

Energy Audit Basics, Energy Audit Tasks And Energy Audit Methods

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Abstract — In this article, information on the basics and methods of energy audit is analyzed on the example of the Republic of Uzbekistan.

Keywords — Energy audit; thermal method; energy survey; general energy audit; Ultrasonic methods

Introduction.

Energy audit, or energy audit of enterprises and organizations, involves the assessment of all aspects of the enterprise's activities that are associated with the cost of fuel, energy of various types and some resources, for example, water.

The purpose of the energy audit is to assess the efficiency of the use of fuel and energy resources and to develop effective measures to reduce the costs of the enterprise.

Energy audit allows you to control energy consumption and, based on research, take measures to minimize and save energy costs. The thermal method of non-destructive testing allows an energy audit of a building without disrupting the functioning of all its systems. The primary and complete energy audit is carried out with the registration of an energy certificate (an insert in the energy passport of a building). An energy passport is an official document for enterprises that have an energy economy. The energy passport contains information on the use of thermal resources by production facilities and an action plan to improve the efficiency of energy use. An energy survey using the thermal method helps to quickly detect defects in roofs of buildings, heat leaks from building seams, places of moisture condensation, and places of bursts of underground heating mains.

The first stage in the development of an energy saving project is an energy audit / energy audit at the facility.

An energy audit / energy survey allows to establish a "diagnosis", recommend methods and ways to improve the state of energy consumption.

An important stage in the implementation of the project is start-up and commissioning works. The purpose of this stage is to bring the equipment to its design capacity, draw up operating procedures, check the readiness of operating personnel to work with new equipment and technologies. Today, prior to the start-up and commissioning work, we attract qualified partners, but work is underway to create a start-up and commissioning group in the company and obtain permits required in accordance with the current legislation to carry out such work.

Methodology. The volume of documentation that is developed depends on the facility, energy saving measures and customer requirements and can vary significantly from a defective act and estimate to a complete project.

The scope of work includes:

I. Express and in-depth survey in industry, energy, transport, housing and communal services, public sector facilities, providing:

- determination of the potential for energy saving, the main directions of resource and energy saving and priority measures with a calculated assessment of the effectiveness of their implementation;
- development of balances for fuel, heat and electricity, water and compressed air;
- development of a complete list of measures and technical solutions for rational energy use and energy saving.

Energy audit of an enterprise is a comprehensive survey of an enterprise, which is carried out in order to determine the structure and efficiency of the enterprise's energy costs, search for the most energy-consuming units, determine the causes of losses and prepare recommendations for their elimination. This is a set of services for checking the efficiency of energy use at an enterprise. Similar work was carried out earlier by design and installation organizations, although they were called a little differently.

In the process of energy audit (energy survey), energy-intensive facilities of the enterprise are examined; assess the state of its power systems and accounting systems; analyze the energy efficiency of the technological cycle; make up energy balances, model the system of energy consumption standards.

As a result of an energy audit (energy survey), an "Energy Saving Program" is drawn up, a technical report (energy passport) is developed.

As a result of work on an in-depth energy audit, an energy passport is being developed, containing an analysis of energy supply, energy consumption and energy efficiency, energy balances, a list of energy saving measures.

II. Development of an energy saving program based on:

- development programs for the examined consumer of energy resources;
- the results of an in-depth survey of the energy sector of the consumer of energy resources.

III. Assessment of the energy effect from the implemented measures and technologies.

IV. Consulting and support for the implementation of energy-saving projects.

Energy audit tasks

When conducting an energy audit, a number of basic tasks are solved, the consistent solution of which is formed into an established method of conducting an energy audit. In addition, in accordance with the requirements of the current legislation in the field of energy saving, some formal tasks of energy inspection are being solved. And finally, the customer of the energy audit may have additional wishes for the scope of work.

The solution of all these problems is possible only with the joint work of highly qualified engineers and experts of the energy auditor with the operational personnel and the customer's specialists directly at the facilities of the enterprise.

The attraction of highly qualified specialists, their work with on-site visits, as well as the need to use specialized devices, implies certain costs for performing these works. Such costs have two main components, rather even hypostases, given their inseparability: time and money.

Time generally has a strange property, especially in our times: problems arise, as a rule, "suddenly", and they must be solved as soon as possible, preferably "yesterday." At the same time, however, one should understand that any work, and especially the expert work of energy auditors, requires a certain amount of time.

The massive start of energy saving activities in Uzbekistan fell on the era of the "free-of-charge economy", when there was no one to draw up convenient and understandable price lists and price tags for an energy audit. Hence, all the problems and difficulties with pricing in this area.

In the simplest case, a manager ordering a cheap energy audit needs to understand that highly qualified energy auditor specialists are in high demand, and their work cannot be valued cheaply.

When conducting energy audits, as in other segments of engineering services, their quality, timeframe and cost vary significantly depending on the specific entity in this business. And there is no unambiguous measure of these characteristics in the energy audit. This explains the difficulties in choosing an energy auditor. Fortunately, there are many auditors. It's bad that there are few real ones.

Of course, the actual output of any auditor is more or less paper. Moreover, a larger amount of it does not mean a higher quality, it is usually the other way around.

Energy auditors' proposals, as a rule, are of a recommendatory nature. Therefore, any work of energy auditors can remain so - only on paper, since the implementation of measures depends on the specialists and the management of the customer's enterprise.

On the other hand, a well-done energy audit can always be turned into money. Sometimes, the amount of this money can be several orders of magnitude higher than the cost of conducting an energy survey. It often happens that the costs are paid off even in the process of work.

The types of energy are distinguished:

- energy audit of power supply and power consumption systems;
- energy audit of heat supply and heat consumption systems;
- general energy audit (for both types of energy).

Cost reduction value:

- depends on the structure of the enterprise, consumed volumes and types of energy carriers, organization;
- power supply and state of power systems;
- provided by the implementation of a set of energy saving measures

The customer is provided with a report that contains the following information:

- a brief description of the existing energy facilities of the enterprise;
- list and technical characteristics of power equipment;
- test and measurement technique;
- a characteristic of the operating systems of production is provided with an indication of energy-consuming units;
- recommendations for elimination of energy consumption are provided;
- results of calculations on energy saving are given.

The term of the energy audit (energy survey) determines the structure of the enterprise: for small - 2-3 months, for medium - 3-6 months; for large - up to 12 months.

The cost of an energy audit (energy survey) depends on the structural complexity of the enterprise and, therefore, the scope of the survey. The final cost and term of the energy audit (energy survey) are determined by drawing up an enterprise survey program.

Energy audit methods

External inspection checks the quality of preparation and assembly of workpieces for welding, the quality of seams during the welding process and finished welded joints. In many cases, visual control is quite informative and is the cheapest and most efficient method of control.

Capillary flaw detection is designed to detect surface and through defects in test objects, determine their location, extent (for extended defects such as cracks) and orientation along the surface.

Capillary flaw detection allows you to control objects of any size and shape, made of various ferrous and non-ferrous metals and alloys, plastics, glass, ceramics, and other hard materials.

According to technical requirements, sometimes it is necessary to identify small defects, which are almost impossible to notice with a visual inspection with the naked eye.

Capillary testing is carried out in accordance with GOST 18442-80 "Non-destructive testing. Capillary methods. General requirements".

Ultrasonic testing is carried out in accordance with the requirements of GOST 14782-86 "Non-destructive testing. Welded connections. Ultrasonic methods".

The ultrasonic method is used to control process pipelines (both steel and polymers), various metal structures, process equipment, and when carrying out thickness measurement. The difference between ultrasonic testing is the efficiency of testing, applicable to most types of welded joints.

Thermal imaging diagnostics is one of the main areas of technical diagnostics. With the help of thermal imaging diagnostics of electrical equipment and thermal imaging inspection, you can monitor the thermal state of equipment and structures, identify defects at an early stage of development.

Thermal imaging control of thermal protection of buildings and structures will reveal the main mistakes made during the construction of buildings, eliminate violations of thermal protection structures. Thermal imaging inspection of heating and boiler plants will reveal the causes of gas leaks, defects in pipelines and equipment, defects in the brickwork of boilers, and will adjust the combustion mode of furnaces and boiler equipment. It is possible to control the quality of the tightness and insulation of residential buildings and premises using thermal imaging diagnostics of the building envelope. Thermal imaging diagnostics are objective, economical, informative and convenient.

Thermal imaging inspection of objects and diagnostics of electrical equipment include inspection of the object in the infrared range, drawing up a "thermal image" of the object, measuring the temperature at various points of the object, monitoring the dynamics of thermal processes, creating a data bank on the thermal state of the object.

With the help of thermal imaging diagnostics, it is possible to detect defects in power supply systems, heating systems, hot water and steam pipelines, chimneys, defects in the thermal insulation of buildings, greenhouses, cottages, country houses and much more.

Conclusion

In conclusion, I would like to say about the trends in energy consumption in the world. After all, the population of the Earth, as you know, has reached 7 billion people and continues to grow. The standard of living, while remaining extremely uneven in different countries and continents, continues, in general, to grow. The evolution of the way of life and population entails a steady increase in the consumption of fuel and energy resources on Earth, despite the technological improvement of the productive forces of mankind, environmental and energy saving trends. Due to the indicated progressive trends, the dynamics of growth in the consumption of fuel and energy resources lags significantly behind and will, in the future, lag behind the rates of economic development of the world community. On the whole, the prospective global energy situation gives grounds to predict at least a preservation or, most likely, an increase in the level of export demand for Uzbek energy resources, taking into account Uzbekistan's entry into the energy markets of the APR.

The main types of exported energy carriers for the next 20 years will remain oil and natural gas. The expected development of the world energy market will take place in areas where the volume of demand for Uzbek energy resources will be limited only by the competitiveness of suppliers. At the same time, Uzbekistan has all the opportunities to participate in the development of integration and unification of energy (electricity, pipeline) systems and energy transport infrastructure in the creation of a single Eurasian energy space.

Uzbekistan possesses a huge fuel and energy potential, which allows our country to occupy a leading position in the world in terms of the production and production of fuel and energy resources. Our country is fully self-sufficient in fuel and energy resources and is considered a major exporter of fuel and energy among the countries of the world. The existing structure of the use of energy resources and, in general, the economy maintains a high demand for energy, makes requirements for an accelerated

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