Assessment of the level of localization of production of equipment for renewable energy

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Abstract. The location of production in the regions where these resources are consumed is a relevant and necessary trend for modern states, in this regard, the study is devoted to assessing the level of localization of production of equipment for renewable energy. It was presented in the work that in the coming years in Russia it is planned to increase the volume of generating capacities operating on the basis of renewable resources. In order to achieve this goal, the potential of renewable energy was analyzed in the work, as a result of which it was revealed that Russia has the necessary potential of renewable resources that can be used to generate electric energy. The work evaluated the level of localization of production, which indicates a sufficiently high domestic production of equipment for renewable energy and the planned growth of component production in Russia. At the end of the study, mechanisms are presented to further increase the level of localization of production of equipment for renewable energy.

1. Introduction
In recent years, processes related to environmental conservation, increasing the efficiency of the use of fuel and energy resources, improving technological modes of operation of enterprises and other trends that will ensure the preservation of the natural environment in an unchanged form have been intensified. The use of energy based on renewable resources in each state of the world is at a different stage of development, for example, in European countries, almost all energy systems have capacities based on renewable energy, and in Asian countries this type of resource is practically not used.

One of the common and frequently used types of renewable resources is wind and sun, which were still used in ancient centuries to provide for human life and production needs. To date, mankind has learned how to more effectively use solar radiation and wind flow to produce electrical and thermal energy. The most popular way to convert wind flow is to use wind generators, and solar energy through the installation of solar panels to collect and produce electrical energy [1-4].

As part of the development of any industrial activity, state bodies strive to ensure the production of equipment, parts and other devices in their territory, that is, the territory of location of these enterprises. A similar trend persists due to the fact that own production provides jobs for the population, obtaining additional added value of production, developing new technologies, maintaining and developing industrial production. This direction is usually called - localization of production.

In Russia, they produce many products, develop technologies and create appliances for production and domestic consumption, however, Russia buys almost all new types of equipment abroad, due to the lack of these technologies in the state. In this regard, it seems relevant to assess the level of
localization of production for a new type of activity - the generation of electric energy using alternative energy sources.

2. Materials and methods
The purpose of this study is to assess the level of localization of production of equipment for renewable energy. In order to solve this problem, the following tasks were formed:

- Analyze the potential of renewable resources in Russia;
- Assess the level of localization of production of equipment for renewable energy and present mechanisms aimed at increasing the level of localization of production.

The study used statistical data from various industry agencies, which allowed to formulate the results of the study. In the work, various scientific methods were applied, with the help of which the goal and objectives set in the study were disclosed.

3. Results
The Russian Federation has adopted many programs that formulate plans for the transition to renewable energy sources and mechanisms for their achievement. In Russia, the transition to renewable energy was actualized at a time when the whole world was moving from the use of fuel and energy resources to the management of unconventional resources, as well as the need to improve the efficiency of power plants, reduce the environmental burden on certain territories and regions, the need to reduce operating costs at power plants and other problems. In this regard, one of the developed plans for the volume of commissioning of generating capacities is presented in figure 1 [1].

It can be seen from the presented figure that the planned input volumes are increasing annually, while we see that in Russia today several hundred megawatts of solar-powered power have been installed. However, in the future it is expected that the installed capacity of solar energy should reach 1.8 GW and 3.2 GW of wind energy, and it is planned to commission plants operating on the basis of municipal solid waste in the region of 0.3 GW by 2024. Thus, it is expected that by 2024 the installed capacity of power plants operating on renewable energy sources will amount to 5.3 GW or about 2% of the total generation in Russia [5-8].

From the information presented, it is clear that Russian energy is planning to make an energy transition from the use of traditional resources to renewable energy. In this regard, it is necessary to analyze the existing potential of renewable energy in Russia (figure 2) [1].

It can be seen from the presented figure that the number of hours of sunshine per year in the considered constituent entities of Russia is comparable with the regions of the European Union, which
indicates the presence of sufficient solar potential in Russia for the development of solar energy in almost the entire territory of the country. Because of the analysis of the wind potential, it was concluded that in some areas the wind speed reaches 18-21 meters per second, which indicates the possibility of building a wind park.

![Figure 2. The number of hours of sunshine per year.](image)

Thus, the analysis showed that Russia has the necessary potential that will allow the Russian electric power industry to switch to renewable energy sources and thereby contribute to increasing the efficiency of electricity production, but it will also create new industries and activities. At the same time, since a number of national documents set tasks for the development of renewable energy, the Russian electric power industry strives to create the necessary production capacities on its territory. Consider the level of localization of production of equipment for renewable energy and its increase.

### 4. Discussion

Localization of production is an adaptation to national requirements of the principles, methods and design decisions of existing products or industries, which allows you to place and develop your own production. Localization of production, in recent years, is a requirement of most multinational corporations that use local raw materials to produce their products. Similar requirements are set at the federal, regional and industry levels, which allows for the creation of new production capacities, the organization of jobs, reduce the cost of production of specific products and provide added value to the economy [9].

Consider the level of localization of production of equipment for renewable energy in Russia (figure 3) [1].

From the presented figure it can be seen that the level of localization in Russia today is at a fairly high level and amounts to 50%. It is worth noting that in the coming years it is planned to increase the production of equipment and components in Russia. At the same time, today it is necessary to develop new mechanisms and approaches that will increase the level of localization of production of equipment for renewable energy in Russia.

It is advisable to base the localization of production on the creation of network or cluster structures, which will include a set of measures allowing formulating the idea of a new production and launching the production process. Localization of the production of wind power plants should consist in the
production in Russia of nacelles, towers, blades and other components. For solar energy, we can single out the production of solar panels, converters and other equipment of the solar park.

![Graph showing localization of production of renewable energy equipment]

**Figure 3.** The level of localization of production of renewable energy equipment.

However, to achieve the goal of localizing production, the following mechanisms should be implemented [1; 3-5; 8-9]:

- Planning the number of equipment and volumes of commissioned capacities based on renewable energy sources;
- Optimization of production capacities and development of a layout of renewable energy facilities in the state;
- Increasing the role of renewable energy at the national level and reducing the number of energy waste and inefficient capacities;
- Conducting research and development activities related to the creation of an electric energy storage system;
- Creation of production capacities for the production of equipment for solar and wind energy;
- Improving the technical and economic characteristics of stations operating on renewable resources;
- Development of regulatory documents aimed at the development of renewable energy, the provision of benefits and the necessary preferences;
- Creation of a fleet management system for power plants consisting of renewable energy sources.

Thus, today the level of localization of production of renewable energy equipment in Russia is at a high level, since approximately half of all equipment is produced at Russian enterprises. At the same time, it is planned that in the near future an increase in the share of Russian production capacities at which equipment for renewable energy will be produced is expected. Of course, to increase the level of localization of production, it is necessary to develop measures that will allow the development and production of Russian equipment for the needs of renewable energy.

5. Conclusion

The analysis showed that in Russia it is planned to introduce generating capacities that will operate based on the use of renewable energy. Therefore, for example, the work revealed that by 2024 the volume of renewable energy should reach two percent of the total installed capacity of the energy system. The work evaluated the existing potential of renewable energy, namely, the number of hours of sunshine per year and wind speed, as a result, it was concluded that renewable resources could be
used to produce electric energy. The study found that in modern times, large multinational corporations use local raw materials and resources for production, in this regard, the level of localization of production of equipment for renewable energy was identified in the work. The assessment showed that today the level of localization is quite high, and in the coming years it is planned to increase the level of localization of production in Russia. The study proposed mechanisms aimed at achieving the goals and increasing the level of localization of production in Russia.

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