STRATEGIC SOLUTIONS FOR THE IMPLEMENTATION OF INNOVATION PROJECTS

Hilorme Tetiana, Oles Honchar Dnipropetrovsk National University
Olena Chernysh, Donetsk State University of Management
Anna Levchenko, Central Ukrainian National Technical University;
Olena Semenenko, Open International University of Human Development Ukraine
Hanna Mykhailichenko, Kyiv National University of Trade and Economics

ABSTRACT

As part of the process of a program planning and development of industrial enterprises on the basis of energy conservation, a procedure for reviewing and approving investment projects should be defined, which determines the procedure and deadlines for accepting a project, the procedure for reviewing and analyzing a project, and criteria for project approval. The coordinate plane for making management decisions on an energy saving project was built on the basis of three success criteria: customer value, risk level and technical capability. The choice of the optimal management decision for the transfer of industrial production to renewable types of energy resources should be carried out on the basis of the hierarchy analysis method, which will allow solving many practical problems at different planning levels. The subcriteria of global priorities for the success of energy saving investment projects were analyzed: consumer value, risk level and technical capability.

Keywords: Investment Project, Energy-Saving Technologies, Analytic Hierarchy Process, Customer Value, Alternative Energy Sources.

JEL Classifications: M21

INTRODUCTION

An important issue in the development of solar energy is the high cost of energy. Improvement of the reliability, durability and safety of solar cells are the main ways to reduce the cost of energy. A significant, still unsolved problem is the failure of individual solar cells in the solar systems for generating power. Up to 30% of damage occurs due to the presence of individual defective solar cells. This leads to a significant reduction in the generating capacity of the entire power generation system, or until its complete failure. In order to solve this problem, it is possible to use switching elements with a positive temperature coefficient of resistance, in particular, thin films based on polymer nanocomposites with wire fillers, which are capable of blocking damaged solar cells.

Industrial enterprises should find the optimal solution for the strategy of innovative development based on energy saving, in which the value of the objective functions will be acceptable. On the basis of this solution, it is necessary to analyze the result obtained and determine the feasibility of implementing various detictions of development of industrial enterprises based on energy saving.

REVIEW OF PREVIOUS STUDIES

The formation of a strategy for the development of industrial enterprises on the basis of energy saving is a process that allows studying the possible behavior of energy suppliers in order to choose the most acceptable energy supply option for a certain period of time (Chang et al., 2017).

The real possibility of choosing suppliers of energy products, taking into account the need for them to ensure an adequate level of reliability of energy supply in the case of the lowest costs is associated with the formation of a competitive market in the energy sector and with the possibility of buying electricity in the wholesale market (Che et al., 2017).

The development strategy of industrial enterprises on the basis of energy conservation, which is functional in nature, should be aimed primarily at the implementation of a general strategy for the development of an industrial enterprise, at the same time taking into account the state of the internal environment and its possible dynamics (Chen et al., 2017).

That is why in the case of forming a development strategy for industrial enterprises on the basis of energy conservation, the limitations imposed by the adopted general development strategy of an enterprise on the number of personnel of energy services, the amount of material resources allocated to them and investments to maintain the necessary proportions in the development of the energy sector and core production should be taken into account (Drobyazko et al., 2019b).

The wide interdependence of individual power plants, the use of fuel and energy resources and the use of technological processes in manufacturing implies an objective need to optimize decisions made in the process of shaping the development strategy of industrial enterprises based on energy saving, taking into account the impact they will have on the economic performance of the enterprise and product competitiveness (Karabegović & Doleček, 2015; Kumar et al., 2017).

METHODOLOGY

The Analytic Hierarchy Process uses a goal tree methodology. It is also based on the formation of a hierarchy of goals and means by type of layers. This method is designed to select possible means for solving a complex multifactor problem and involves decomposing of target into simpler components (means and subgoals) and the subsequent evaluation of all these constituent elements using pairwise comparisons. The result will be a numerical evaluation of the importance of the hierarchy elements used to select the best alternative solutions for the original problem (Hilorme et al., 2019a).

The Analytic Hierarchy Process to assess the possibility of introducing investment projects consists of several components. The main steps of the hierarchy analysis method are: hierarchical representation of the problem; construction of the set of matrices of pairwise comparisons; definitions of local and global priority vectors; checking the consistency of the results; calculate total AHP scores (Drobyazko et al., 2019a).

As a result, the relative importance of the considered alternatives for all criteria that are in the hierarchy was determined. Relative significance is expressed numerically in the form of priorities (vectors). The resulting values of the vectors will be estimates in the scale of relations and will correspond to *"hard"* estimates. The result of this method will be the determination of a better option and a specific rationale in the selection and distribution of options, which will generally allow the problem to be studied in detail.

RESULTS AND DISCUSSIONS

An effective investment project in energy saving should be evaluated, created, selected from a number of possible before it starts to be implemented. As for most difficult controversial issues, it is impossible to immediately select the most optimal investment project, if you do not realize the potentially available opportunities for their risks, requirements and benefits. For a more detailed picture of energy consumption, which will allow to evaluate energy saving projects that are planned to be implemented at industrial enterprises, it is worthwhile to introduce energy management (Hilorme et al., 2019b & c); Drobyazko et al.,2019c).

In order to determine the effectiveness of an investment project in energy saving, it is necessary to define evaluation criteria. We propose to determine the three components of the coordinate system of the management decision-making plan for an energy saving project (Figure 1): Axes: x-value (combination of consumer and business), y-technical capability, z-degree of risk, they in turn have several levels of subcriteria. Thus, value is a compositional characteristic that is a synergy of customer value and business value. Thus, the subcriteria of value are four main characteristics: Cost; Lifetime performance; Security; Reliability.

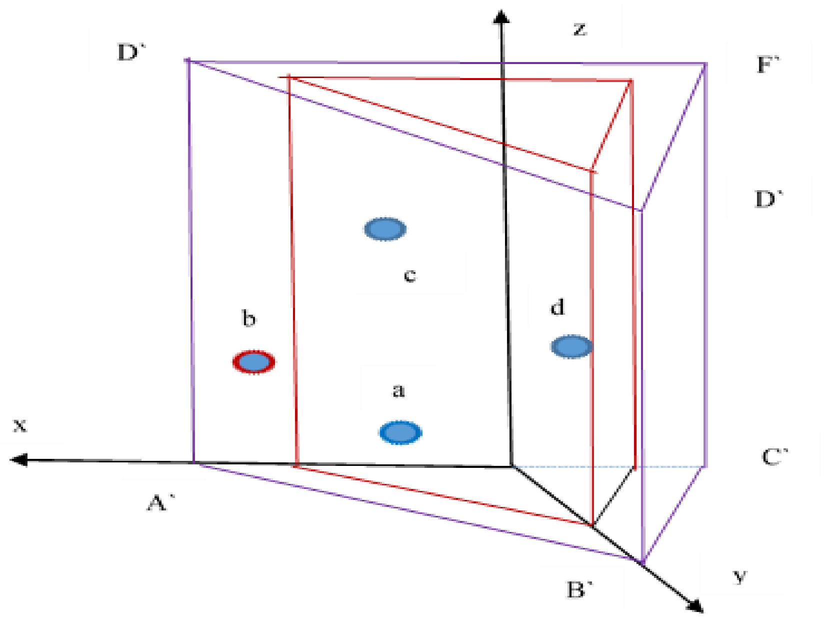

FIGURE 1
COORDINATE PLANE OF MANAGEMENT DECISION MAKING ON AN ENERGY SAVING PROJECT (AUTHORING)

All three vectors in Figure 1 are the investment characteristics of the energy saving project (in accordance with the quantitative value). Quantitative values can be determined by calculating the weighted average distortion coefficient along the axes of the coordinate plane. Thus, the project on energy saving and creation of protection of solar cells against overloads based on polymer nanocomposites (conventionally designated b in Figure 1) has the following investment characteristics: high consumer value, high technical capabilities and medium risk. This is determined using the analytical system in accordance with Figure 1:

$$\begin{cases} (x_b = k_x x_b; y_b = k_y y_b; z_b = k_z z_b) \rightarrow \\ k_x = k_z = 1, k_y = \frac{1}{2}k_x = \frac{1}{2}k_y. \end{cases}$$

Where:

$(x_b = k_x x_b; y_b = k_y y_b; z_b = k_z z_b)$ → coordinates of the point b

$k_x = k_z = 1, k_y = \frac{1}{2}k_x = \frac{1}{2}k_y$ → weighted average distortion factors along the axes of the coordinate plane, respectively, of the axes *x, y, z*.

We consider the dominant hierarchy of criteria for investment projects on energy saving for industrial enterprises built from the top (from a management point of view) through intermediate levels (criteria on which subsequent levels depend) to the lowest level, which is usually a list of alternatives. The hierarchy is considered complete if each element of a given level functions as a criterion for all elements of a level, stands below. We apply the hierarchy analysis method to determine the strategy of transition to an alternative type of energy carrier.

In order to implement the strategy for the development of industrial enterprises on the basis of energy saving, we are guided by the following criteria: cost; lifetime performance; security; reliability.

Renewable energy sources for an enterprise can be such alternatives: wind energy, solar energy, biofuel, energy of secondary energy resources. Summarizing estimates of priority when choosing an alternative are given in Table 1.

Table 1
SUMMARIZING ESTIMATES OF THE PRIORITY WHEN CHOOSING AN ALTERNATIVE

Types of renewable energy	**Numerical value of the criteria priority**				**Global priorities (business and customer value)**
	Cost	**Lifetime performance**	**Security**	**Reliability**	
Solar energy	0.5204	0.3227	0.7884	0.7185	0.5875
Secondary energy resources	0.1938	0.1237	0.3677	0.2462	0.4657
Biofuel	0.0941	0.5388	0.1634	0.3894	0.296425
Wind energy	0.818	0.3548	0.1005	0.046	0.329825

Source: Author's calculations

In our case, the maximum, taking into account all the criteria, is the estimate of the first alternative-solar energy, which has the highest priority value. On the other hand, the solution of this problem gives us the opportunity to allocate the available resources among alternative options according to their priorities. The next priority is the alternative-the use of biofuel, then-the use of secondary energy resources and in the fourth position-the use of wind energy.

As for the other criteria for the efficiency of an investment project on energy saving-the degree of risk and technical capabilities - we can also highlight the corresponding sub-criteria. Thus, the criterion *"degree of risk"* has the following hierarchies of criteria of the third order: incompleteness (fuzzy license for the production and sale of energy from alternative energy sources, lack of standards, premature offer from the supplier, fuzzy payment model for use); loss of control (lack of leadership, inconsistency of corporate policy); legal and regulatory issues (compliance with regulatory documents); security issues (data protection, lack of energy audit). The criterion *"technical capability"*-ease of integration, ease of migration, technological stack and the like.

RECOMMENDATIONS

Study of the aspects of energy saving in the development of industrial enterprises in business planning is recommended when considering these types of planned work, emphasizing energy saving measures that should be reflected in relevant plans in parallel with innovative measures, which will lead to the need to transfer the economy to an energy efficient way of industrial development, improve the investment climate for attracting business, contribute to improving the competitiveness of production.

CONCLUSIONS

Based on the calculations made on the implementation of an industrial enterprise strategy based on energy saving, it is important to note some recommendations for its implementation: the use of solar and wind energy can be applied at industrial enterprises for the production of hot water, for technological, household needs, for the production of electric energy (with the introduction of a *"green tariff"* for the production of electric energy, the development of industrial production of electricity using solar panels became financially reasonable). High power consumption of electric energy and significant energy consumption of outdated equipment will not allow fully switching to autonomous power supply with this type of energy, since solar installations and wind turbines are low-power and operate with low efficiency and require special environmental conditions, large areas and large capital expenditures.

Thus, strategizing the development based on the energy saving of industrial enterprises is becoming an indispensable tool in the system of strategic management of the enterprise's activities, aimed at increasing the efficiency of using energy resources and reducing the amount of energy costs. The formation of a strategy for the development of industrial enterprises on the basis of energy conservation requires the comprehensive consideration of the influence of various factors of the external and internal environment on the results of the enterprise's activities and increasing the competitiveness of products.

The main mechanisms for the long-term development of all industrial enterprises are the reduction of the corporate income tax and the receipt of concessional loans for the purchase and installation of energy-efficient equipment, as well as special depreciation rates for energy-efficient equipment that stimulate the introduction of this equipment; use of energy audit, energy management, voluntary agreements.

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