Features of the formation of environmental protection mechanisms during the operation of objects of the electric power complex

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Abstract. Based on the analysis of the methods of greenhouse gas stations used for environmental pollution, their systematization into a single mechanism for ensuring environmental safety at various levels is presented: from the state level to the technological system. The content of the constructed mechanism for substantiating the need for the interdependent functioning of its elements. The peculiarity of the proposed mechanism is that it contains elements that ensure the safety of the environment, guaranteeing the means and methods of implementing environmental protection issues.

1. Introduction

The topic of environmental safety and environmental protection in connection with the operation of energy facilities is in demand and is widely discussed, since these facilities, already by their very existence, are a source of increased danger to the environment. This is primarily due to the problem of greenhouse gas emissions, "… which is most relevant for companies in the fuel and energy complex" [1].

The problem of environmental pollution in connection with the functioning of energy facilities in the long term may become decisive for the existence of future generations. Therefore, the increased concern about it at the level of an independent direction of state policy is quite understandable and natural. "... Significant restraint of the growth of greenhouse gas emissions and the reduction by organizations of the fuel and energy complex of harmful emissions into the environment" is considered an important consequence of the energy conservation policy in the Energy Strategy of the Russian Federation for the period up to 2035 [2]. In science, it is proposed to solve the existing problem, in particular, by rejecting the use of outdated equipment, development and implementation of innovative technologies in the field of energy production [3].

The attention of scientists and politicians, in the light of its solution, is riveted to the digital transformation and intellectualization of the fuel and energy complex, which is also provided for in the Energy Strategy of the Russian Federation for the period up to 2035 as significant characteristics of the chosen course of development.

"The more the public sees the environment as a priority policy issue, the more likely it is that corresponding policies will be implemented" [4].
Studies have shown that "… if individuals perceive a policy instrument as fair, they are more likely to support that policy instrument" [5]. It is no coincidence that environmental disasters are called a potential engine of public opinion related to the environment [4].

"At the same time, in order to switch to new conditions for the functioning of the industry, it is necessary to form new subsystems to ensure the implementation of digital and intelligent networks in the electric power complex, which, in the future, should provide economic, environmental, social and technological effect for the national economy" [6].

In this connection, the transition to new conditions for the functioning of the entire energy system (extensive modernization) is complicated by the need to achieve a balance of economic benefits and environmental safety.

It is proposed to solve the problem of reducing harmful emissions into the environment proceeding from the fact that "… the electric power complex is currently not only a branch of the national economy, but also a system forming element of the national economy" [3]. Therefore, economically profitable energy facilities continue to remain in demand, despite their potential danger to the environment "… the historically established system for the production of electricity at coal-fired thermal power plants is economically beneficial; however, such power plants have a negative impact on the environment" [3].

In this direction, the researchers identified problems "… among which are the high level of moral and physical deterioration of equipment, a decrease in efficiency and resource saving in the industry, a high proportion the use of obsolete technologies, a low share of the introduction of innovative and advanced technologies in the industry, a high share of the environmental load on the environment and other problems" [7].

2. Materials and methods
The main purpose of the study is to systematize the elements and form a mechanism for environmental protection in connection with the functioning of the electric power system, to identify areas that require enhanced modernization.

The following tasks were formulated:

- To define the elements of the mechanism ensuring environmental safety during the operation of energy facilities;
- To present the elements of the mechanism that guarantee compliance with safety requirements during the operation of power system facilities.

The study of the stated problem was based on an assessment of existing solutions at various levels of organization in the field of energy (political, economic, legal) using modern scientific approaches, as well as the method of comparative, logical, systemic analysis and other methods.

3. Results
In light of the stated problem, the proposals of scientists, developed in the spirit of preventing environmental pollution about "… switching from coal to gas and renewable energy sources, electrification of transport" [1], are quite natural, which, along with "sequestration technologies" [1], are considered in quality of modern emission reduction technologies. However, the solution to this problem is not limited to technological aspects and necessitates a more detailed approach to the prevention of environmental pollution in connection with the activities of energy facilities. Therefore, the method of state stimulation of the reduction of greenhouse gas emissions - carbon pricing, as well as the legal mechanism within the framework of determining the conditions of anthropogenic confrontation to the problem, acquire its own significance. Such an aggregate positioning of means and methods of counteracting further escalation of the problem gives reason to consider them as independent elements of a preventive mechanism, the object of protection of which is environmental safety. New technologies, such as switching from coal to gas and renewable energy sources, allow for
an overall reduction in global emissions, which is one of the main requirements of the Paris Agreement.

However, the understanding of the safety of functioning of energy facilities from the point of view of ecology should not be limited to the transition to new technologies. It should not be forgotten that energy facilities are a priori a source of increased danger, and their operation requires special control over the observance of special safety rules "... the number of accidents has been decreasing in recent years, but their negative consequences are increasing" [8]. At the same time, the reliability of power supply includes "... maintainability, uninterrupted operation, durability and maintainability of the system ..." [8].

In addition, the causes of accidents, in addition to the use of worn out equipment and weather conditions, are "A lot of the reasons of system accidents are coming due to organizational work. The situation is complicated by insufficient qualify" [9]. Therefore, the decrease in the accident rate observed in recent years [10], due to a number of factors, should be considered as one of the significant independent elements gaining positive momentum in the direction of environmental protection.

The mechanism responsible for the safe operation of these facilities must include warranty elements that ensure the safe operation of the relevant facilities. Such protective guaranteeing mechanisms exist and are presented at the state level in the form of imperatives and are of a pronounced preventive nature. Constructions containing responsibility allow the implementation of the stimulating properties of the entire mechanism that ensures the safety of the environment in the area under consideration, a serious attitude in the operation of energy facilities and equipment. Consequently, the aspect of safe operation and the guarantee of its observance should be considered as one of the equally important and relevant elements of the proposed mechanism, along with, for example, the pricing mechanism, since it presupposes not only the protection of the environment as a human habitat, but also directly provides guarantees of the highest values established by the Basic Law of the state - the right to life and health in connection with the operation of energy facilities that serve as a source of increased danger.

The safe functioning of the electric power complex is not only the most important condition for positioning this industry as a component of the state economy, but also provides a favorable environment for the existence and development of future generations.

Safety as a necessary specific property of the power system is realized through a whole complex of interdependent elements, only the combination of which is able to guarantee the preservation of the environment.

The environmental protection mechanism in relation to energy facilities includes the following main components:

- Innovative equipment, which allows, first of all, to reduce harmful emissions into the environment and to implement the provisions contained in the legal mechanisms and regulating the goals to reduce the content of carbon dioxide in the air;
- Safe operation of the relevant equipment at energy facilities;
- Guaranteeing means of compliance with the requirements for safe operation of the energy complex (imperative mechanisms of responsibility).

Thus, the safety of the electric power system, including the implementation of a set of interdependent elements that ensure it at various levels, creating the possibility of stable, continuous development of the electric power economy in the state, is a set of preventive measures in order to prevent negative impact on the environment with high quality and uninterrupted power supply consumers.
4. Discussion
Our proposed model of the safe existence and functioning of the electric power system takes into account both the technological safety of the equipment used at the energy complexes from the point of view of maintaining the ecology, and the factor of accidents, considered as an independent element of the threat to environmental safety.

In a broad sense, the mechanism for the safe operation of the relevant facilities cannot be limited only to harm to the environment, but must include the safe existence of people, without endangering their highest values of the right to life and health, guaranteed by the fundamental law of the state. This is directly related to compliance with safety requirements and rules at energy facilities. In the light of the above, special attention should be paid to the mechanisms that guarantee the exact implementation of the requirements of the legal and regulatory framework.

The procedure for the operation of such facilities is under special state protection, due to the nature and level of public danger of possible consequences both for the environment and for the population, therefore, this factor must be taken into account when developing a mechanism for the safe functioning of the entire energy system.

At the same time, the elements of this mechanism should not abstractly exist independently of each other, but constantly dynamically interact, ensuring the management of factors that influence the state of the environment in the implementation of preventive measures.

5. Conclusion
As a result of the study, dedicated to the peculiarities of the formation of the mechanism of environmental protection during the operation of energy facilities, it was found that the mechanism for ensuring environmental safety, aimed at reducing greenhouse gas emissions, should include the following elements:

- Provision of the energy system with modern technologies (switching from coal to gas), which create the technical possibility of reducing emissions, which is one of the main conditions for the implementation of the environmental protection mechanism;
- Widespread use of sequestration technology aimed at absorbing and reducing carbon content in the atmosphere;
- Public policy, the elements of which are a carbon pricing mechanism as the main method of government incentives for emission reductions and a legal mechanism that regulates targets for reducing carbon dioxide in the air;
- A set of measures aimed at reducing accidents as an independent factor of environmental pollution in connection with the operation of energy facilities, including ensuring safety requirements and rules at energy facilities by means of guaranteeing mechanisms, that is, legal structures that stimulate compliance with the stated requirements.

The presented mechanism is complex and is based on the interdependent functioning of the constituent elements, including specific guaranteeing features. Its application is not limited to the territorial boundaries of one state, in connection with which it can be equally promisingly implemented in order to reduce the level of greenhouse gas emissions and preserve the environment.

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