

# Methodology Of Energy Audit In Uzbekistan

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**Abstract** — *This article provides information on the methodology of the energy audit system in Uzbekistan.*

**Keywords** — Energy audit; fuel and energy; energy survey; general energy audit; Preparation of the report

## Introduction

Energy audit consists of six consecutive stages:

1. Determination of the volume of energy consumption and its cost over a representative period of time.
2. Inspection of fuel and energy flows at the facility.
3. Analysis of the efficiency of the use of energy and energy carriers.
4. Development of recommendations for the efficient use of energy resources.
5. Economic justification for the proposed recommendations.
6. Preparation of the report.

The approximate duration of individual stages of the audit is, respectively, 10%, 30%, 10%, 10%, 20%, 20% of the total duration, which depends on the size and complexity of the object, which is directly estimated through the amount of the object's expenses for energy. For example, in the UK an audit of an object with an energy bill of \$ 1 million lasts 25 days and costs \$ 18,000, at \$ 5 million - 40 days and \$ 30,000, respectively, at \$ 10 million - 50 days and \$ 37,000 ... On average, the cost of an energy audit is 2% of energy costs, an audit provides about 20% energy savings, and the cost of its implementation is paid off within two years.

Any energy audit work is performed by two persons: the lead auditor and the auditor.

When conducting an energy audit, the auditor must be aware of what the client requires and the resources of time and money available. It is important for the auditor to give the client what he wants, but not more than what he wants to pay for. These considerations can affect the detail of the energy audit, the number of meters used, the emphasis on specific equipment or energy saving measures, etc. On the one hand, an energy audit can be a simple overview of energy consumption based on the meter readings of the enterprise. On the other hand, an energy audit can involve the installation of new (permanently or temporarily) measuring equipment, testing and measurements over a long period of time. Due to the detailed audit, the auditor will be able to make sound recommendations. Naturally, the second one from the mentioned energy audits will be much more expensive.

## Materials and methods

The method of conducting an energy audit also depends on the qualifications and skill of the energy auditor.

The Lead Product Approach is a simple technical trick for energy auditors - beginners. After preparing the first few reports from the study of energy use, the beginner realizes the relevance and importance of recommendations for energy conservation, such as the use of low energy consumption luminaires, enhanced thermal control and insulation. After that, the auditor can easily inspect similar objects and determine the possibilities of applying those energy saving technologies that he has already successfully used. This technique is actively used to find sales markets for companies that sell energy-saving equipment. In addition, this technique can be used by "internal" energy managers of energy consuming companies, in which all objects have similar energy characteristics. For example, the energy manager of a company that owns a chain of hotels could identify a list of energy-saving measures that can be implemented across all the hotels in the chain. This approach is not recommended for use by professional energy auditors.

The Lead Review Approach is the recommended method for professional energy auditors. The method is based on determining the amount of energy used and comparing this value with industrial standards or the theoretically required amount of energy consumption. The method helps to identify potential energy savings. First of all, the amount of energy consumed by the main equipment groups is determined and compared with the total consumption at the enterprise. Having completed this work, the auditor shows ways to save energy, which consist, firstly, in the modernization of equipment, secondly, in a new mode of maintenance and operation, and, thirdly, in the restructuring of energy consumption at the facility (decentralized power supply, the use of alternative processes, complex production of heat and electricity (cogeneration)). In the end, to account for the specific conditions of the facility, a scientific approach is used instead of the "typical average savings" approach. This method allows a high quality energy audit, which is based on the study and measurement of various parameters, as well as on the experience of an expert.

A "blended approach" is a partial combination of both methodologies described above. It uses auditing techniques, but instead of looking for a wide range of energy conservation opportunities, it focuses on a small number (most often one) of energy conservation technologies. For this reason, the approach is convenient, for example, for the study of cogeneration. In conclusion, let us dwell briefly on the requirements for the qualifications and human qualities of an energy auditor. He must have sufficient knowledge and skill from technical aspects, accounting, safety and management. The auditor should be able to collect, analyze and interpret data from energy consumption. Due to the need to analyze large amounts of information, he must know the habits of working on personal computers and have access to them. The auditor should know the principle of operation and the performance characteristics of the basic equipment. In-depth knowledge of the specific equipment being operated on site is desirable but not required, as detailed information can be obtained from design documents and manufacturer's instructions. Familiarity with the technological process and with the energy resources that are used at the facility is important. It should be noted that in audit firms experts specialize in areas of production and have in-depth knowledge in these areas.

### **Discussion**

Auditors should be experienced engineers with human communication habits, strong enough character to question the obvious, and initiative to come up with solutions to a variety of problems.

An important feature of the auditor is open-mindedness, he must constantly work on himself, if only for this reason, then the statement "they always did this" does not mean at all, then "the way they did" was correct.

2. The volume of energy consumption, its cost according to the documentation of the object

An energy audit starts with determining the current energy consumption and its cost. This information resolves the mental scope of the problem and shows where efforts should be focused for best results.

Information on the current state of energy consumption is collected over a representative period, usually one year, in order to assess the impact on energy consumption of climatic conditions and the seasonal nature of certain facilities; this obviously requires monthly data.

Monthly data on the consumption of all types of energy and energy carriers are supplemented with data on the cost of fuel and electricity for the year and for each month, on the heat-generating capacity of the fuel, if it is non-standard. Cost information should include the unit cost of fuel and electricity and tariffs for its supply. Variations in the heat generating capacity of the fuel and the characteristics of the sources of its production are taken into account.

It is also necessary to obtain information on the temperature of the outside air during the period under consideration, at least monthly. For further analysis, monthly data on the volume of production or the provision of services by the enterprise are desperately needed. The auditor can receive this information even before visiting the enterprise in the form of answers to the request he has drawn up. The answers should be accompanied by invoices and copies of receipts for all types of fuel, electricity and other resources.

To get a feel for how energy costs are generated, the auditor should become familiar with the system of tariffs for the supply of energy and energy carriers.

Some energy resources, in particular, electricity, have a complex price structure, which also depends on several factors.

In Uzbekistan, for the calculation of consumed electricity, there are 2 tariffs: one-rate and differentiated for periods of time throughout the period, the so-called zone tariff.

Electricity consumers are divided into 2 classes. The first includes those that consume energy at a voltage of 35 kV and above, the second - at a voltage of up to 35 kV.

Below are the ones valid in Uzbekistan from 01.11.2020. tariffs (excluding VAT). The one-rate tariff for all first-class consumers is 295 som / kWh.

However, due to the tense situation in the electric power industry of Uzbekistan, in order to align the loading schedule, limiting electricity consumption during the period of maximum loading of the energy system, it is possible to introduce other components of payment for electricity supply, the practice of which is used in foreign countries.

In particular, outside the payment for the consumed electricity at the zone or one-rate tariff, there is an additional payment for the connected capacity of power consumers, for the contractual and actual average monthly maximum load. And in addition, the surcharge for maximum power consumption can have its own tariff zones with tariff changes throughout the year.

Determining the cost of electricity bills is not easy, but it is necessary to assess the potential for energy savings and the cost of electricity supply.

The energy auditor must obtain information about the total connected capacity of power consumers and the maximum power consumption, find out the size of daily and seasonal load fluctuations, and obtain characteristic load graphs.

Separately, attention should be paid to the power factor, the system of payment for the consumed reactive power stipulated in the contract with the power supply company, the limitation and penalties for their violation. It is necessary to have information about the measures already used at the site and the improvement of the power factor.

### **Conclusion**

There is also useful and necessary information about what part of the electricity is consumed by individual groups of power consumers: electric motors, lighting, heating, technological processes, etc.

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As a result of processing the accounting and financial documentation of the object, the following information is obtained:

- the total cost of energy resources that the object consumes (here it is important not to forget about water supply and related costs);
- distribution of costs between types of fuel;
- seasonal changes in fuel consumption;
- information on prices, on the tariff system.

This information gives a picture of the current situation at the facility and allows to highlight priority areas where energy saving measures should be introduced in the first place. For example, in a brick factory, where electricity costs account for 30-40% of all energy costs, and gas costs - 60-70%, priority efforts should be focused on limiting gas consumption.

The more energy is consumed and its cost, the more time should be spent on evaluating possible ways of saving.

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