CURRENT STATE AND PROSPECTS FOR THE DEVELOPMENT OF RENEWABLE ENERGY IN RUSSIA

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Abstract. *It has been established that global investment in renewable energy has been growing steadily over the past ten years. The purpose of this paper is to analyze the current position of Russia in the field of renewable energy production and to develop recommendations for the further development of renewable energy. As a result of the analysis, it is determined that almost all regions of the Russian Federation have opportunities for economically viable use of several types of renewable energy sources. The potential of renewable energy sources available in Russia will be able to provide one third of the annual energy needs of the domestic economy. At the same time, the study showed that Russia is currently not a leader in renewable energy production. The authors evaluated the current state in Russia in the field of hydropower, geothermal energy, solar energy, wind power plants, biomass, biogas and landfill gas. Renewable energy in Russia is underestimated in terms of its socio-economic and political importance. At present, Russia is implementing a raw materials model of development. A set of measures has been defined, the implementation of which will promote the development of renewable energy sources in Russia. The results of the study can be used in practical activities of public authorities in the development of strategic directions of innovation-oriented development of the Russian Federation.*

Keywords*: energy, renewable energy sources, energy efficiency, renewable energy*

INTRODUCTION

In a growing number of countries around the world, renewable energy is becoming the primary means of meeting energy demand. About 150 countries are currently implementing policies to stimulate investment in renewable energy technologies. Global investment in renewable energy has been growing steadily over the past decade (from less than $50 billion in 2004 to $348 billion in 2015), (https://www.irena.org/-/media/files/irena/agency/publication/2017/irena_rethinking_energy 2017).

According to estimates of the International Renewable Energy Agency (IRENA), increasing the share of renewable energy sources to 36% by 2030 is technically feasible and economically viable, as it can ensure growth of the global gross product by about $1.3 trillion, create millions of jobs and save millions of lives that would be lost due to environmental pollution (Figure 1), (HOHLOV, 2018).

As for the Russian Federation, it is an absolute global fuel and raw material donor, which is predetermined not only by the rich mineral resources of the country, but also by its vast territory characterized by different landscapes, geological and climatic diversity, which provides ample opportunities for the development of renewable energy (MINAKOVA et all., 2018).

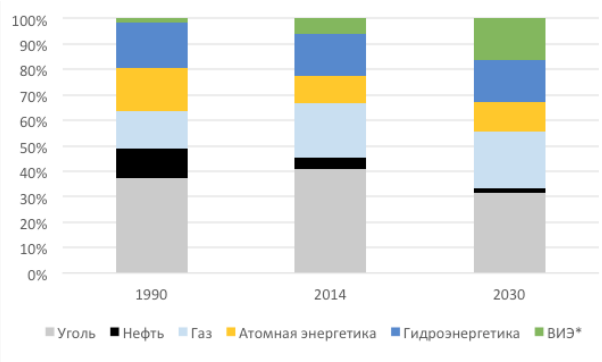

Fig. 1. Share of renewable energy sources in global electricity production

Almost all regions of the Russian Federation have opportunities for economically viable use of several types of renewable energy sources. The potential of renewable energy sources available in Russia will be able to provide one third of the annual energy needs of the domestic economy. This means that every third tonne of oil and cubic metre of gas burned can be successfully replaced by wind, solar and biomass energy (MINAKOVA et all., 2020, DANCEA and REIANA, 2011; DANCEA and URSU, 2012).

At the same time, it has to be stated that Russia is not currently a leader in renewable energy production. According to estimates of the Ministry of Energy of the Russian Federation, in 2018 the share of renewable energy sources in the total structure of power generation was 17.8% (https://minenergo.gov.ru/node/532 2019). Renewable energy sources accounted for 0.5% of this share, while the rest was the contribution of hydropower plants (HPPs).

MATERIAL AND METHODS

The works of (JEWELLA et all., 2014; JAMASB and KOHLER, 2007; MONÉ et all., 2014) devoted to the study of the role and prospects of traditional and renewable energy in the world economy.

The purpose of the work is to identify and analyze trends in the development of renewable energy in Russia.

Within the framework of the research, the author used the method of system analysis, statistical and mathematical methods, methods of comparisons and analogies, expert assessments.

RESULTS AND DISCUSSIONS

HYDROPOWER PLANTS

Hydropower plants as sources of cheap electric power play a key role not only in the power industry of Russia (17.7% of the total power generation), but also, for example, in China (20%), (https://chinaenergyportal.org/en/2018-detailed-electricity-statistics-update-of-dec-2019/). At present, six hydro power plants are under construction in Russia, including one in the Caucasus (Verkhnebalkarskaya HPP) and five in the regions of Siberia and the Far East (Beloporozhskaya HPP).

The main objective of the project is to develop a new hydroelectric power plant in the Russian Far East. At the same time, out of the 14 HPPs with capacities over 1,000 MW operating in Russia, only three of them had units commissioned after the collapse of the USSR, and out of 32 HPPs with capacities from 100 to 1,000 MW, only four had units

commissioned in the post-Soviet period (http://www.rushydro.ru/activity/marketing/production/capacities). It is obvious that construction and reconstruction of HPPs are carried out in insufficient volumes. Experts authoritatively state that water resources of the Far East are developed by 5%. Part of the problem is the relatively low attractiveness of hydropower projects for investors, due to the problems of regulatory regulation of "certain issues" (https://inform-24.com/15620-perspektivy-gidroenergetiki-v-rossii-fotoreportazh.html.2019).

Thus, the most urgent problem of the Russian hydropower industry is insufficient legal regulation, which requires amendments to the Urban Planning, Land, Water and Environmental Codes in order to regulate the creation of reservoirs for hydropower, the determination of the compensation for environmental damage and standards for the safety of hydraulic structures.

SOLAR POWER PLANTS

Currently, there are 94 qualified solar power plants (SPPs) operating in Russia, the total capacity of which is 1305.6 MW.

For comparison, the capacity of Sayano-Shushenskaya HPP alone is 6400 MW. The Astrakhan Oblast, Altai Republic, Stavropol Krai and Crimean Peninsula are the leaders in Russia in terms of the number of constructed SPPs. This location of the solar power plants is logical: it is the southern regions of Russia that have the highest insolation coefficient. It should be noted that construction of solar power plants is also possible in Siberia. On average, the insolation level in these regions allows generating about 1000 kWh/m2 a year (http://www.energyland.info/analitic-show-179347 - 2019).

Constructing SPS is a technically simple process that includes landscaping, vertical planning of the site, erection of supporting pillar structures, installation of photovoltaic modules, erection of utility buildings, start-up and adjustment works and obtaining permissions from the necessary services. In this case, the payback period of the SES is from 10 to 14 years.

In 2017, an investment project competition was held for construction of generating facilities based on renewable energy sources. As a result, 26 solar power plant construction projects were selected. Thus, the construction of solar power plants in the country is developing steadily. The constraints for the mass use of solar power plants are rather technical: expensive energy accumulators and loss of generation efficiency over time. A natural obstacle to the widespread construction of solar power plants is the insufficient insolation factor in the northern and central regions of Russia. That is why a stable supply of solar energy is possible only in the southern regions of Russia.

WIND POWER PLANTS

The official register of qualified generation facilities contains 8 wind power plants (WPPs) with a total installed capacity of 97.265 MW. They are located in Belgorod, Orenburg, Ulyanovsk regions, in the Republic of Crimea and Bashkortostan. It is noteworthy, that in their location WPPs gravitate to the southern border of Russia, as well as the SES. This is due to the fact that the steppes and semi-peninsulas of some southern regions of Russia are well blown by winds, which is a prerequisite for the construction of wind farms.

Based on the results of the tender for investment projects for construction of generating facilities based on RES, 78 wind power generation facilities were selected. The total generation volume of all projects by 2022 should make 1651,06 MW (http://www.energyland.info/analitic-show-159691– 2018).

Thus, the construction of WPS in Russia is developing quite dynamically. If all selected projects are realized, capacity of generating installations based on wind energy will increase by 1697% by 2022. In order to eliminate excessive requirements to design,

construction and operation of generating facilities.

The Decree of the Government of the Russian Federation of January 15, 2019 № 5 was signed to eliminate excessive requirements for the design, construction and operation of generating facilities operating on the basis of renewable energy sources.

In accordance with this decree, the need to establish protective zones in relation to wind power plants was excluded, as such facilities are not critical, and technological disruptions in their operation do not have social-economic, environmental and other consequences for the population and socially important objects. The adopted decision will make it possible to remove administrative barriers to the construction of wind power plants and to use land plots located near wind power plants to the full extent (http://static.government.ru/media/files/Wy8kEam4TnCP4fAZxdB8GdRtOraQYEB6.pdf.)

GEO POWER PLANTS, BIOMASS, BIOGAS AND LANDFILL GAS

Enterprises generating energy from geothermal energy, biomass, biogas and landfill gas, in the register only 6, their total capacity is 74.5 MW. At the same time, up to 84% of this capacity is generated by GeoPPs.

In the competitive selection of 2017 there was not a single application for construction of facilities of such types, which allows to conclude about stagnation of this RES sector in Russia.

At the same time, from the environmental point of view, the project of landfill gas processing is quite interesting. There is already experience of such type of construction in Europe. In Russia, there is only one such station at the moment.

Stations running on LFG not only reduce methane emissions into the atmosphere, but also free the air around the landfill from the smell of rotting garbage (MINAKOVA, et all., 2018).

The main obstacles to the construction of geo-electric power stations in Russia are often too high depths of thermal springs. It is also necessary to note the high localization of thermal springs: the most promising are the springs on the Kuril Islands and in the Caucasus Mountains.

The factors restraining the construction of plants working on biomass, bio-gas and landfill gas are the general lack of mastery of the necessary technologies in Russia.

CONCLUSIONS

Overall, research shows that the global potential for renewable energy is enormous and far exceeds current and projected global energy demand. If economies are reoriented towards renewable energy sources, the global problem of climate change can be successfully addressed. Combined with a significant increase in energy efficiency, a further reliance on renewables could cut CO2 emissions by half every year to around 20 GT in 2030. This would be enough to keep the world on track for 2°C, with more to come.

The prospects for the future use of renewable energy are largely predetermined by its differences from conventional sources. The most important disadvantage of renewables is the unstable generated energy flow. However, this problem can be successfully solved through the creation of hybrid plants (involving the simultaneous use of several energy sources).

It should be noted that the existing stereotype about the high cost of renewable energy has a negative impact on its development. At the same time, the experience of countries that are actively introducing RES shows that the cost of energy generated by renewable energy sources is practically comparable with the traditional energy. Over the last ten years, capital expenses for construction of solar power plants, which are currently one of the most expensive

sources of energy, have decreased by more than half. Yet the potential of such plants is far from being exhausted.

Renewable energy in Russia is underestimated in terms of its social and economic and political importance. At present, Russia is implementing the raw materials model of development. The main advantage of alternative energy (first of all, solar and wind energy) is a short investment cycle and fast commissioning times. In addition, RES are capable of creating many more jobs per unit of energy produced than conventional energy. Renewable energy production is environmentally friendly and clean, while the development of bio-energy would provide the rural population with cheap fuel and quality organic fertilizers.

All this indicates that renewable energy will develop as the most expedient alternative to the use of coal-hydrocarbon resources. In the Russian Federation, the development of renewable energy requires modernization of the regulatory and legal framework of its functioning and its financial support. An important role in the development of renewable energy can play the refusal of direct and hidden subsidies for traditional fuels. It is advisable to initiate educational and outreach programs that would give a wide range of people an idea about the real possibilities of renewable energy source

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