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TRANSFORMATION OF THE ENERGY SECTOR IN CONDITIONS OF DIGITAL ECONOMY

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ABSTRACT

Negative climate change processes on our planet, along with rapid development of macroeconomics, stipulate the necessity of the energy sector transformation. Constant increase in energy consumption due to the growing needs of industry and population, including electric lighting, which according to OECD and IEA is going to increase by 80 % by 2050, accentuates the need to address issues related to energy conservation and energy efficiency on a global scale. At the same time, steady economic growth of any state is closely related to the availability of sufficient electricity volume. Given the current trends in the development of digital economy, which depends entirely on reliable and efficient electricity supply, the transition to low-carbohydrate power systems is a matter of concern for the vast majority of countries interested, on the one hand, in a favourable environment, and on the other hand, in stable and sustained economic growth. The given study is devoted to the interrelationship between improving energy efficiency and solving environmental problems, which, under the national idea of developing digital economy and joining the Paris Agreement on climate, is extremely relevant for Russia.

Keywords: energy saving, energy efficiency of lighting equipment, green economy, digital economy, climate change

1. INTRODUCTION

The purpose of this paper is to study the relationship between energy efficiency improvements, including energy efficiency of lighting equipment, and the need to address environmental problems in the context of the national idea for the development of digital economy and the accession of Russia to the Paris Agreement on Climate Change. To achieve this goal, the following tasks were formulated: to consider the prerequisites that necessitate the transformation of the energy sector; to study major trends in the development of digital economy in Russia and in the world, as well as its impact on energy efficiency; to explore the existence of legal foundations that promote energy saving and energy efficiency in Russia; to study the best experience of foreign countries on energy saving and energy efficiency.

In 2011, the "OECD Green Growth Studies: Energy" was prepared and published by the Organization for Economic Cooperation and Development (OECD) together with the International Energy Agency (IEA), the main aspects of which are devoted to the need to transform the energy sector to preserve the environment and stimulate economic growth [1]. This can be done by reducing the adverse impact on the environment by promoting policies for energy efficiency, introducing low-carbon energy technologies, and eliminating state support in the form of subsidies for fossil fuels. The OECD and the IEA estimate that, given the growth

rate of the world economy, it is expected to increase by at least four times by 2050, which will naturally affect the growth in energy consumption (by 80 %), so that global CO_2 emissions will be also increased (twice). The World Meteorological Organization assumes that an increase in the concentration of carbon dioxide contributes to the aggravation of the greenhouse effect. According to the World Health Organization (WHO) analyst, about 7 million people die every year from diseases caused by environmental pollution, by air pollution in particular, such as cardiovascular diseases, stroke, cancer, respiratory diseases, including asthma and pneumonia [2]. WHO, in 2005, developed an Air quality guidelines, which set thresholds for the level of atmospheric pollution that adversely affect human health. At the same time, in 2016 almost the entire population of the world (91 %) lived on territories where WHO recommendations were not implemented. According to WHO estimates, as for May 2018, 9 out of 10 people breathe constantly contaminated air, in which the concentration of pollutants exceeds all permissible standards [3].

Thus, global economic growth is closely related to the growing demand for electricity, which in turn has a negative impact on the state of the environment and on human health.

2. METHODS

To carry out research and achieve the goal, the author used universal methods of cognition (analysis, synthesis, generalization, induction, deduction), methods of empirical research (scientific research, comparison, description), methods of theoretical knowledge, comparative law method, historical method, formal-logical method.

3. RESULTS

The international community, in the name of recognized international organizations and institutions, is concerned about energy efficiency issues and is doing serious work aimed at studying the emerging architecture of electricity consumption and its impact on the global state of the environment. The International Energy Agency in 2011 prepared a set of 25 recommendations for improving energy efficiency in various areas, including lighting. The identified recommendations, among other things, contribute to reducing CO_2 emissions. In terms of lighting, the IEA proposes to phase out inefficient lighting devices and systems, as well as to ensure the introduction of energy-efficient lighting systems [4].

In 1992, more than 180 states signed the United Nations Framework Convention on Climate Change, which goal is “to stabilize the concentration of greenhouse gases in the atmosphere at the level that would prevent a dangerous anthropogenic impact on the climate system” [5]. In 2015, within the framework of this convention, an agreement on the climate in Paris was adopted (the Paris Agreement) [6]. The purpose of the agreement correlates with the objectives of the United Nations Framework Convention on Climate Change, but it also seeks to “strengthen the global response to the threat of climate change in the context of sustainable development and efforts to eradicate poverty”, also by minimizing the prerequisites for increasing temperature growth and limiting the rate of greenhouse gas emissions. The Russian Federation is also a party of the Paris Agreement that is why it committed itself to reduce greenhouse gas emissions by (25–30) % by 2030.

The Institute for Natural Monopolies Research in 2017 conducted a study “Carbon regulation models – lessons for Russia”, as a result of which experts came to the conclusion that it is necessary to provide incentives to reduce emissions, otherwise, Russia may incur reputational risks associated with non-fulfilment of taken over obligations under the Paris Agreement [7]. The study identified various approaches to current models of greenhouse gas emission regulation in the world: direct payments for emissions; taxation of motor and energy fuel; stimulating the development of renewable energy sources; promoting energy efficiency. As the most optimal for Russia, experts noted a model aimed at stimulating energy efficiency, which is due to the presence of positive experience of implementing the fundamentals of energy efficiency principle, including energy efficiency standards for consumer electronics and household appliances and lighting equipment as well. The main goal of this model is to reduce the specific energy consumption for each of its consumers. The indicated can be provided through tariff and price regulation, implementation and compliance with technical standards, the extension of the system of obligations and penalties, the provision of tax incentives and other methods.

The efficiency of the energy-saving approach is highlighted in the scientific literature. For example, A. Bhattacharjee and S. Mazumdar, in the framework of the study comparing different light sources for museum illumination, emphasize that the use of LED lamps within the energy-saving approach, including the design of museum lighting, contributes to the "green" future of our planet [8].

The Energy Strategy of Russia for the period until 2030 notes that in the implementation of a similar strategy until 2020, substantial work was carried out on one of the priority areas such as "Energy and energy saving", thanks to which new technologies were developed, including "energy-saving and environmentally friendly lighting devices of a new generation with light emitting diodes and mercury-free gaseous discharge lamps" [9]. At the same time, among the main tasks of the Energy Strategy of Russia for the period up to 2030 is a task aimed at "enhancing energy and environmental efficiency of the Russian economy and energy, through structural changes and activation of technological energy conservation" [9]. Within the framework of the Energy Strategy for the period up to 2035 a new subsection "State Policy in the Field of Energy Saving and Energy Efficiency Enhancement" was added, where various types of state support in the field of energy efficiency are envisaged, including introduction of tax incentives for the acquisition of energy efficient equipment, etc. [10] That causes the need for further changes in this area.

Among other things, the Institute of Natural Monopolies Research experts note that stimulating energy efficiency as the most effective model for regulating greenhouse gas emissions in Russia will contribute to the successful implementation of the principles of best available techniques (BAT) widely used in the European Union countries. These principles are set out in the framework of the Directive of the Council of the European Union on the Integrated Pollution Prevention and Control (IPPC) (2010/75/EU) [11] and the OECD Council Recommendation on the Integrated Pollution Prevention and Control C (90) 164 [12]. The vector of BAT principles is aimed at creating conditions for the modernization of industrial equipment, thereby ensuring environmental protection in the most effective way in comparison with other technologies used. In Russia, the benchmark for BAT was reflected in the Federal Law of 21.07.2014 N219-FZ "On Amending the Federal Law "On Environmental Protection" and certain legislative acts of the Russian Federation" [13]. BAT can be applied to those areas of activity that have a "significant negative impact on the environment", including those caused by the application of certain technological processes, equipment, technical methods and techniques. The list of such areas is established by the Government of Russia and currently includes 29 points [14].

For the transition to the principles of BAT, similar to the experience of foreign countries, in Russia special information and technical reference books on BAT are being developed that contain information on the type of activity, indication of the negative effects on the environment from its implementation, the methodology for determining BAT aimed at reducing the negative environmental factors from such activities, etc. [13] In addition, the Russian Government's Order N398-r of March 19, 2014 approved a set of measures, the implementation of which aimes to ensure the abandonment of the use of obsolete and inefficient technologies, as well as to implement the transition to the principles of BAT and the introduction of modern technologies [15].

Thus, energy efficiency is fixed by the legislator as one of the guidelines of the state policy aimed at ensuring energy saving in accordance with the universally recognized international standards for the prevention of environmental pollution.

Turning to the prospects for increasing energy efficiency, it seems necessary to pay attention to the current trend – the digitalization of economy. World trends show that the main reference point is currently focused on the universal digitization of various spheres of human life: the Internet infrastructure continues to improve, which stimulates the use of digital tools in everyday life.

The OECD report the Digital Economic Outlook of 2017 notes that in 2016 83 % of the population of the OECD countries had access to the Internet, while in 2005 only 56 % of the population had access to the Internet and only 30 % uses the Internet constantly [16]. At the same time, there is a fall in the cost of Internet connection services: for example, the cost of connecting for one month with 200 GB traffic decreased for the period from 2013 to 2016 from $43 to $37 in 2016; the cost of mobile Internet with 2 GB traffic decreased for the period from 2013 to 2016 from $71 to $39. Currently, almost half of the world's population uses the In-

ternet, while in 2001 the number of users was only 500 million [17]. The IEA estimates that for the acquisition of various services, the number of connected devices to the Internet of Things (IoT) technologies will increase from 8.4 billion in 2017 to more than 20 billion by 2020 [18]. The OECD emphasizes that the key to the digital economy is the mobile use of data: the use of mobile applications for purchases, payment for digital services, payment of current bills, etc.

Thus, digital innovations inevitably transform the economy and society. At the same time, the digitalization of economy is positioned as a blessing and is strongly encouraged at the highest levels. For example, the OECD calls on all states, not limited to member countries, to intensify efforts and encourage the widespread use of digital technologies for the flourishing of the global digital economy [19].

In Russia in 2017, the government of the Russian Federation approved the program "The Digital Economy of the Russian Federation" [20], the direction of which, in essence, is determined by the provisions of the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030 [21]. Both documents presume the necessity of creating an enabling environment conducive to the development of digital economy in order to improve the standards of living. The program defines the definition of digital economy, which is understood as "… economic activity, the key factor in the production of which is digital data… contribute to the development of the information infrastructure of the Russian Federation, the creation and application of Russian ICTs, and the formation of a new technological basis for social and economic development" [20].

At the same time, the program for the development of the digital economy in Russia provides for the need for its widespread distribution, also by increasing the use of broadband Internet access for households, including sparsely populated areas, medical and preventive organizations and educational institutions, public authorities and local governments, defining a stable vector for ensuring the use of data in a digital format. It is also planned to implement other large-scale measures to introduce digitalization, as envisaged by the "road map" of the "Digital Economy of the Russian Federation" program.

Undoubtedly, digitalization, on the one hand, contributes to the development of economic growth, but on the other hand it tends to form stable dependence on electricity, which is due to the constant need for information and communication technologies (ICT), through which access to products of digital economy and electricity becomes possible. To catch this close relationship, it seems quite enough to be an active user of any iPhone model: a rare user can do without the need to recharge his or her phone for one day. Thus, it is obvious that the progressive development of national economic growth based on digital economy is due, among other things, to the need to modernize the corresponding energy infrastructure systems.

Having compared the Energy Strategy of Russia, other normative acts in this area, including state programs on energy efficiency, with documents aimed at the development of digital economy in Russia, the author concluded that in the "Digital Economy of the Russian Federation" program there is no indication of approaches to compliance with energy conservation measures and energy efficiency, as well as in documents dealing with energy efficiency there is no mention of the need to take into account the increasing demand for electricity caused by the development of digital economy.

Within the framework of the "road map" for the implementation of the program on the digital economy, there is only one mention of energy, in particular, to implement the direction of the development of the digital economy in Russia it is supposed: "4.9. Ensure the availability of data storage and processing services throughout Russia for citizens, businesses and authorities". This item should be implemented also by elaboration of a general scheme for the development of data storage and processing infrastructure, taking into account the development plans for the energy and telecommunications infrastructure (the deadline is the end of 2018). Obviously, this can not be regarded as a system-forming approach to implementing the idea of energy efficiency, taking into account the interrelation between increases in the use of the necessary electric power resources for the implementation of the tasks set for the development of digital economy of Russia. Thus, data storage and processing are carried out by data processing centres (data centres), the number of which is steadily growing in proportion to the increase in the volume of transmitted information. For example, Google has chosen Den-

mark to host data centres in Northern Europe. For a general understanding of the scale, we note that the area of this data centre is approximately 23 football fields [22]. According to the estimates of the independent state enterprise of the Ministry of Climate and Energy of Denmark, three data centres located today in the country (Facebook, Google and Apple) will increase Denmark's energy consumption by 11 % by 2022 [23]. In general, according to experts, global data centres consume about 3 % of the total world electricity supply and allocate 2 % of the world's greenhouse gas emissions, essentially the same as the aviation industry [24]. At the same time, attention is drawn to the presence of an active position of developed countries with regard to the "making more eco-friendly" data centres. Thus, for instance, in the USA the federal program of energy consumption management is launched, the main idea of which is energy saving in the data centre. For this purpose, the program includes publications on best practices in energy efficiency and energy conservation, recommendations for data centres, training programs for energy specialists, other tools aimed at supporting organizations in implementing measures to improve the energy efficiency of the data centre, including the Data Centre profiling tool, which allows data centre operators to estimate the use of energy [25]. Also, Centres for expertise on energy efficiency in data centres and requirements for energy efficiency of national data processing centres were established [26]. Consequently, there is observed a certain activity to maintain the balance of the development of the digital economy and energy efficiency.

In its turn, Russia has a fragmented approach to the two interrelated vectors of the country's national economy development: Russia is guided by international approaches to the introduction of energy efficiency frameworks; it actively joins global digitalization processes. At the same time, the effect from achieving each of the indicated processes is not taken into account. In other words, at the present stage, the elaborated strategies and programs aimed at developing digital economy do not consider negative factors of widespread digitization to the results of implementing approaches to energy efficiency, in turn, documents that fix the benchmark for energy efficiency underestimate the potential risks of not achieving the objectives set in the conditions of the country's transition to digital economy, which, in the context of Russia's accession to the Paris Agreement on Climate, forms reputational risks of non-fulfillment of international obligations.

4. CONCLUSION

Under conditions of the need to transform the energy sector, in connection with the obligations assumed by Russia within the framework of the Paris Agreement, when Russia moves to the global processes of digitalization of economy, it is advisable to take into account the effects of such integration in terms of their impact on achieving the set targets for energy saving and energy efficiency. Currently, the indicated priority in national approaches to the development of digital economy and the achievement of energy efficiency in Russia is not indicated, which states that this aspect is missing from the legislator's field of vision. In connection with the above, it is proposed to make changes to the program "Digital Economy of the Russian Federation", concerning the consolidation of priorities for the registration of national benchmarks for energy conservation as well as due to Russia's accession to the Paris Agreement. It is also advisable to introduce changes to the Energy Strategy of Russia for the period until 2035 to take into account the potential impact of the effects of the digitalization of the national economy on achieving benchmarks for energy efficiency. The indicated changes should be strategic in nature and consider Russia's long term interests, having respect to the undertaken obligations to the international community. It is regarded as advisable to borrow the US experience in implementing the federal energy management program aimed at saving energy in the data centre and initiatives to optimize the energy efficiency of the data centre. In general, it seems that linking such topical vectors of Russia's development as energy efficiency and digital economy will meet international experience in this matter and will allow to ensure most efficiently the transformation of the energy sector in the conditions of digitalization of economy.

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