ANALYSIS AND EVALUATION OF THE EFFECTIVENESS OF ENERGY SAVING IN INDUSTRIAL ENTERPRISES

Kurbonov Nurali Abdullayevich
teacher
Qurbonova Munisaxon Sanjar qizi
student
Karshi Engineering and Economic Institute

Abstract: *Analysis and evaluation of energy efficiency in in cocoon – winding industrial project. Energy – saving measures at cocoon – winding industrial enterprises are aimed at reducing the amount of energy resources to products. The solution for building effective energy saving management is carried out by modeling saving management processes in projects in the context uncertainty and inaccuracy of information based on the assessment of the efficiency of energy saving measures and technologies and the search for permissible control actions in which the project's performance indicators reach their maximum values, taking into account the influence of the environment and for specified restrictions. A set of measures to improve energy efficiency in cocoon – winding industrial enterprises are aimed at reducing the amount of energy resources to produce produccts.*

Keywords*: the power savings, management of power savings, an efficiency estimation, efficiency parameters, modelling and forecasting.*

Energy-saving measures at cocoon-winding industrial enterprises ensure the implementation of organizational, legal, technical, technological, economic and other measures aimed at reducing the volume of energy resources used, while maintaining the volume of manufactured products and increasing the competitiveness of products [6].

Energy saving management is carried out through the implementation of cocoon winding industrial projects, the purpose of which is to achieve maximum energy efficiency. Evaluation of the effectiveness of project management is carried out as a result of monitoring and measuring energy saving at each stage of the project's operation in terms of indicators equal to the ratio between the achieved or expected results and the resources spent on the formation and functioning of these control actions. Optimization of the management of energy-saving projects is aimed at achieving the maximum efficiency of the project and consists in finding from a variety of possible control options for given such admissible control actions that will have maximum efficiency indicators.

Optimal management of energy-saving projects at cocoon-winding industrial enterprises is carried out with the help of an appropriate choice at the design and implementation stages of energy-saving measures and energy-efficient technologies, which are a combination of methods, operations, techniques, stages and other methods, the consistent implementation of which ensures the solution of the energy saving task. In practice, when forming control actions, it is necessary to take into account the incompleteness and distortion of information about the state of the control object, the

impact of external factors on the object, the inability to analyze all possible control options to achieve the maximum efficiency criterion. The solution of the problem of effective energy saving management should be carried out by modeling the project under conditions of uncertainties of various nature, incompleteness and inaccuracy of information about the processes in cocoon winding industrial projects, as well as insufficient and unreliable knowledge for estimating their parameters and characteristics. Modeling of energy saving management processes in projects should be carried out on the basis of an assessment of the effectiveness of energy saving measures, technologies and the search for such acceptable control actions under which project performance indicators reach their maximum values, taking into account the influence of the external environment and under given restrictions.

The life cycle of an energy-saving cocoon winding industrial project consists of the following stages:

- energy audit, the purpose of which is to examine the current state of the energy system in question and the potential for a possible increase in its energy efficiency;
- development and planning, as a result of which measures and technologies are formed taking into account their energy efficiency in order to achieve the set targets for energy saving;
- project implementation;
- completion of the project.

The composition of the mathematical model required to describe energy saving management in projects is presented in Table 1.

In the course of modeling energy saving management, it is necessary to provide for the possibility of predicting quantitative estimates of the characteristics and parameters of the project at each stage of its life cycle. For correct modeling of probabilistic and fuzzy processes of the project, risks and uncertainties of the influence of the external environment, it is necessary to use methods of probability theory and procedures of fuzzy set theory as part of the model [7].

Moreover, the choice of probabilities or a fuzzy model for describing processes depends on the nature of the presentation of the initial and current parameters of an energy-saving project. To describe the partial lack of information about the states of processes in cocoon winding industrial projects and the environment, fuzzy parameters are accepted. In the presence of technical, technological and economic risks, it is advisable to represent the process parameters in the form of probabilistic values. Therefore, energy saving targets for each stage of the project are set in the form of probabilistic or fuzzy values.

To solve the problem of evaluating project management efficiency indicators, it is advisable to model in the form of a connected directed graph, when during the simulation the parameters of energy-saving measures and technologies are set (execution time and probability of transition between graph vertices, technological, techno-environmental results), as well as target indicators. Such a directed graph is weighted by the values of the parameters of the energy-saving processes of the activities and technologies of the project.

The effectiveness of managing energy-saving projects in cocoon-winding industries is assessed by socio-economic indicators discussed in detail in [4].

The composition of the mathematical model of energy saving management in cocoon winding industrial projects

Stages of the project cycle	Procedures included in the mathematical model
Initiation stage	Assessment of the current state of the object under study in terms of energy consumption and the possible potential for increasing its energy efficiency.
Development and planning phase	Prediction of quantitative estimates of the characteristics and parameters of the project, energy saving measures and energy efficient technologies. The task of selecting measures and technologies with maximum performance indicators is being solved based on quantitative assessments and taking into account the specified target indicators of the energy saving project.
Implementation phase	Comparison of the achieved results and target indicators during the implementation of the energy saving project. In case of failure to meet the target indicators, the selected group of activities and technologies is adjusted and/or supplemented taking into account the values of their performance indicators and external conditions.
Final stage	The final calculation of the indicator of efficiency of management of energy-saving projects, taking into account the disposal of measures and technologies.

The process of evaluating the effectiveness of managing energy-saving projects in cocoon winding industries in terms of technical, economic and socio-environmental indicators is illustrated in Figure 1.

The analysis of energy saving indicators characterizes the activities of the enterprise for the implementation of measures aimed at the efficient use and economical use of fuel and energy resources at all stages of the project life cycle, which can be carried out as a result of:

- actual economy of fuel and energy resources;
- reducing losses of fuel and energy resources by optimizing industrial processes, energy consumption;
- carrying out energy-saving measures;
- reducing the energy intensity of production through the introduction of less energy-intensive energy saving schemes;
- use of secondary energy resources;
- implementation of energy saving projects, implementation of energy saving technologies, etc. [2].

Limiting the cost of using energy-saving measures and technologies has the form;

$\sum_{i=1}^{N} G_i * t_i$

where ti are the costs necessary for the operation

i -th event and technology;

G is the total amount of monetary resources allocated to achieve the energy saving target at this stage.

Energy intensity is estimated as the sum of the costs for all types of fuel required for the production, maintenance, repair, transportation, storage and disposal of one product, according to the formula

$$Э_c = \frac{\sum_{i=1}^{N} G_i}{N}$$

where Gi - the cost of all types of fuel for a certain period of time;

N is the number of manufactured products for that period of time [3].

The use of secondary energy reserves that arise at cocoon-winding industrial enterprises is an additional reserve. The calculation of fuel savings through the use of secondary energy resources shows the degree of utilization of secondary energy resources at industrial enterprises and evaluates the economic effect of the enterprise.

It should be noted that in the process of functioning of measures for the development and implementation of resource-saving technologies, in addition to the energy-saving result, a secondary social and environmental effect arises, expressed in reducing the negative impact of energy saving and energy consumption on the environment. In particular, as a result of energy saving, the emission of greenhouse gases (water vapor, carbon dioxide, methane, etc.) into the atmosphere is reduced, as well as the content of harmful substances in combustion products, which will not only have a positive impact on the environment, but also increase the social effect. Obviously, such an environmental effect will be directly proportional to the saved fuel - the result of the work of energy-saving measures and technologies. At the same time, improving the environment will lead to an improvement in social working conditions in the workplace and an improvement in the quality of life.

The calculation of the social and environmental component should be carried out according to social and environmental indicators that characterize the magnitude of the reduction in environmental payments for nature use, the improvement in the quality of life of the population as a result of the optimization of production and the introduction of energy-saving measures.

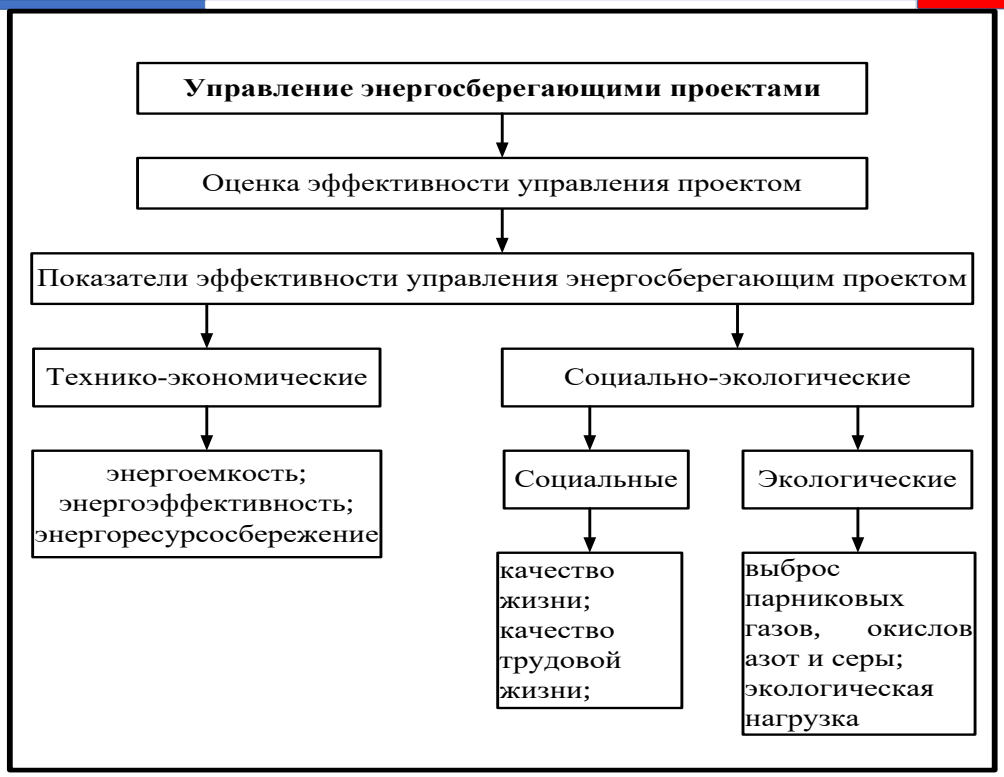

Fig.1. Evaluation of the efficiency of energy saving projects management

The calculation of the socio-economic components of the external effect can be performed using the methodology for assessing the quality of life, according to which the quality of life is based on the following principles: a comprehensive assessment; complexity; universality; taking into account the specifics of the object of study, which is measured by some integral indicator, which includes the relevant characteristics of the quality of life, which can be represented by standard static indicators. Accordingly, the integral indicator of the quality of life is determined by the formula [1].

$$I_i = \sqrt{\frac{x_m}{x_{il}} * \frac{x_i}{x_{il}}}$$

where I_{i} is the subindex of the i-th local indicator; x_{il} - value

i -th indicator in l - subject; x_{m} is the average value of the m-th indicator; x_{i} is the average value of the i -th indicator in the Republic of Uzbekistan.

Thus, energy saving management in textile industrial projects is aimed at choosing energy-saving measures and technologies with maximum efficiency indicators to achieve specified targets under given resource constraints. The developed algorithm for analyzing and evaluating performance indicators is of practical importance, since it can be used to analyze and improve the efficiency of management processes for energy-saving projects in the textile industry.

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