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## MODERN METHODS OF ENERGY CHECKUP OF BUILDINGS AND STRUCTURES

**Abstract:** This article discusses improve energy efficiency and implement global energy conservation measures and improvements by providing concrete evidence of successful performance-enhancing activities from which the economic benefits become apparent.

**Key words:** Audit, development, efficiency, energy, implementation, monitoring, methods.

**Language:** English

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### Introduction

The main reason for the need to improve energy efficiency and the implementation of global energy conservation measures is the depletion of natural resources and greenhouse gas emissions. Limited energy, one way or another, affects all states and has become a global problem.

The change in attitude to the use of energy resources is associated with high energy intensity of products. This problem, in turn, entails such consequences as the inefficiency of the economy, the lack of competitiveness of products, low sales on world and domestic markets, export costs, the closure of inefficient enterprises, etc.

Energy efficiency monitoring is initially used to document the current situation. Once a review is received — for example, data from 6 months to one year — you can set complex, but realistic goals to increase efficiency, while continuing to track progress toward your goals. In turn, more data will lead to a better understanding of the energy characteristics of the plant and the development of further goals. This is a well-known procedure known as “Monitoring & Targeting”.

Monitoring & Targeting (M & T) is a management approach that helps companies eliminate waste and reduce the current use of energy (and other supplies) by providing timely and relevant

information. It also provides an incentive for further improvement by providing concrete evidence of successful performance-enhancing activities from which the economic benefits become apparent.

Similar approach can be adopted for monitoring and managing emissions, although the concept of “goals” is somewhat different here. A reasonable goal is to monitor the level of emissions established by relevant regulations, and many enterprises will strive to fulfill their obligations, rather than reduce emissions further. This can ensure regulatory compliance, although it may well be possible to increase profits by further reducing emissions. Each case must be considered individually, as the situation will vary from enterprise to enterprise.

The implementation of a monitoring and targeting system includes two main functions:

- continuous monitoring of energy use;
- Investing in energy efficiency measures.

Management information from effective monitoring and targeting can improve both performance and quantification of these improvements.

Management information is a vital element in successful monitoring and targeting.

The types of savings that have been achieved through successful monitoring and targeting with minimal or zero investment are improved working

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methods, improved maintenance schedules and staff training.

Along with cost savings, systematic monitoring and evaluation of energy consumption can lead to higher product quality and higher productivity, as well as lower maintenance and waste costs. Effectively implement a monitoring and targeting system, some costs will be required. Actual cost depends on the details of the monitoring that will be carried out.

The goal of a good M&T system should be:

- Establishment of a consumption model over the past period of time;
- comparison of current consumption with data from previous consumption and (or) standards;
- setting future energy goals;
- comparison of actual consumption with goals;
- determination of consumption trends.

The energy audit methodology includes the following levels of energy audits:

- preliminary energy audit (pre-audit);
- energy audit of the first level - calculation of energy consumption and costs;
- energy audit of the second level - an in-depth examination of energy technology systems and the industrial enterprise as a whole, calculation of energy flows.

Pre-audit aims to assess the need for an audit.

To do this:

- assessment of the share of energy costs in the total costs of the enterprise (electricity, heat, fuel, water, etc.);
- identification of the dynamics of changes in the share of costs for the last 2-3.

If the share of energy consumption is:

- 5-10%, then an energy audit can not be carried out so far;
- 11-15%, then an energy audit is necessary;
- 16-20% or more, an energy audit should be carried out urgently.

An energy audit of the first level has the following objectives:

- determine the structure of energy consumption and the structure of energy use;
- identify and present to the enterprise management the potential for energy conservation;
- identify areas where energy is wasted or wasted;
- prioritize future work;
- identify and prove to the management of the enterprise the feasibility of conducting an in-depth examination.

The energy audit of the second level has the following objectives:

- find opportunities for implementation energy saving projects;
- evaluate their technical and economic effectiveness;

combine recommendations and technical solutions for rational energy use and energy saving in one system;

create prerequisites for the preparation of a comprehensive long-term plan for the implementation of energy conservation at the enterprise.

Preliminary audit serves to draw up an energy audit program. At this stage, the main characteristics of the enterprise are determined - the range of products, the composition of energy resources consumed, the production structure, the number of employees, the composition of the main equipment and buildings, the operating mode, management structure, etc.

Preliminary audit stages:

- acquaintance and initial conversation with top managers;
- familiarization with the company;
- analysis of energy supply agreements concluded by the enterprise.

In the process of conversation with the first managers of the enterprise, it is necessary to identify those who make decisions, obtain initial information about the enterprise, obtain information about the amount of energy consumption in the cost of products, determine the goals of energy-saving measures; to allocate responsibility for the energy audit work carried out at the enterprise and to clarify the list of persons with whom it is necessary to work in the process of energy audit.

Acquaintance with the enterprise includes: inspection of the enterprise; study of power supply schemes; energy accounting systems and production technological schemes.

At this stage, it is necessary to clearly determine the available information on energy use at the enterprise, assess the degree of its reliability, highlight the part that will be used in energy audits.

It is necessary to identify the most energy-intensive units, technological cycles and the places of the most probable losses of energy resources.

At the end of the preliminary stage, an energy audit program is drawn up, which is agreed with the enterprise management and signed by two parties. When compiling the program, the opinion of the surveyed enterprise on the order and priority of work at various sites is taken into account.

The main types of work:

- familiarization with the enterprise, collection and analysis of information available at the enterprise that is useful for energy audits;
- identification of potential energy saving potential at the enterprise.

The main stages of energy audit of the first level:

- 1) collection of primary information,
- 2) analysis of energy and economic indicators of the industrial enterprise,
- 3) selection of audit objects,

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4) preparation of a conclusion on the main results of the primary energy audit.

At the preliminary stage, both the survey organization and the surveyed enterprise participate in the collection of information. Information is recorded in standard forms.

Throughout the energy audit, information is collected in accordance with the developed program. Sources of information are:

- interviews and questionnaires of management and technical personnel;
- power supply and energy metering schemes;
- reporting documentation on commercial and technical accounting of energy resources;
- invoices from energy suppliers;
- daily, weekly and monthly load schedules;
- data on the volume of production, prices and tariffs;
- technical documentation for technological and auxiliary equipment (technological systems, specifications, operating cards, regulations, etc.);
- reporting documentation on repair, commissioning, testing and energy-saving measures;
- promising programs, feasibility studies, project documentation for any technological and organizational improvements approved by the enterprise development plan.

The company must provide all the necessary information for work for at least the last 3 years. In this case, the surveyed company is responsible for the accuracy of the information provided.

The composition of the primary information:

- general information about the enterprise;
- actual reporting data on energy use and output in the base year and for the last 3 years (by months);
- list of basic energy technology equipment;
- technical and energy characteristics of installations;
- technical and economic characteristics of energy carriers used at the enterprise;
- information about the sources of electricity, heat, water, compressed air, fuel, etc.

Analysis of energy and economic indicators of the enterprise:

- quantitative characteristics of production over the past 3 years by month;
- the cost of production, including the cost of fuel, electric and thermal energy, water at the time of the survey and for the last 3 years by month;
- energy intensity of products;
- specific energy intensity of products by months;
- specific energy costs for major products by month;
- the average annual number of employees, including production and managerial personnel, energy service personnel, etc.

It is necessary to find out the share of which energy resources in total consumption is the most

significant, the use of which energy resources should be paid attention to, first of all. Information on energy consumption should show the share consumption of various energy resources at the enterprise and their costs. Information on prices should include the price per unit of fuel and the tariff (if used). Components of prices and differences in prices should be noted.

When considering the structure of tariffs for energy resources, it is necessary to take into account all factors that ultimately determine how much an enterprise pays for energy resources: price changes during the year; tariff structure; differentiated tariff rates; penalties and other payments.

The most complicated is usually the structure of electricity tariffs, which depends on the type of consumer consumption. To assess the potential savings in electricity consumption, you must obtain the following information:

- what is the capacity of each electricity input;
- what is the total power of the connected load;
- what are the load profiles - daily and annual;
- what is the average power factor;
- Is reactive power compensation available?
- What is the general structure of power consumption (engines, lighting, technological processes, etc.).

To assess the efficiency of energy use and the visibility of the information provided, various types of unit costs can be obtained: the average cost of energy and energy; marginal cost; unit cost of energy in an energy carrier; unit cost of useful energy.

At the end of the first familiarization phase, energy auditors should have an idea of the enterprise and the main technological processes, as well as the following information:

- the total cost of the enterprise's costs for energy, water, sewage and sewage, etc.
- cost structure for energy carriers;
- seasonal changes in consumption and value;
- price structure for each energy resource.

This information will give a clear picture of the current situation with energy use at the enterprise and the opportunity to identify priority areas for further work.

The objectives of the energy audit of the second level:

- determination for each energy resource of the most significant consumers in terms of costs and consumption;
- distribution of consumption of each energy resource by main consumers (development of energy balances);
- development of measures to reduce energy consumption.

To achieve your goals you must:

- conduct a survey of the enterprise;
- draw up diagrams of technological processes;
- make a list of key energy consumers;

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- calculate the energy consumption of each of the main energy consumers;
- analyze the work of key consumers.

When examining the enterprise, you must:

- identify energy flows to and from processes;
- determine the flows of raw materials and products;
- establish flows of losses and waste;
- establish production operating modes and key figures at the enterprise (the key people in the enterprise are process plant operators, supervisors and technologists, product managers).

### Conclusion

Consequently, collection of statistical data and primary information, which includes:

- annual and monthly production of primary and secondary products for both the current and previous 3 years;
- annual and monthly consumption and consumption of energy resources;
- specific norms for the production unit;
- fund of working time and shift;
- sources of heat, electricity, water, gas, water, compressed air, etc. ;
- schemes of heat, water, gas, electricity and air supply systems, etc. enterprises and individual divisions;
- indicators of energy consumption in existing forms of statistical and in-plant reporting;
- measures to improve energy efficiency and their implementation over the past 3 years;

- state of accounting and rationing of the consumption of heat and electric energy, water, etc. ;
- availability of passports for energy-intensive equipment;
- availability of secondary energy resources, including low potential ones, and their use;
- availability of an energy passport of the enterprise.

Process flow charts are a diagram showing the main steps through which materials pass sequentially from the initial state to the finished product.

The diagrams should show the places of supply and use of energy resources, marked the processing of materials, waste disposal in the process.

It is possible to identify the main consumers on the basis of a conversation with the staff, studying the schemes of technological processes, equipment certificates and bypassing the enterprise.

- The largest consumers of electricity are usually
- electric furnaces;
  - heating, ventilation and air conditioning systems;
  - compressed air compressors
  - technological pumps;
  - vacuum pumps;
  - hydraulic pumps;
  - equipment for mixing and heating liquids;
  - lighting systems.
- The main major fuel consumers are usually:
- steam and hot water boilers;
  - furnaces for various purposes;
  - fluid heaters;
  - heating systems.

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