IMPROVING THE PROCEDURE OF ENVIRONMENTAL AUDIT AT TRADITIONAL ENERGY ENTERPRISES

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ABSTRACT

The environmental impact of the energy sector demonstrates an upward trend in the last decades due to growing demand for energy around the world. Increasing the share of renewable energy in the structure of global energy production and avoiding the use of organic fuels are the main directions of greening the sector in the upcoming decades which corresponds to the sustainable development goals. However, despite the wide range of measures taken at various levels, the volume of fossil fuel consumption by energy facilities remains substantial and energy-related emissions of greenhouse gases into the atmosphere are only increasing, which leads to irreversible environmental consequences. Taking into account the fact that traditional energy facilities continue to prevail in the structure of the global energy sector, it is necessary to introduce green approaches to their management and efficiency assessment. Environmental audit is an important component of efficiency evaluation of an enterprise activity, which enables to assess how correctly and reliably data on environmental impact were collected and analysed and, consequently, to determine the value and objectivity of the results obtained. Currently there is a lack of unified approach adapted to the energy specifics of environmental audit and environmental reporting. The purpose of the study is to provide a list of recommendations on improving the environmental audit procedure for traditional energy facilities. The recommendations for environmental audit presented in international standards have been analysed. The key tasks and requirements for environmental audit at energy enterprises have been identified, considering the specifics of their impact on the environment.

Keywords: traditional energy, environmental audit, sustainable development, power sector, environmental impact assessment, energy enterprise.

1 INTRODUCTION

Environmental audit is one of the organisational and managerial tools for assessing the compliance of an enterprise's activities with current environmental legislation and compliance of its production and technical processes with state and international regulations and standards [1]. Regular environmental audits allow to timely identify facts and causes of violations of environmental legislation, identify weaknesses in current environmental activities and prevent the imposition of environmental fines on the enterprise.

Due to the growing negative environmental impact around the world, the observed climate changes and the deterioration of natural environments, the current pace of tightening environmental legislation will continue, remaining the most effective tool to stimulate the greening of industry [2]–[4]. Fig. 1 shows the dynamics of changes in the Environmental Policy Stringency Index of the 10 largest economies in the world in 2024 according to the International Monetary Fund [5].

The index has been steadily growing for 30 years: the index value has increased by 3.5 times in Canada, 3.4 times in India, 2.4 times in France, the country with the highest index, and 4.3 times in Brazil. It should be noted that despite the considerable growth, Brazil demonstrates the lowest index value among the countries under consideration. China shows the largest growth in the index: from 0 in 1990 to 3.14 in 2020.

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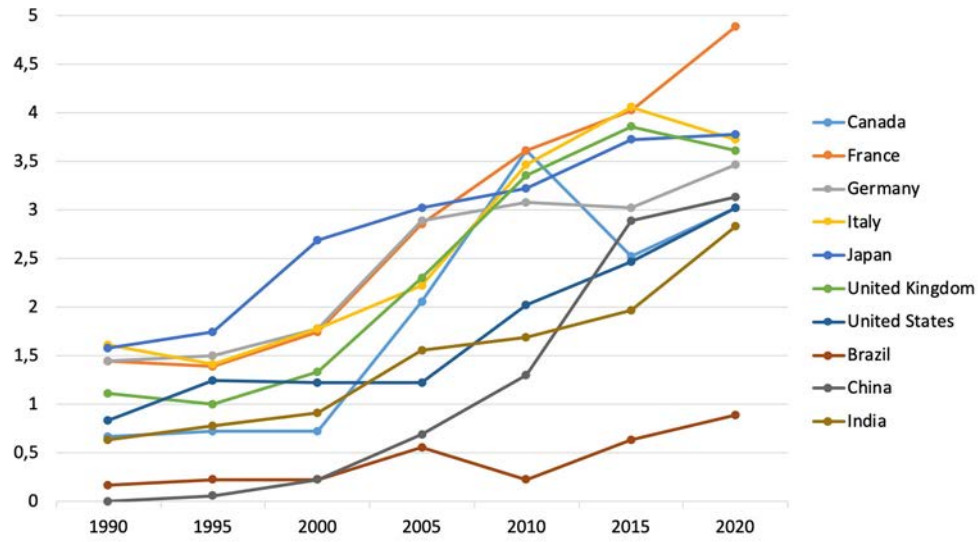

Figure 1: Environmental Policy Stringency Index of the top 10 largest economies in the world from 2000 to 2020. *(Source: Made by the authors using data from the OECD [6].)*

The measures taken by the world community to decarbonise the economy, to mitigate the environmental pollution, to slow the climate change and to abandon fossil fuels for energy production demonstrate low efficiency, despite the steady tightening of environmental legislation [7]–[9]. According to the statistical data for 2023, energy-related CO_2 emissions reached the point of 37.2 Gt CO_2, which is a record value in the entire history [10]. Environmental audit could become the most effective tool for monitoring environmental activities both from the point of view of business and from the point of view of the state.

Environmental audit, according to the definition given by the European Environment Agency (EEA) is 'a management tool comprising a systematic, documented, periodic and objective evaluation of how well a project, organisation or equipment is performing with the aim of helping to safeguard the environment. The audit should facilitate management control of environmental practices and assess compliance with policy objectives and regulatory requirements' [11]. There are four main stages of environmental audit [12], [13]:

1. Survey or preliminary review: Collecting information, setting key objectives and planning the audit procedure.
2. Fieldwork: Meeting with the company's management and employees involved in environmental activities, conducting an audit, holding final meetings.
3. Audit report: Preparation of a report on inconsistencies, problematic areas of environmental protection activity, preparation of an audit report and recommendations.
4. Follow-up review: Identification and coordination of suggested actions for improvements with the company's management, their implementation and conduction a secondary audit.

Environmental audit is an external managerial tool: it should be conducted by the independent external expert. Lewis [14] came to the conclusion that government

environmental audits (GEAs) motivate local authorities to develop and implement practices in the field of sustainable development and environmental protection, and local businesses to reduce the negative impact on the environment by improving the efficiency of environmental protection activities. A large-scale auditing system reform was carried out in China, as a result of which GEA made it possible to achieve a significant reduction in the negative impact of industry on the environment through the implementation of effective control over high-polluting enterprises and local governments [15]–[17]. In addition, conducting national environmental audits can have a beneficial effect on regional energy efficiency indicators [18].

Environmental audit at the level of an individual enterprise can be characterised as one of the key tools for external control over the effectiveness of the environmental management system (EMS) [19]. It allows not only to independently assess the effectiveness of current environmental protection activities, but also, depending on the results obtained, to adjust environmental protection activities and review production processes from the point of view of environmental impact [20], [21] and reduce the amount of potential environmental payments for non-compliance with current environmental legislation [22]. All this, on the one hand, together increases the effectiveness of environmental and economic risk management in the long term, on the other hand, it allows to reduce the negative impact on the environment at the regional level.

Despite the obvious advantages of this management tool of environmental control for business and government, the procedure is not mandatory in many countries of the world and is of a recommendatory nature. In the future this optionality may reduce the overall effectiveness of national environmental policies and initiatives in the field of environmental protection and climate conservation.

Moreover, the procedure is poorly regulated and the quality of its results depends on a large list of factors, including the inability to collect and analyse the data necessary for its implementation, the presence or absence of the necessary competencies of the auditor, the subjective nature of the auditor's assessment, the lack of auditor's qualification and experience, the reluctance of management to conduct an environmental audit, etc. [23], [24].

There are three main types of environmental audit: compliance audit, management system audit and performance audit. In some cases, more than one type of audit is used, depending on the requirements of the government, investors or top management of the company. One of the most common standards for environmental auditing is ISO 19011:2018 'Guidelines for auditing management system' (formerly ISO 19011:2022 'Guidelines for quality and/or environmental management systems auditing') [25]. It should be noted that enterprises certified according to ISO 14001 are required to conduct regular environmental audits and meet a number of requirements for extending the validity of certification [26].

Thus, in addition to establishing the mandatory nature of environmental audit at the legislative level for industries that are the largest environmental pollutants, it is necessary to develop common standards and requirements for its implementation and to adapt monitoring and assessment tools for various sectors of the economy. The latter will allow taking into account the specifics of the negative impact of a particular industry on the environment, as well as the role and features of its functioning within the national economy.

For example, the energy industry has a large list of administrative, technical, industrial, economic and environmental features that must be taken into account by the auditor. Given the significant contribution of the sector to environmental pollution and climate change, the tightening of environmental legislation, the need to achieve Sustainable Development Goals (SDGs) and implement the principles of circular economy, the approaches and tools used by auditors for assessment should also be adapted to the energy industry, in particular to

traditional energy facilities using natural energy sources as fuel for heat and electricity production [27]–[30]. A review and analysis of foreign and scientific literature has demonstrated the lack of a unified approach adapted to the energy specifics of environmental audit and environmental reporting.

The purpose of the study is to provide the list of recommendations on improving the environmental audit procedure for traditional energy facilities. The authors analysed the features of the energy sector and its impact on the environment, studied the components of the environmental audit procedure, the specifics and complexity of its implementation. Based on the data obtained, an environmental audit concept was drawn up for traditional energy facilities and recommendations for its implementation were given.

2 MATERIALS AND METHODS

The study was conducted using theoretical (concretisation, generalisation, comparison) and empirical research methods (literature review, study of regulatory documents and statistical reports) and included four main stages:

1. Literature review on the topic of the environmental audit.
2. Determining the need to improve and adapt the environmental audit procedure for the energy sector.
3. Formation of a list of energy specifics that should be considered within the framework of the environmental audit procedure. Defining audit objectives for the energy sector.
4. Development of the concept of environmental audit for traditional energy facilities. Drawing up a list of recommendations for its implementation.

3 RESULTS AND DISCUSSION

The energy sector is a system-forming branch of the global economy that has several features which should be considered while conducting the procedure of the environmental audit, namely [31]–[37]:

- high capital intensity;
- long payback periods of investments;
- high degree of legal regulation of the industry;
- significant state presence in the industry (in some countries, the entire industry may be 100% owned and controlled by the government);
- strong dependence on the energy markets conditions and geopolitical situation (especially important for conventional energy facilities);
- complex production infrastructure and high depreciation of fixed assets (including moral depreciation);
- high level of environmental impact (especially important for conventional energy facilities);
- considerable use of natural resources for energy production and, as a consequence, their depletion (especially important for conventional energy facilities);
- need for strict compliance with current environmental legislation;
- significant role of the energy sector in achieving SDGs;
- strong technological dependence of the functioning and efficient operation of all sectors of the country's economy on the uninterrupted and complete satisfaction of their energy needs.

Based on the above-mentioned features, the tasks of environmental audit of traditional energy facilities include:

1. Determining priorities in planning environmental activities of an energy enterprise. Substantiation of the current environmental policy, if necessary, provision of recommendations for its adjustment of the existing environmental policy.
2. Verification of compliance with environmental legislation at the regional, national and international levels (relevant for large energy enterprises).
3. Collecting and obtaining reliable information about the environmental protection activities of the energy facility and its impact on the environment.
4. Implementation of a full-fledged environmental performance audit to assess the dynamics of changes in the negative impact of an energy enterprise on the environment and the resource efficiency of production and organisational processes.
5. Assessment of the compliance of current environmental protection activities with the goals and priorities of the national energy and environmental policy, sustainable development goals.
6. Timely identification of violations of environmental legislation, revealing of weaknesses in current environmental protection activities and prevention of fines imposed on the enterprise.

Fig. 2 shows the proposed concept of environmental audit for traditional energy enterprises. The proposed concept involves auditing both large enterprises and small and medium-sized enterprises: solid elements are highlighted that are mandatory for all energy facilities, regardless of their size, dotted elements are highlighted that must necessarily be evaluated only at large energy enterprises. This division is due to the fact that small and medium-sized enterprises often do not have sufficient labour, financial and technical resources to evaluate certain aspects of their activities. For example, a small regional energy facility using natural gas as the main fuel does not generate a significant amount of production and consumption waste, requiring the introduction of waste management practices, the establishment of appropriate processes and their subsequent assessment. In addition, small regional energy facilities do not have an urgent need to implement a full-fledged EMS audit or carry out certification according to ISO 14001 due to the relatively small volume of heat and electricity production, the lack of an extensive management apparatus and the lack of required resources.

The situation is similar with environmental reporting: currently, the preparation of a public report on the results of environmental activities is more of an image and investment tool used by large industrial enterprises. Small and medium-sized businesses are either not interested in preparing and publishing reports, or do not have enough financial and labour resources. Therefore, when conducting an environmental audit of small and medium-sized energy facilities, the absence of an environmental report is allowed.

The proposed concept of environmental audit forms a certain set of requirements for the auditor:

- knowledge and professional competencies in the field of energy;
- familiarity with the current national energy and environmental policy, initiatives of the world community to reduce the anthropogenic impact of the sector;
- taking into account the general condition of the energy infrastructure at the regional level when assessing the degree of equipment depreciation and environmental treatment technologies used;

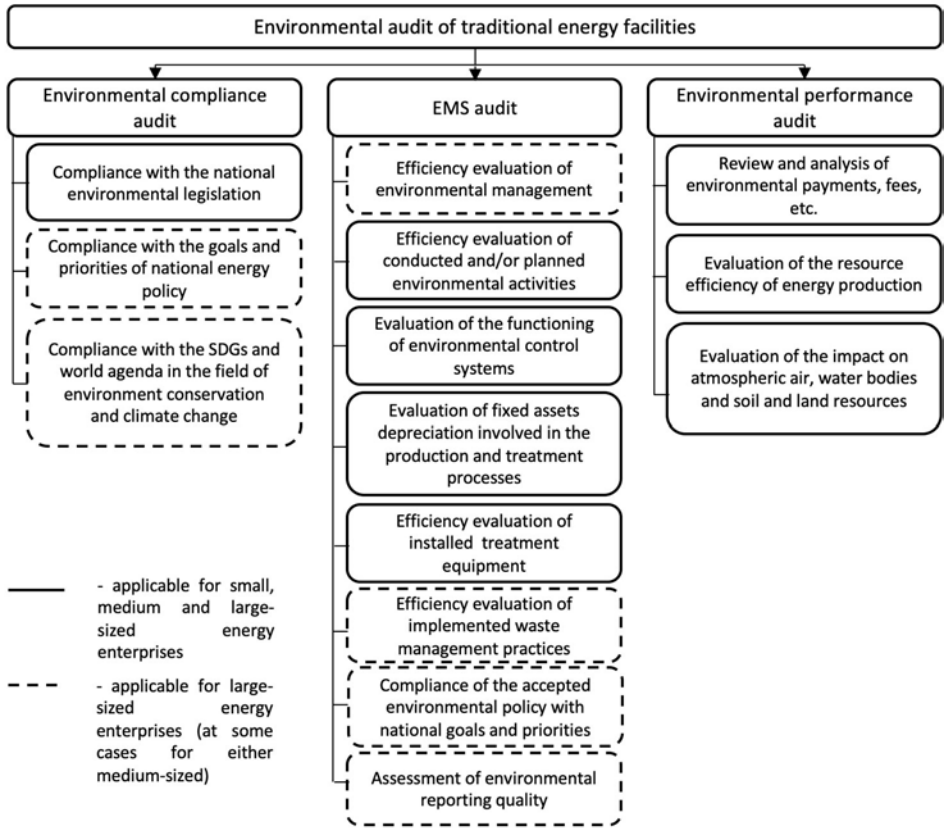

Figure 2: The concept of environmental audit for traditional energy enterprises.

- adequate assessment of the possibilities of replacing and updating fixed assets, taking into account financial, technological and geopolitical aspects;
- consideration of the industry specifics of energy, its role in ensuring the normal functioning and development of society;
- taking into account the specifics of the negative impact of the industry on the environment (for instance, gas and coal-fired power facilities have different levels and directions of impact on natural areas).

From the point of view of the energy facility, the key requirement is the provision of all necessary and reliable data for conducting an audit (in particular, EMS audit and environmental performance audit) and active interaction of the company's management and personnel with auditors.

Based on the results of the study, recommendations were also developed for conducting an environmental audit at traditional energy enterprises:

1. Mandatory assessment of the compliance of the energy facility's activities not only with current energy legislation, but also with key priorities and goals of the national energy and environmental policy.

2. In-depth independent assessment of the impact of an energy facility on natural environments (atmospheric air, water resources, soil and land resources) using a unified methodological toolkit. Assessment of resource and energy efficiencies of production.
3. Mandatory inspection of production and environmental protection equipment with the involvement of external technical specialists, assessment of its compliance with current standards and regulations. Assessment of equipment wear and analysis of the prospects for its renewal, taking into account environmental factors.
4. The auditor or the audit team must have knowledge and professional competencies in the field of energy.
5. The environmental audit procedure for small and medium-sized energy facilities can be shortened and include only environmental performance audit and compliance with the national environmental legislation. An audit of large energy facilities should include all the steps outlined in Fig. 2.
6. Assessment of the effectiveness of management in the field of environmental protection should be carried out regardless of the availability of EMS or ISO 14001:2015 certification.

The importance of consolidating the need for regular environmental audits of energy enterprises at the legislative level should be noted. China's experience has shown that mandatory inspections of polluting enterprises by external independent specialists stimulate management to implement more effective environmental practices and, as a result, reduce anthropogenic impact [15]–[17].

4 CONCLUSIONS

In order to achieve goals, set by international and local community in the field of environmental protection and climate change, it is necessary to develop unified methodological recommendations for the environmental audit procedure and adapt them to industry specifics. Based on the results of the study, the concept of environmental audit for energy enterprises was presented, requirements for the auditor were formed, and recommendations for conducting an environmental audit were proposed.

The results obtained can become the basis for the development of a full-fledged framework of environmental auditing and requirements for environmental reporting. As part of the continuation of the research work, it is planned to:

1. adapt tasks and activities within each stage of the audit to the specifics of the functioning of energy enterprises;
2. develop a unified standard for conducting environmental audits at energy enterprises, which will consider the specifics of their anthropogenic impact and the production of heat and electricity;
3. develop unified recommendations for the preparation of environmental reporting in compliance with the principle of accessibility and clarity of the results obtained for all stakeholders, including the public;
4. draw up a list of mandatory environmental indicators that will be calculated during the environmental audit.

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