

# The problem of the energy sector to modern technologies in the field of generation

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**Abstract.** Within the framework of this work, the analysis of the existing dynamics of changes in the structure of world states at the current stages is carried out. The main reasons and factors that contributed to these changes are given, and the main comparative characteristics of traditional and non-traditional generating facilities are considered. It also provides examples of the advantages and opportunities that the energy sector will receive in the transition to the use of renewable energy sources. Special attention is paid to the problem of insufficient speed of reorientation of the energy sector of the to modern technologies in the field of generation. The results of the analysis of changes in the structure of the world energy at the current stages are also presented.

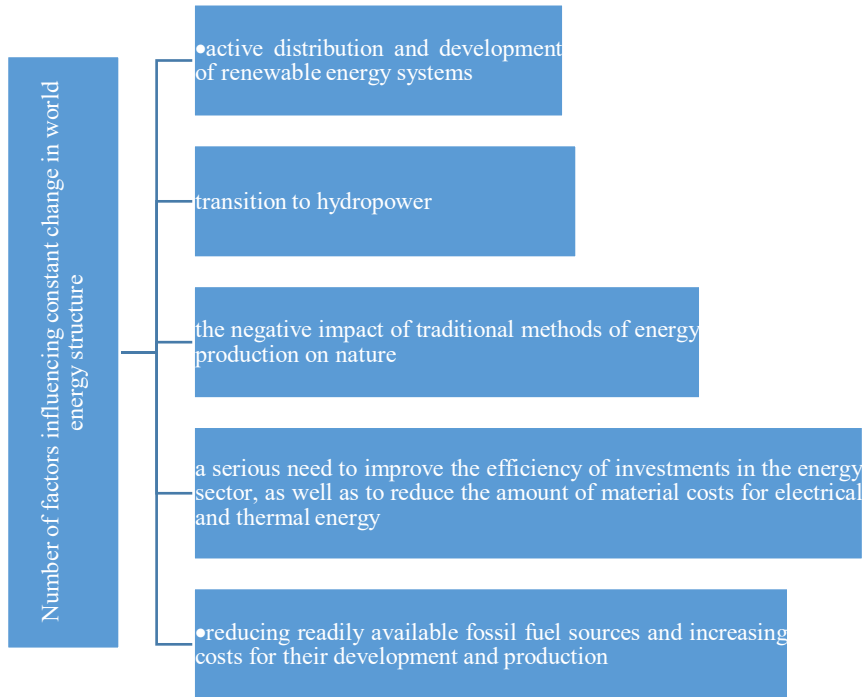
## 1 Introduction

In the realities of the modern world, a huge number of factors affect the constant change in the structure of the world energy. Among the main influencing factors are the following (figure 1):

- active distribution and development of renewable energy systems;
- transition to hydropower;
- the negative impact of traditional methods of energy production on nature;
- a serious need to improve the efficiency of investments in the energy sector, as well as to reduce the amount of material costs for electrical and thermal energy;
- reducing readily available fossil fuel sources and increasing costs for their development and production.

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**Fig. 1.** Number of factors influencing constant change in world energy structure.

## 2 Problem statement

The current energy balance of the Russian Federation is 70% of traditional types of thermal energy. This industry is also the largest anthropogenic source of harmful emissions. Coal power plants emit the largest number of harmful substances into the world around them, since coal is the most common fossil fuel on Earth.

It is also worth considering the fact that the operation of TPPs leads to a large number of thermal emissions with an extremely low efficiency in the region of 40%. At the same time, thermal power plants lead to a stable increase in the average annual temperature in the atmosphere, which is extremely dangerous for humanity.

At the same time, the measures taken to reduce emissions into the atmosphere, which were developed and implemented by the Government of the Russian Federation, have not received sufficient distribution.

Hydroelectric power plants, which form 20% of the state's energy balance, do no less harm. Their negative impact consists in the destruction of many territories, since often, in order to activate a hydroelectric power station, flooding of a significant number of territories is required. All used dams in most cases block the channels of the arms, which interferes with the natural migration of fish, which leads to a significant reduction in its number in the places of construction of such structures.

The third and perhaps most controversial category of power plants is nuclear power plants. They cause the greatest outrage on the part of the population of all countries of the world, since they have the potential to cause the greatest damage to the environment. The problem of nuclear power plants became especially clear after three major disasters: Three Mile Island in the USA in 1976, Chernobyl in the USSR in 1986 and Fukushima in Japan in 2011. The main concern is that as the number of nuclear power plants grows, so will the number of potential accidents. At the same time, NPPs have a significantly higher cost of

their construction, require more resources for maintenance and operation, and their thermal emissions exceed those of TPPs [1].

Despite the voiced problem, Russia continues to build new nuclear power units. RosAtom is also constantly looking for ways to extend the life of existing reactors, since the cost of deactivating them is high and can lead to significant losses. It should be understood that such attempts to extend the period of operation significantly increase the level of risk of an accident, since the reliability of worn-out power units decreases.

At the moment, the states of the world are beginning to abandon the idea of using nuclear energy. For example, Italy has closed all nuclear power plants on its territory and many European and Asian countries are going to follow their example. Many countries also abandoned the construction of their first nuclear power plants after the accident in Fukushima.

At the moment, 164 nuclear reactors have been closed in the world. A similar trend is associated with the humanity's awareness of the need to take care of the environment [2].

### 3 Findings

One of the most pressing problems of modern attempts to fully transition the world economy to the use of an energy efficient low-carbon approach is the increase in the use of renewable energy sources. The problem is that there is a serious need to revise investment projects, which should henceforth be aimed at re-equipping plants in order to enforce the principles of renewable energy generation.

As the restrictions on traditional energy sources increase, as well as the increasingly acute formulation of the energy balance problem, renewable energy sources are becoming more and more important for the countries of the world and their economies.

It is noted that in the near future this transition will become widespread for all countries of the world, which will begin a full transition to such methods of obtaining energy. It should be noted that at the moment, the implementation of a full transition is impossible due to the current technical base, but this plan is realizable in the long term.

The energy complex is one of the most important elements of the modern Russian economy. Thus, it is required to introduce a set of measures for its innovative development and diversification. It should be noted that at the moment many countries, including the USA, China and Germany, are investing in the development of the renewable energy industry.

Renewables currently account for approximately 23% of total electricity generation. The most developed industry is the solar photovoltaic industry. Wind power is the second most developed industry. It is worth noting that in some countries of the world energy from renewable sources has become equivalent in cost to traditional energy sources. At the moment, photovoltaic energy is the most promising development vector at the moment. Its use makes it possible to largely cover the energy costs of many countries [3].

State support is becoming more and more important for renewable energy sources, which, in terms of their share and number, are in many ways equal to classical energy. For example, traditional and nuclear energy industries currently receive large government subsidies to help develop these industries. In turn, traditional energy sources cannot count on such a level of government support.

The main reason for the increased costs in the development of renewable energy sources is the high risks of R&D development. The fact is that the renewable energy industry implies the use of innovative technologies and approaches that have not yet been fully tested, therefore, can lead to additional problems and costs.

The renewable energy industry has also received increased attention in the Russian Federation, where more and more funding and attention is paid to the development of a system of state support for this industry. In the near future, one should expect a serious

restructuring of this market, which will lead to a new round of technology development. In this regard, Russia should be as prepared as possible for this problem, as well as develop its own system for the use and implementation of such technologies.

Studies of current international experience show that all countries involved in the widespread introduction of renewable energy sources have consistently implemented a certain set of measures for a long period of time, which should take into account the level of costs for the development of the industry.

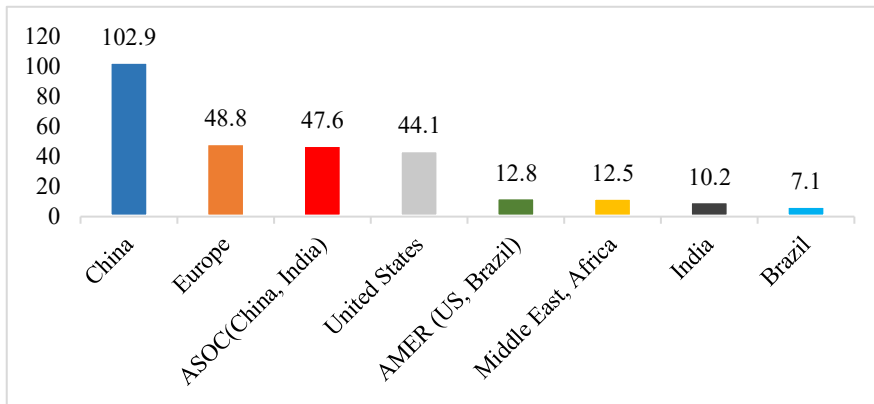
At the same time, government incentives were based on such instruments as price premiums and fixed tariffs. Instruments that were volume-based deserve special attention, and included quotas and certificates for renewable energy sources supported by traders, for whom not adjusting process selection and cost is an important factor.

Also, it has become quite easy to regulate the volume of renewable energy due to the use of tenders, which were played during public auctions for the supply of electricity.

It is worth noting that the Russian Federation also adopted a set of certain measures and official decisions, which in their essence were aimed at promoting renewable energy. First of all, a system of measures was implemented that stimulates the use of renewable energy in the wholesale and retail electricity markets through payment. However, among the negative factors, one can single out the fact that the Russian Federation currently does not provide support to farms that seek to use renewable energy sources.

Nevertheless, work in the development of this direction of the energy sector is being steadily carried out. The main impetus was received after the results of a study by scientists who recorded that in the next 50 years, traditional energy sources could potentially be completely exhausted, and humanity will not have any substitutes. In addition, renewable energy sources are much safer for the environment. This is especially true in modern conditions, when the modern world community is trying to find completely new ways to improve the global environmental situation in the world.

One of the indicators that some modern countries are interested in the development of this industry is the amount of investment in projects for the development of renewable energy (Figure 1).



**Fig. 2.** Global new investment in renewable energy by region, 2019, \$ bn [2].

After analyzing the information in the figure, we can conclude that the largest number of investments in the development of the renewable energy industry was made by China (more than \$100 billion).

Despite the fact that the green energy industry showed significant growth in 2019, one cannot fail to note certain problems that were recorded back in 2018. These problems require an early solution, since they are a serious barrier to the development of this industry. This problem is associated with the dependence of most of the states on traditional energy sources,

and with the fall in oil prices, many of them were unable to develop alternative energy sources [4].

It should be noted that the Russian Federation has huge resources in renewable energy sources. The greatest potential is not geothermal energy, small hydroelectric power plants and biomass. At the same time, practically in every region there is a potential for the introduction and use of one of the sources of renewable energy, which should make it possible to receive significant economic income.

However, it should be noted that despite the presence of certain progress and the huge potential of the industry in Russia, its development is being implemented rather slowly. The Russian Federation has a huge technical and financial potential for the development of this industry, but it continues to invest a huge amount of funds in the development of traditional energy, where the main government subsidies are directed. This is all explained by the position that there is a belief in the inexhaustibility of traditional energy sources, since new fields are being discovered on the territory of Russia on an ongoing basis.

Another problem for the development of renewable energy sources is its high-cost relative to traditional energy, which provides the Russian Federation with an impressively low consumer cost of electricity. In addition, the current extremely difficult political and economic environment significantly reduces the level of spending on the formation of the renewable energy industry [5].

## 4 Conclusion

As the study shows, the use of renewable energy sources has become the norm for most countries in the world. The only exceptions at the moment are the CIS countries. At the moment, there is a serious gap between Russia and the world's leading states in the development of renewable energy.

Eliminating this problem requires the creation of a clear plan for the deployment of new capacities in the regions with the decommissioning of outdated systems. At the moment, it is becoming more and more obvious that the energy plan developed by the Government until 2035, which implies the prevailing use of traditional energy, does not correspond to reality and requires revision. In addition, more and more legislative projects are aimed at limiting emissions in order to reduce global warming. Thus, humanity will have to largely abandon traditional energy sources and switch to renewable ones. Consequently, it is required to develop a plan and budget sources that will be aimed at the development of such energy carriers in Russia instead of classical raw materials

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