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# System analysis of the energy complex of engineering enterprise as a basic tool of effective energy management

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**Abstract.** Approaches to system analysis of difficult energy objects of the machine building enterprise and its energy complex as a whole are considered. The role of system researches in the general structure of energy management of the enterprise is analyzed. Recommendations for choice of efficiency indicators and methods of revealing of technically recoverable losses of energy resources are offered.

## 1. Introduction

Improving energy facilities of engineering enterprise that combine dozens of pieces of equipment is a complex task that is possible to solve only on the basis of system analysis methodology [1, 2]. The complexity of the task is defined with hierarchical rank the selected object of study: apparatus □ setting □ technological system, etc. The higher the level of the object is, the wider the range of possible solutions for its improvement.

## 2. The algorithm of the research

The algorithm of the system of research involves a number of sequential subtasks:

1. Analysis of the effectiveness of the original object vigorously to the selected criterion or set of criteria.
2. Structural analysis of the object with the introduction of elements hierarchy of the equipment included in its composition. The hierarchy is built on the degree of importance of a particular element to obtain the final result. The dominant and dependent components of the system are pointed out (including the dependent chain elements).
3. Decomposition of a complex object.
4. Definition of a set of measures aimed at improving the facility.
5. Introduction of new pieces of equipment in the structure of the object.
6. Mathematical modeling of the object.
7. Synthesis of a new object
8. Optimization of synthesized object.

The international standard of ISO 50001:2011 "Energy Management Systems" [3] identifies a number of functions that must be performed at the plant in order to ensure effective management of the expenditure of energy.:



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- The development of methodology and updating of energy analysis;
- Construction of the energy balance of the enterprise on the basis of measurements and other data;
- Determination of areas (equipment, subsystems, systems) meaningful use of energy;
- Identifying and ranking of opportunities for improving the level of enterprise energy efficiency;
- Planning the implementation of energy saving measures;
- Compensation of plans if the current results of energy analysis show a need for it;
- Search of mechanisms and means of implementation activities, including energy service contracts.

From the comparison of the features of the system analysis and energy management functions can be concluded that the system analysis is a tool, which is based on the possible development of a methodology energy analysis of large production units, including engineering enterprises.

An important issue in enterprise energy management system is the selection of energy efficiency indicators. As shown in [3, 4] indicators are selected for different enterprises in different ways, based on the guidance of the goals of the enterprise. It can be simple parameters, such as the amount of energy consumed per year or the number of energy consumed per unit of product. But also more complex parameters and the models can be applied.

**3. Conclusion.** In practice, it is usually limited to simple performance indicators, which are not always informative. For example, the performance indicators defined on the basis of the energy balance of the energy facility, reflect the amount received and the useful energy consumption. The issue of quality of energy used in this way is not affected. Meanwhile, the potential of energy resources (e.g. steam pressure) in this site may be used not enough. To determine the efficiency of energy resources and the extent of its use in the process of energy is rational to apply the parameters of thermodynamic efficiency of the object [2].

Methods for determination of compliance with quality energy resources, for example, the method of compliance with the temperature [5], allows to detect technically avoidable loss of efficiency of energy resources, including direct loss of energy, and also to identify the processes, implementation of which will eliminate these losses.

#### 4. References

- [1] Melent'ev L A 1983 *System studies in engineering. Elements of the theory, development trends.* 2<sup>nd</sup> Edition - M: Nauka
- [2] Nazmeev J G Konahina I A 2001 *Organization of energy technology complexes in the petrochemical industry.* – M.: Publishing house of MEI
- [3] *The international standard ISO 50001: 2011. Energy Management Systems - Requirements with guidance for use*
- [4] *Practical tips for energy saving in the rubber processing industry.* – Good Practice Guide No 262, Energy Efficiency Best Practice Program, ETSU, Great Britain – Crown copyright 1999
- [5] V G Grigorov, V K Nejman, S D Churakov and others 1987 *Disposal of low-grade thermal waste energy in chemical plants.* / – M.: Chemistry