

Trends and conditions for the development of green energy in the Russian Federation

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Abstract. The second decade of the twenty-first century was a turning point when the leaders of the largest and most developed countries began to talk about a gradual transition from traditional energy sources to renewable ones. This decision was made in connection with the growth of carbon dioxide emissions into the atmosphere, and, as a consequence, an increase in the temperature of the lower layers of the atmosphere due to the greenhouse effect. The purpose of the study is to identify effective practices and prospects for the development of green energy in Russia through a comparative analysis of trends and conditions for supporting the production of renewable energy in the country. The study was carried out using methods of descriptive statistics analysis and comparative analysis, graphical and tabular visualization of the results. Sources used include data from the International Energy Agency, independent information, and an analytical center under the Government of the Russian Federation.

1 Introduction

The high risks of anthropogenic pollution of the environment, global warming and catastrophic climate change have made scientists, politicians, public and government officials in most countries understand the need for a transition to a low-carbon, resource-efficient and socially inclusive economy, that is, a "green" economy. Today, up to 80% of global emissions of greenhouse gases, which pollute the environment and lead to an increase in atmospheric temperature, are produced in the field of traditional carbon energetics, namely, on the combustion of coal, gas, oil, oil products and other types of fossil fuels. The key point in the transition to green energy will be a complete rejection of the use of minerals and the transition to renewable energy sources (RES), such as water resources, solar energy and wind energy [1, 2].

Nuclear energy plays a special part in the context of green energy development. Very often, questions concerning the purity of the "peaceful atom" cause a lot of controversy and discussions among representatives of science, politicians and society, to this day there is no consensus on this issue. In this regard, the problem of nuclear power is not considered in this article.

Modern long-term guidelines for the transition of the world economy to a green model was outlined 5 years ago by the Paris Agreement, which was signed by 195 countries that voluntarily assumed the relevant obligations [3, 4].

Over the past 20 years, the renewable alternative energy sector has experienced a period of intensive development around the world under the influence of established international politics. Already in 2015, the total installed capacity of generated renewable energy, excluding hydroelectric power plants, was close to the installed capacity of all Russian power plants combined, and taking into account the capacities of hydroelectric power plants, the total capacity of generated energy exceeded it almost three times [5]. According to forecasts of Russian and foreign experts, by 2040 renewable energy sources will be able to provide 35–50% of world electricity production and 19–25% of world energy consumption [6, 7].

The rapid development of alternative renewable energy sources reduces the competitiveness of countries that use oil, gas, coal as their main sources of energy. According to the well-known theory of the competitive struggle of advantages [8], participants in the world energy markets move from a lower level of competitiveness, due to excess mineral resources, to a higher level, where investments and innovations become the main drivers of competitiveness [9]. Advanced economies have an opportunity to be the first to make the transition to green energy, as a result of which developing countries will face the need to catch up with world leaders in this trend in order to ensure national competitiveness in the new environment.

The high rates of development of renewable energy sources observed in the world economy in recent years are primarily provided by government support as a key driving force for the use of alternative energy [10, 11]. Moreover, government energy regulation measures vary considerably from country to country.

2 Research and methodology

The research methodology consists in the use of methods for analyzing descriptive statistics and comparative analysis. Graphical visualization of the data obtained is also used. The data for the analysis were taken from open sources, for example, the website of the International Energy Agency.

3 RES development trends in the power industry

3.1 Development trend of renewable energy sources in Russia in 1995–2018

Figure 1 shows the annual electricity production from renewable energy sources of all types, including water resources. It can be seen from the presented graph that wind, geothermal and solar energy occupy a very small volume of all alternative energy in comparison with hydropower produced in the Russian Federation.

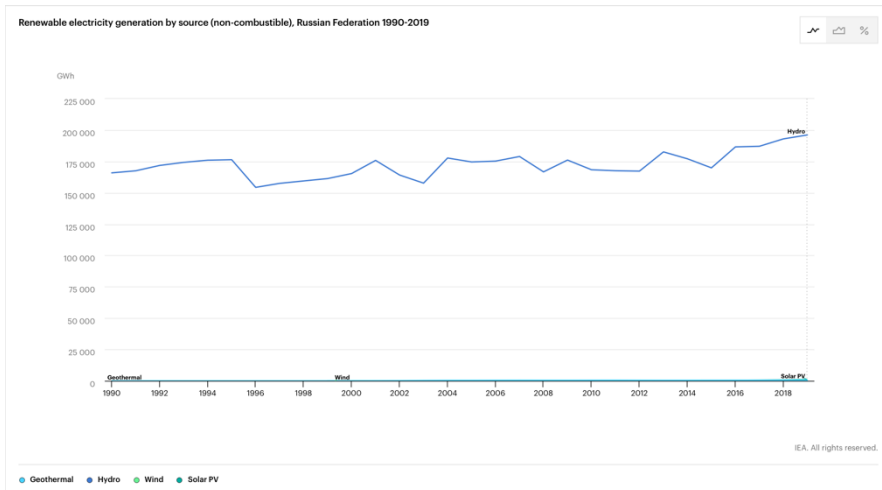


Fig. 1. Volumes of electricity production from renewable energy sources in the Russian Federation of all types, including water resources from 1990 to 2018.

Figure 2 shows the share of RES generation in the total electricity production in the Russian Federation, measured in oil equivalent.

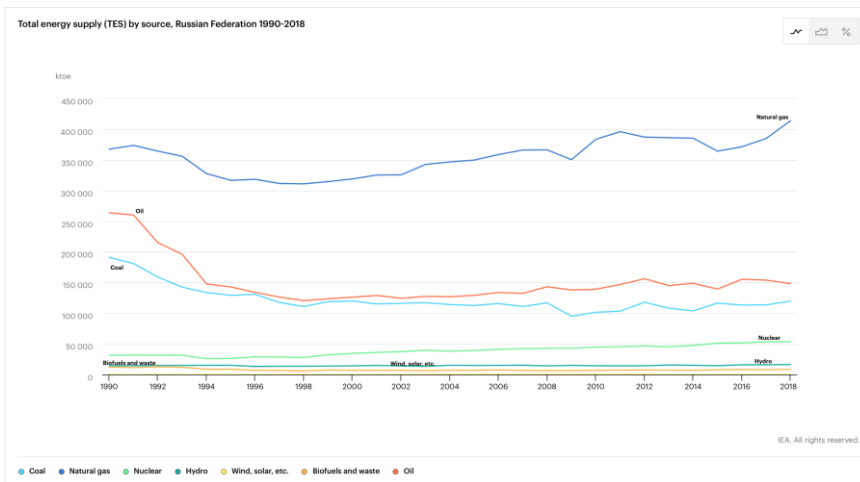


Fig. 2. Part of RES generation in the total electricity production in the Russian Federation, measured in oil equivalent.

Russia is by far the leader among the CIS countries in terms of green electricity production from all types of renewable energy sources, including water resources. It is worth noting that the entire resource of hydropower was obtained during the existence of the USSR; in the post-Soviet period, the Russian Federation chose the development in the nuclear power industry. During the existence of the Russian Federation, 11 reactors were put into operation within the country and 7 reactors abroad [12]. Excluding hydropower resources, the share of RES in electricity generation in Russia is less than 1%. At the same

time, the share of solar and wind energy is less than 0.2%, which is significantly lower than the world level (about 5%) [13, 14].

3.2. Conditions for the development of green energy in Russia: goals and mechanisms of state support, problems and prospects

Russia ratified the Paris Agreement in 2019 and committed itself to reduce greenhouse gas emissions by 25-30% of the 1990 level by 2030.

In recent years, these emissions in Russia, taking into account the absorption capacity of the forest, amounted to about 52% of the 1990 level.

Russia possesses huge reserves of hydrocarbon energy resources, the export of which provides a significant share of the country's budget (the oil and gas sector brings up to 40% of the consolidated budget revenues); the country ranks second among European countries for the production of atomic energy [15]. These circumstances, together with a significant share of hydropower in the structure of the energy balance, determine the relatively low level and low rates of development of alternative energy sources, such as solar and wind.

However, Russia is pursuing a comprehensive policy of developing alternative energy technologies [16]. According to the accepted rules for the localization of production, a manufacturer of equipment for renewable energy sources must use only those raw materials that are produced in Russia or organize their own production in Russia. If this requirement is violated, the manufacturer must pay high contractual penalties. Today the Russian Federation has its own production of solar modules and blades for wind turbines [17].

Since 2013, the main measure to support alternative energy in modern Russia is the mechanism for concluding agreements on the provision of capacity (CDA) for the construction of renewable energy facilities – wind power plants, solar power plants and / or small hydroelectric power plants. This measure is unique as it helps to subsidize the construction of renewable energy facilities, and not sell green electricity through the mechanism of green tariffs, as it is done in most countries. The contract guarantees the return of costs for the construction of a renewable energy facility by increasing the cost of capacity. However, such support is provided only to those RES generation facilities that are connected to the centralized power grid.

In regional retail electricity markets, renewable energy facilities are included in regional energy development programs and provide long-term tariffs that provide a sufficient level of return on investment. Since 2017, incentive programs have been introduced for the development of micro-retailers for renewable energy sources, which involve the emergence of prosumers on the electricity market.

Let us outline the range of problems for improving the Russian system of support for alternative energy. Firstly, it is the need to curb the anticipatory rise of electricity prices for consumers, for whom electricity from renewable energy sources is quite expensive. Secondly, it is the need to create incentives to improve the efficiency of renewable energy generation projects, since today such incentives are absent due to insufficient competition between investors. The third problem is the limitation of the development of the renewable energy due to the requirement to localize production. Finally, the fourth drawback of the regulatory system: there are no mechanisms to stimulate the distribution of this kind of electricity to those regions that are not connected to the centralized energy system of the country. The area of such territories is about 60% of the total area of the country, and about 20 million people live there [18].

It is obvious that the existing system of stimulating the renewable energy production in Russia needs to be reformed in terms of organizing a competitive selection of investment projects. It is necessary to create conditions for attracting investments in the capital market

with the help of green bonds; to attract investments in alternative energy in the territories of autonomous energy supply (for example, using the mechanism of accelerated depreciation).

4 Conclusion

The support provided for the development of green energy in the Russian Federation takes into account the commitments undertaken in accordance with the Paris Agreement. The dynamics of RES generation volumes indicates positive trends in the development of green energy. However, the achieved levels of clean energy development indicators are still significantly lower than their global average values.

Russia has a unique mechanism for concluding capacity supply agreements (CDAs), which was developed and used to support the green energy sector, along with the requirement to localize the production of the equipment for the construction of renewable energy sources.

The development of clean electricity in the Russian Federation will be facilitated by the improvement of state regulation of the energy sector by creating transparent mechanisms for a competitive market and providing conditions for attracting investments in the capital market using green financing.

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