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Modification of the Methodology for Calculating Tariffs of Natural Monopolies to Counter the Threat to Economic Security

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ABSTRACT
The result of state regulation of the activities of natural monopoly entities is the established tariffs, the values of which are often challenged by enterprises in courts, since the costs included in the tariff, in their opinion, are economically unjustified. In this regard, the purpose of this study is to modify (develop) the methodology for calculating tariffs of natural monopolies, and as a result, to ensure economic security, based on preventing the implementation of the threat associated with further negative consequences for enterprises, for example, non-fulfillment of production programs of monopolies due to lack of funds. To achieve this goal, the paper uses the method of case analysis and benchmarking, as well as methods of economically justified costs and tariff indexation used in the areas of heat supply, water supply and sanitation. The information base consists of rulings of the Supreme Court of the Russian Federation, the analysis of which revealed controversial issues and problems that arise when setting tariffs. Based on the results of the study, a graphical model of the methodology for setting tariffs for natural monopolies has been developed, which will counteract the threat of lossesand welfare of resource-supplying companies and ensure their economic security.
Key words: *economic security, threat, natural monopoly, tariff, commodity markets, infrastructure.*

INTRODUCTION

One of the goals of the Economic Security Strategy of the Russian Federation for the period up to 2030 is to increase the level and improve the quality of life of the population. However, on the one hand, the achievement of this goal is hindered by the challenges and threats identified in the Strategy, including, for example, insufficiently effective public administration and increasing differentiation of the population by income level, on the other hand, inflation and rising prices (tariffs). In this regard, today it is relevant to consider the processes taking place in the basic industries – the spheres of operation of natural monopolies. Natural monopolies are a state in the market in which market mechanisms, such as competition, become ineffective and are replaced by mechanisms of state regulation. At the same time, as we can see in these basic areas, on the one hand, there are constant disputes between regulators and resource supply companies about the size of tariffs, on the other hand, monopolists go bankrupt, and their infrastructure has long been in need of modernization, which has predetermined a new state program with investments of 4.5 trillion rubles. In this regard, the purpose of this article is to modify (develop) the methodology for calculating tariffs of resource-supplying organizations, for example, in the areas of heat supply, water supply and sanitation, to ensure their economic security by countering threats that arise in the commodity markets of these basic industries. The implementation of this goal will contribute to the achievement of the previously introduced concept of "fair tariff", which should be understood as a tariff based on the balance of interests of the state, economic entities (resource supply companies) and consumers. It is economically justified and provides an increase in energy efficiency.

The existence of problems in the tariff regulation of natural monopolies is associated with one of the market failures – the asymmetry of information when setting tariffs. When one party to a contract has access to information and the other party is provided with a limited amount of it, there is a problem of unfavorable selection. Armstrong M., Sappington D. E. M. tried to solve these regulatory problems due to the presence of hidden information Sappington D. E.M.[2]. In this regard, the state is constantly looking for a more effective regulatory model, reforming the sphere of activity of natural monopoly entities. At the same time, scientists suggest various areas for improving this area. For example, Y. M. Shvyryaev's dissertation focuses on achieving a balance of interests in tariff regulation, taking into account the interests of investors, consumers and the state. Baron D., Myerson R. propose to subsidize the activities of economic entities that are in a state of natural monopolies, depending on their useful supply of resources [3].

E. A. Ponomareva touches upon the importance of state regulation of tariffs for natural monopoly entities in her scientific workПономарёва. The main conclusion of the author is that a 10% increase in tariffs increases production costs in industry and leads to a 2% increase in prices in the corresponding industries.
The analysis of state regulation of monopolies in heat supply and tariff policy is also carried out in the work of E. V. Kulagina. The author considers the issues of inefficiency of the tariff formation model and existing problems in this area: the need to modernize equipment, lack of funding for the heat supply sector and, as a result, social tension.
Investigating tariff formation in the district heating sector of European countries Delgado A., Charles M. M., Evans M., Kholod N., Kuznetsov A., Pinchuk S. & Kutsman V. come to the conclusion that the state should develop a clear policy with a single set of rules for setting and approving tariffs by the regulator [5]. One cannot disagree with the authors, since effective implementation of the policy will promote investment and systemic innovation in the heat supply sector.
The study of Ziemele J., Vigants G., Vitolins V., Blumberga D. is of interest. & Veidenbergs I., who developed a method of multi-criteria analysis for setting tariff guidelines, tested on the example of Latvian tariffs [12].
Djørup S., Sperling K., Nielsen S., Østergaard P. A., Zinck Thellufsen J., Sorknæs P. & Drysdale D. the algorithm of research and reform of the tariff scheme of heat supply on the example ОльборгаofAalborgis highlighted: determination of the optimal level of heat savingin the current tariff structure, analysis of the impact of changes in tariff policy on financial incentives to save heat, and analysis of reactions against fluctuations in the capital markets of the current and alternative tariff systems [7].
Special attention in foreign studies is paid to the search for the optimal water supply tariff. Caravaggio A., De Cesare L. & Di Liddo A., investigating two types of water supply tariffs (linear and increasing/decreasing block), come to the conclusion that the first one is preferable, while in the practice of tariff regulation of countries there are both the first (Denmark, Germany, Great Britain) and the second options (Italy, Japan, Spain), as well as a combination of them (Australia, Canada, USA) [4].
Macchiaroli M., Dolores L. & De Mare G. offers a mathematical model (non-linear function) that can minimize the difference between tariffs before and after the implementation of ARERA Resolution 665/2017/R/idr (TICSI-Integrated Text on Water Service Tariffs). The model is based on the binomial structure of the tariff-the division of the tariff into a fixed part (QF), which does not depend on consumption, and a variable part (QV), proportional to consumption [7].
The need to take into account in the tariff regulation of water supply the availability of payment for this service by the population with low incomes was studied by Xenarios S., Edwards E. Y. & Buurman J. [11]. The possibility of establishing a special social tariff for this category of citizens is also considered by Amorim D., Resende M. & Miranda R. J. S. [1].
I. I. Drobysh in his scientific work to improve the efficiency of natural monopolies suggests conducting pilot studies of their production efficiency using benchmarking. K. A. Kudryavtsev, one of the authors of this articleбенчмаркинга, also used the benchmarking method repeatedly to find the most effective tools for improving the regulation of natural monopolies. The scientists proposed a new model of tariff regulation of natural monopolies, taking into account the choice of consumers, based on the need to use the developed new menus of contracts for consumers, in order to achieve a balance of interests between the subjects involved in regulation. The model changes the idea of the tariff regulation process. If earlier the concept of tariff regulation was based on the relationship between regulators and natural monopolies when setting tariffs and the consumer accepted the results of regulation, then taking into account the new menu of contracts, consumers are included in the process of influencing the size of tariffs. This will contribute to achieving a balance of relations and economic security of regulatory entities.
В работе Magnus Gammelgard and Mats BO Larsson review the introduction of a new model for regulating natural monopolies in Sweden. The authors emphasize the importance of creating conditions that are as close as possible to a competitive market, despite the presence of natural monopolies. They emphasize that the new regulatory approach is aimed at ensuring efficient operation of distribution companies and creating incentives to improve their reliability and reduce costs. In particular, a model for evaluating the performance of companies based on external data and general assumptions about the performance of all companies is described.
Special attention is paid to tariff regulation, which plays a key role in ensuring a fair distribution of income between companies and consumers. The regulator sets tariffs in such a way that the company can cover its operating expenses and make a reasonable profit. This method is often used to regulate the tariffs of

natural monopolies. Companies are also rewarded for improving their efficiency, such as reducing costs or improving the quality of service. The study highlights the importance of introducing new regulatory methods to improve the functioning of the energy sector and protect the interests of consumers [8].
Mulder M. and Woerdman E. They also raise the issue of regulating the activities of natural monopolies. The main focus is on the need for government intervention to prevent monopoly prices and ensure fair pricing, as well as to encourage efficient operations on the part of network operators. Scientists consider the main methods of tariff regulation, such as "costs plus" regulation, marginal price regulation, profit rate regulation, and standard regulation. Each of these methods has its own characteristics and influence on the behavior of operators and end users. For example, when using the "costs plus" regulatory method, tariffs are set based on the company's actual costs plus compensation for the cost of capital. This method provides low motivation for improving efficiency, since the company receives a refund regardless of the level of its expenses. Whereas in the marginal price regulation method, tariffs are fixed and independent of the real costs of companies, creating powerful incentives to reduce costs and increase efficiency [9].
Separately, it is worth noting an attempt to implement the reference cost method in Russia, through the creation of alternative boiler houses (альткотельныхaltkotelny). According to this method, the cost of building a new boiler house, which will cover the entire locality, is calculated and a tariff is formed based on the volume of useful vacation time for all consumers. However, despite the fact that this method is aimed at upgrading infrastructure, it is unlikely to be suitable for producers and citizens and will contribute to ensuring their economic security, since the increase in tariffs will be significant.
Renzhe Xu, Xingxuan Zhang, Peng Cui in their research consider the device of monopoly, as well as regulatory tools for fair personalized pricing. Regulation is carried out using two main methods:differenceand ratio constraintsratio. The first method sets the maximum difference between the highest and lowest tariffs offered to consumers. The goal is to prevent excessive tariff discrimination by keeping tariffs within a certain range. This helps maintain a fair pricing structure, preventing unfair discrimination. The second method regulates the range of tariffs, limiting the ratio between the highest tariff and the lowest. The goals of this method are also to prevent excessive discrimination, but it provides more flexibility in setting tariffs, since it covers a wider scope in the tariff range [10].
However, the above-mentioned studies of the authors do not solve the problem that poses a threat to economic security, which consists in determining the economic justification of the level of costs included in the tariff and their further illegal recognition as economically unjustified and subject to exclusion when regulators form the necessary gross revenue of resource-supplying companies. In this regard, we will continue our research in this direction.
Based on the results of setting tariffs by regulators, disputes arise about the amount of economic justification of the costs included in the tariff. At the same time, due to the interconnectedness of the areas of heat supply, water supply and sanitation, and the proximity of the methods used in them, the disputes are identical.

MATERIALS AND METHODS

The study used normative legal acts regulating the areas of heat supply, water supply and sanitation, as well as rulings of the Supreme Court of the Russian Federation on administrative cases in the field of tariff regulation. Based on the analysis of these materials and expert processing of information, a modification (development) of the methodology for setting tariffs of natural monopolies was carried out to ensure economic security by countering threats that arise in the commodity markets of basic industries.

RESULTS AND DISCUSSION

In the course of this study, the regulatory methods used in regulating tariffs are considered: economically justified costs (expenses) and tariff indexation. It should be noted that the method of indexation of established tariffs is the most frequently used, and when it is used in calculating, for example, operating expenses for the first long-term period of regulation, reference is made to the method of economically justified expenses (expenses), i.e. these two methods are interrelated.
In the sphere of heat supply, tariffs are set for heat energy, heat carrier and hot water. When calculating одноставочногоa single-rate tariff for thermal energy (capacity), the regulator calculates and coordinates the required gross revenue of the regulated organization separately for each i-th billing period of the long-term regulation period.

$$NVBI = OPI + HPI + REI + Ni + \Delta Resi + RPPi$$

OPiORi – operating (controlled) expenses in the first year, thousand rubles.
NRi – uncontrolled expenses in the first year, thousand rubles.
REi – expenses for the purchase of energy resources, cold water and heat carrier in the first year, thousand rubles.
Pi – the regulatory profit established by the regulatory body for the i-th year, thousand rubles.
РезResi – a value that determines the results of the regulated organization's activities before the transition to price (tariff) regulation based on long-term regulatory parameters, thousand rubles.
RPi – estimated business profit, thousand rubles.
The one-time tariff for thermal energy (capacity) for the i-th settlement period of regulation is calculated as the ratio of the required gross revenue (NVBi) to the volume of useful heat output (Qi).

$$\mathrm{Ti} = \frac{\mathrm{NVBi}}{\mathrm{Qi}}$$

The heat carrier tariff is similarly calculated as the ratio of the required gross revenue to the volume of useful output.
The hot water tariff consists of a cold water component and a thermal energy component.

$$\mathrm{Ti} = \frac{\mathrm{NVBi}}{\mathrm{Qi}}$$

Qi – water supply volume, thousand$^{m^3}$.
In the field of cold water supply and sanitation, the regulator calculates and agrees on the required gross revenue (hereinafter referred to as "GW") of the regulated organization separately for each i – th settlement period of regulation of the long-term regulatory period.

$$\mathrm{NVBI} = \mathrm{TRi} + \mathrm{Ai} + \mathrm{PRI} + \mathrm{PR}_{\mathrm{I}}^{\mathrm{th}} + \Delta\mathrm{NVB}_{\mathrm{I}}^{\mathrm{S}}$$

TRi – current expenses of the regulated organization planned for year i, thousand rubles.
Ai – depreciation of fixed assets and intangible assets in year i, thousand rubles;
PRi – standard profit established for year i, thousand rubles.
$\mathrm{PR}_{\mathrm{I}}^{\mathrm{go}}$ – estimated business profit of the guaranteeing organization for year i, thousand rubles;
$\mathrm{HNVB}_{\mathrm{i}}^{\mathrm{C}}$ – the amount of change in the required gross revenue in year i, carried out for smoothing purposes, where i1 is the last year of the long-term regulatory period, i0 is the first year of the long-term regulatory period, thousand rubles.
Current expenses are calculated using the formula below.

$$\mathrm{TRi} = \mathrm{OPi} + \mathrm{REi} + \mathrm{HPi}$$

TPi – current expenses, thousand rubles.
OPi – operating expenses, thousand rubles.
REi – expenses for the purchase of electric energy (capacity), heat energy, fuel, other types of energy resources and cold water, thousand rubles.
HPi – uncontrolled expenses, thousand rubles
The tariff for drinking water (water supply) and sanitation is determined by the formula below.

$$\mathrm{Ti} = \frac{\mathrm{NVBi}}{\mathrm{Qi}}$$

NVBi – the required gross revenue of the regulated organization, calculated for the i-th year, thousand rubles.
Qi – volume of water supply (drainage), thousand$^{m^3}$.
The procedure for calculating the necessary gross revenue and tariffs in the areas of heat supply, water supply and sanitation is similar, in addition, these areas are technologically interconnected, which predetermined the proximity of the methods used in them. In this regard, disputes about the amount of economic justification of the costs included in the tariff are identical.
Based on the above approaches to tariff formation, the model of the methodology for setting economically justified tariffs of natural monopolies will take the following form (Figure 1).

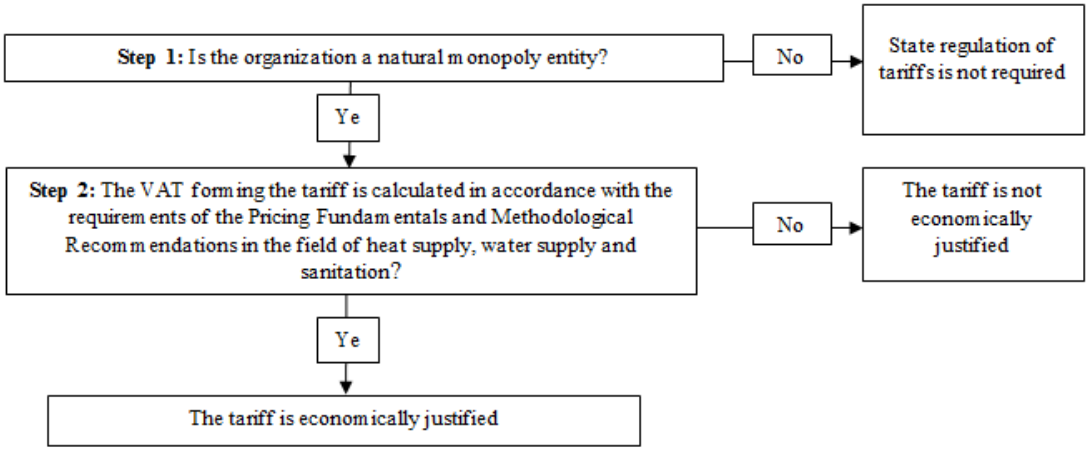

Figure 1. Model of the methodology for setting tariffs for natural monopolies

This methodology does not reflect all the processes that occur when setting tariffs. In this regard, we will modify (develop) the methodology for setting economically justified tariffs of natural monopolies to counter the threat to economic security, using the method of case analysis and benchmarking. As a basis for improving the methodology, we will put the most frequently encountered and discussed in disputes questions about the level of economically justified costs included in the necessary gross revenue when forming tariffs. The results shown in the model methodology (Figure 2) are based on a study of 86 rulings of the Supreme Court of Russia in the field of heat supply and 17 rulings in the field of cold water supply and sanitation, adopted as a result of consideration of disagreements in various regions of Russia.

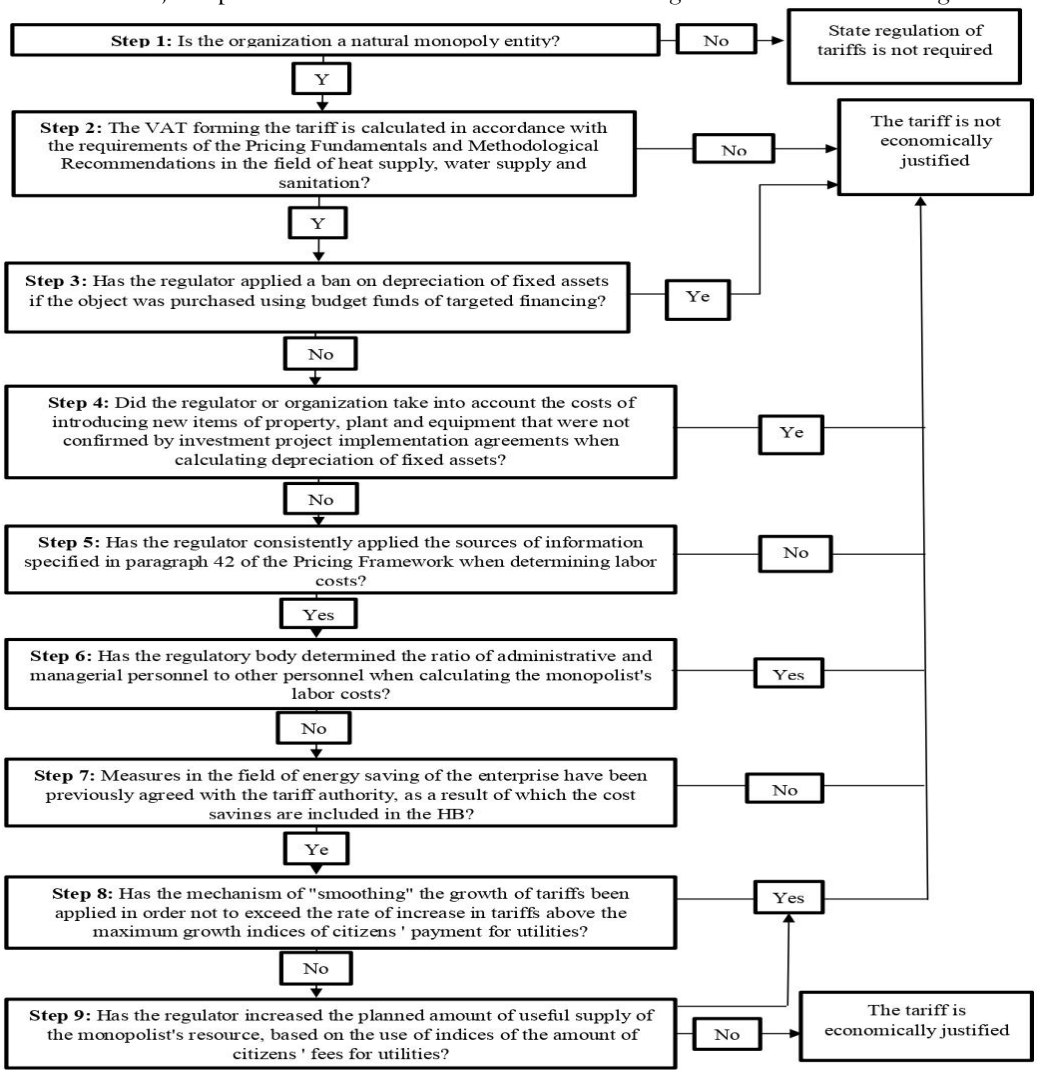

Figure 2. Model of a modified methodology for setting tariffs of natural monopolies to counter the threat to economic security

CONCLUSION

1. The implementation of the threat to economic security, implemented by regulatory bodies to establish economically unjustified (unfair) tariffs, contributes to the fact that natural monopolies do not fulfill production programs, and consumers do not receive quality services (raising the level and improving the quality of life of the population does not occur), respectivelyбазовых отраслей, economic security is not provided in the markets of basic industries, and infrastructure is not it's getting outdated.
2. Attempts by regulators not to go beyond the forecast values of the consumer price index in terms of tariff growth for the next yearresult in legal costs imposed and contribute to the emergence of the threat to economic security discussed above. In this regard, to ensure economic security, the article modifies (develops) the methodology for setting tariffs of natural monopolies, using the example of heat supply, water supply and sanitation markets. The use of the provisions reflected in the proposed model above will contribute to achieving the goal reflected in the Economic Security Strategy, namely, improving the standard of living and improving the quality of life of the population.

Conflict of interest. The authors declare that there is no known conflict of interest associated with this publication.

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