

PAPER • OPEN ACCESS

## Research on the energy audit from the perspective of environmental protection

To cite this article: Kailei Wu 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **252** 042055

View the [article online](#) for updates and enhancements.

# Research on the energy audit from the perspective of environmental protection

**Kailei Wu\***

Shanghai University, Shanghai, China

\*Corresponding author e-mail: dtdpzsmile@163.com

**Abstract.** With the continuous development of the social economy, energy conservation and environmental protection are becoming more and more important. By introducing the management and control methods of audit into the energy management of enterprises, the energy audit is beneficial for enterprises to use energy resources rationally and improve the energy efficiency. Besides, it can also promote the sustainable development of economy and society. Thus, it is necessary to pay attention to the importance of energy audit and improve energy management in the enterprise.

## 1. Introduction

As a new type of scientific management method for energy, energy audit is not only an important way to improve economic and social benefits, but also conducive to strengthening energy management and transforming energy conservation management into standardized and scientific. The energy audit is a comprehensive review and supervision of energy production, conversion and consumption of enterprises in accordance with national energy regulations and standards. Besides, the energy audit is the representation and extension of audit work in energy management. It is also beneficial to promote energy management and energy conservation in energy-using enterprises. Carrying out enterprise energy audit needs to inspect and analyze the energy consumption process of enterprises. Thus, enterprises can grasp the status of energy management and energy use in time and find out the causes so as to propose practical improvement measures and technological transformation plans.

## 2. The content of the energy audit

Energy audit refers to the inspection, verification, analysis and evaluation of the physical processes and financial processes of energy use in the enterprise by energy audit units in accordance with relevant national energy-saving regulations. It is an effective method to strengthen energy science management and energy conservation in enterprises. According to the purpose and requirements of the energy audit, the audit unit may select some or all of the following contents to conduct energy audit work: an overview of the energy management in the enterprise; an overview of the energy utilization status and the energy flow in the enterprise; the energy measurement and statistical status in the enterprise; calculation and analysis of enterprise energy consumption indicators; calculation and analysis of energy equipment operating efficiency in the enterprise; calculation and analysis of the integrated energy consumption and output energy consumption index of products in the enterprise; calculation and analysis of energy cost indicators in the enterprise; calculation of energy savings; review of financial and economic analysis of energy-saving technical measures. Besides, there are still many other contents that need to be considered.



### 3. The type of the energy audit

As an approach to strengthening enterprise energy science management and energy conservation, energy audit can be divided into three types: preliminary energy audit, comprehensive energy audit, and special energy audit.

#### 3.1. Preliminary energy audit

The targets for conducting preliminary energy audit are generally relatively simple. The preliminary energy audit requires the general survey of energy utilization status through an understanding of the site and historical statistics. It takes a relatively short time for enterprises to conduct the preliminary energy audit. For one thing, the preliminary energy audit can find obvious energy saving potential and the simple measures to improve energy efficiency in a short period. For another thing, the preliminary energy audit can lay the foundation for the comprehensive energy audit.

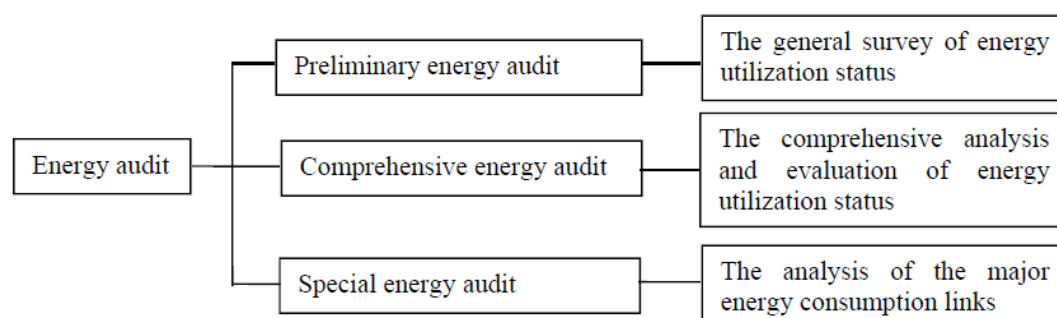
#### 3.2. Comprehensive energy audit

A detailed energy audit is required for a comprehensive analysis and evaluation of the energy system. For one thing, the comprehensive energy audit requires the more robust metering facilities before the full audit so as to fully collect energy usage data from enterprises utilization data. For another thing, the comprehensive energy audit requires to test the energy-using equipment in order to supplement the important data that lacks measurement. Besides, the comprehensive energy audit is supposed to conduct energy-saving analysis on the major energy utilization facilities or energy utilization systems and find feasible energy-saving projects. Then it is required to propose energy-saving technological transformation programs. Finally, it needs to make economic, technical and environmental evaluations of the programs.

#### 3.3. Special energy audit

For the major energy consumption links found in the preliminary audit, the targeted energy audit is called special energy audit. On the basis of the preliminary energy audit, the closed test and audit analysis of the aspect can be further carried out to find out the specific causes of waste. Then the special energy audit requires to propose the specific energy-saving technical transformation projects and measures. Finally, it also needs to make quantitative economic and technical evaluation.

Regardless of the type of energy audit conducted, the energy audit team is required to be composed of personnel familiar with energy-saving legal standards, energy-saving monitoring related knowledge, accounting, economic management and other related knowledge to ensure that the role of energy audit is fully utilized.



**Figure 1.** The type of energy audit

### 4. The basic method of the energy audit

The basic method of enterprise energy audit is to investigate and analyze. It mainly uses on-site inspections, case investigations and inventory checks to conduct the energy audit. If necessary, the on-site test is also required. When conducting energy audit work, it is necessary to find the source of various data in the energy-using enterprise and analyze the accuracy and rationality of statistical measurement.

Besides, it is also important to make energy balance and material balance analysis. And it is also necessary to take a variety of effective means to check and verify the relevant data. Only when the data is completely accurate and reliable can the calculation and analysis of energy consumption indicators and material consumption indicators be carried out. Then it is supposed to find the energy-saving potential and propose reasonable rectification suggestions and measures.

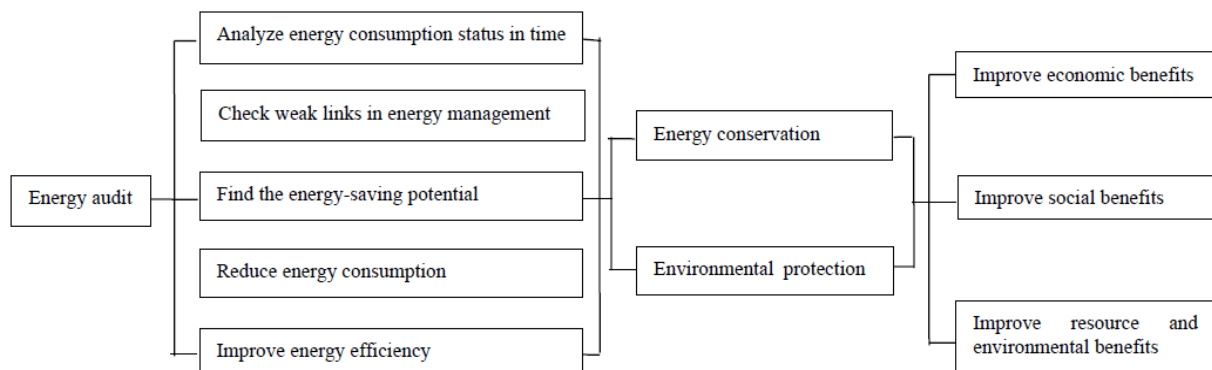
The basis of energy audit is the statistic. The basis of statistics is the measurement. Therefore, the following two aspects should be noted in the energy audit process. First of all, the internal organization and production process of the enterprise should be understood. The internal economic responsibility system and the specific implementation of the responsibility system should be clearly recognized. Only in this way can the management status and energy processes of the enterprise be understood. Then the next step of energy audit analysis can be better conducted. Second, the measurement and statistical status of the audited enterprise should be understood in detail. In addition to that, the accuracy of the measurement instrument and the true degree of the statistical data should be determined.

### 5. The significance of the energy audit

First, the energy audit is an important way to improve economic and social benefits. It not only helps to achieve the unity of economy, society and environment, but also enhances the market competitiveness of energy-using enterprises. It is the fundamental requirement and final destination for the development of energy-using enterprises. The energy audit enables enterprises to analyze and master the energy management level and energy consumption status in time. Then it is beneficial for the enterprise to check weak links in the energy management and find the energy-saving potential. The essence of energy audit lies in the reduction of energy consumption and the improvement of energy-using efficiency. Energy audit enables the enterprise to achieve economic and social benefits. Besides, it can also achieve the goal of energy saving, consumption reduction and efficiency improvement.

Second, the energy audit is beneficial to strengthen energy management and transform energy conservation management into the standardized and scientific way. The energy audit enables the management of the enterprise to analyse energy utilization status accurately and reasonably so as to guide the daily energy-saving management and supervise energy consumption status in the enterprise. For one thing, it can ensure the rational allocation of energy and improve the energy efficiency. For another thing, it is beneficial to protect the environment and promote sustainable economic development.

Finally, the energy audit is conducive to promoting the energy management. Energy management is an important and complex task for the energy-using enterprise. It requires a lot of manpower, material resources and financial resources. However, the energy audit can accurately reflect the energy measurement statistics status in the energy-using enterprise and ensure that the energy-using enterprise takes measures efficiently. Therefore, the enterprise can use the appropriate energy management system to reduce manual management workload and management costs.



**Figure 2.** The structural framework of energy audit

## 6. Suggestions

### 6.1. *Improve the energy management system*

A sound energy management system should have the following functions. For one thing, it must ensure the supply of energy needed for production safely and stably. For another thing, it should discover and correct the abnormal energy consumption promptly. In the specific energy audit work, enterprises should pay attention to the completeness of energy management policies and objectives, the effectiveness of energy management implementation and the effectiveness of management responsibilities so as to help enterprises to understand the operation of the energy management system more clearly and improve the energy management system. Through comprehensive analysis of the overall energy management, energy utilization status and energy efficiency of the enterprise, the energy-using enterprise can analyze and master the energy management level and energy consumption status promptly. Then the enterprise can find problems and weaknesses in the energy management and propose the related measures to tap the energy-saving potential.

### 6.2. *Strengthen enterprise understanding and improve the basic work of energy audit*

Enterprises should take into account the importance of energy audit when formulating their business strategies. For one thing, enterprises need to fully understand the positive significance of energy audit and improve energy management institutions. For another thing, it is necessary to combine the energy audit work with the energy-saving work so as to reduce consumption in all aspects and achieve process optimization. Besides, enterprises are supposed to attach importance to the positive significance of energy audit strategically. The enterprise management should be fully aware that competition among enterprises should not only be based on the economic benefit, but also should consider social responsibility, energy consumption reduction and environment protection. Enterprises can combine energy audit with financial revenue and expenditure audit. More specifically, enterprises can increase cost and expense indicators, income indicators and profit change indicators so as to review the input and output of enterprise energy funds, analyze the effect of energy funds and make the use of funds is more reasonable and effective. At the same time, it is also necessary to strengthen and improve the energy measurement system and the basic work of energy statistics. Finally, enterprises are supposed to strengthen data quality control. By strengthening data matching relationship review and using data from relevant departments, the enterprise can evaluate and analyze the energy consumption data. Therefore, enterprises should combine data quality control with energy conservation management so that enterprises enable the energy audit to play an important role in the enterprise cost management.

### 6.3. *Improve the training of professional energy auditors*

Enterprise energy audit work is not only a complicated task, but also a technical work. For one thing, enterprise energy audit requires auditors to master various standards and methods of statistics, testing and analysis. For another thing, auditors are supposed to calculate various energy consumption indicators according to the relevant data of enterprise energy input and output. Then auditors need to analyze energy utilization status of the enterprise according to these indicators and make reasonable suggestions to achieve energy conservation. Therefore, it is necessary to strengthen the construction of enterprise energy audit institutions and improve the training of personnel involved in energy audit work. These are important guarantees for enterprises to carry out energy audit work. Therefore, it is necessary to cultivate professionals in the field of the energy audit. At the same time, it is also necessary to improve the knowledge structure of auditors in order to meet the needs of energy audit for talent quality.

## 7. Conclusion

The energy audit has a lot of effects. For one thing, it is beneficial for enterprises to have a more comprehensive understanding of their energy management level and energy utilization status so as to lay the foundation for effective energy conservation and emission reduction work. For another thing, it is also beneficial to improve energy-saving measures and provide a basis for energy consumption

assessment. Therefore, enterprises should pay attention to the importance of energy audit and improve the energy management system so as to lay the foundation for the sustainable development.

### References

- [1] Abdelaziz E A, Saidur R, Mekhilef S. A review on energy saving strategies in industrial sector [J]. *Renewable & Sustainable Energy Reviews*, 2011, 15 (1): 150 - 168.
- [2] Chen X H, Zhang Z, Xing X J. Research on Implementation Framework of Sustainable Energy Auditing in China [J]. *East China Economic Management*, 2012, 26 (06): 65 - 68.
- [3] Dongellini M, Marinosci C, Morini G L. Energy Audit of an Industrial Site: A Case Study [J]. *Energy Procedia*, 2014, 45: 424 - 433.
- [4] Li H T, Li X M. Energy Management and Corporate Energy Audit [J]. *Technology Economics*, 2000 (12): 37 - 39.
- [5] Ma H T, Huang Y, Cai J H, Ma J, Song X D, Liang P. The effect of energy audits on improving energy efficiency [J]. *Energy Conservation*, 2013, 32 (01): 4 - 6
- [6] Shi G M, An Y L, Zhao Y. Application of enterprise energy audit [J]. *Energy Research and Information*, 2008 (03): 136 - 141.