly produced pellets, t/month
Useful output	appropriate to the product, t
Energy input	used electricity, kW

2. Methodology

Actual data from a wood pellet production unit was used when developing the calculation model. Using previous research and correlation of parameters [5], as well was established potential maximum amount of produce per hour and installed capacity of equipment, it was possible to determine the consumption of electricity versus one tonne of produce C_P_Pellet, kWh (1):

$$\mathbf{C\_P\_Pellet} = \frac{\mathbf{W}}{\mathbf{P\_Pellet}} \tag{1}$$

and to evaluate the efficiency of the operation, which according to [6], was expressed with formula (2):

$$\mathrm{EEI} = \frac{\text{Useful output}}{\text{Energy input}} \tag{2}$$