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Developing microgeneration based on RES as a driver of decarbonisation and economic growth in Russia

L.K. Babicheva[1]
E.V. Neprintseva[2]
S.A. Shubin[3]
[1] Russia Renewable Energy Development Association (Moscow, Russia)
[2] Moscow State University of Technology «STANKIN» (Moscow, Russia)
[3] Financial University under the Government of the Russian Federation (Moscow, Russia)

Abstract

Having analysed the domestic and foreign experience of developing the market of microgeneration based on renewable energy sources (RES) the authors conclude that a smart industrial policy can ensure an expedited transition to zero-carbon economy and stimulate economic growth. Research background – Russia's commitment to achieve carbon neutrality by 2060. Research purpose – assessing the prospects and barriers in the development of microgeneration based on RES. Methods – generalising, comparing, analysing empirical evidence of microgeneration market development in Russia and abroad, calculating the levelized cost of electricity (LCOE) of a solar plant and comparing it with current low voltage tariffs for small and medium-sized businesses. Results and novelty – the authors have determined the most effective industrial policy tools for developing the market of microgeneration based on RES.
Keywords: industrial policy, RES, microgeneration, zero-carbon economy.

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Introduction

Currently, about 80% of the world's countries have committed themselves to achieving carbon neutrality by a specific date[1]. Russia has determined that it will achieve the specified goal by 2060. At the same time, the President of the Russian Federation V.V. Putin instructed the Government about the Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050. It is necessary to provide for a reduction in the volume of net greenhouse gas emissions accumulated in the Russian Federation from 2021 to 2050 to lower values compared to the indicators of the European Union[2].

One of the significant sources of CO_2 emissions in the world is the sector of housing and communal services. In 2020, the operation of buildings and structures generated about 30% of global energy demand, and emissions from the operation of buildings and structures amounted to about 28% of the total global energy-related CO_2 emissions [Global status report.., 2021]. An effective tool for reducing the carbon footprint of buildings and structures, along with increasing energy efficiency and energy saving, is the transfer of energy supply to microgeneration facilities based on renewable energy sources (RES).

The article provides an empirical analysis of the world experience in the development of microgeneration based on

[1] About 80% of the world's countries have set deadlines for achieving carbon neutrality (2021). *TASS*, 31 October. URL: https://tass.ru/obschestvo/12812589.
[2] Clause 14 of the List of instructions for the implementation of the Message of the President of the Russian Federation to the Federal Assembly of the Russian Federation of April 21, 2021 No.753.

renewable energy since 2010. The factors that stimulate and hinder the development of the microgeneration market are identified as well as the most effective tools to support the development of microgeneration applicable to the domestic market.

An assessment of the development potential of the microgeneration market in Russia was carried out. An analysis of the cost (LCOE) of a solar power plant for various regions of Russia was carried out, based on its comparison with low-voltage tariffs for small and medium-sized businesses, conclusions were drawn about the prospects for the development of microgeneration in Russia, and the main instruments of industrial policy in this market were identified.

1. Incentives and obstacles for the development of microgeneration abroad

World experience shows that the development of microgeneration based on RES is mainly aimed at solving two main tasks: reducing the negative impact on the environment and obtaining positive economic effects. The study [Motyka et al., 2020] cites the results of a survey of US private homeowners: 68% of those surveyed want to reduce their carbon footprint, while 53% stated that it is extremely important that part of the electricity they consume is generated from renewable energy sources. Business is also increasingly focused on the environmental agenda and seeks to introduce renewable energy technologies in its activities, and this trend will be maintained in the long term.

A survey of 291 residents in the UK [Balcombe et al., 2014] showed that economic benefits and the desire to reduce the negative impact on the environment were considered as the main motives for using microgeneration. The authors [Hakon et al., 2018] also conclude in their study that the presence of state support schemes has accelerated the development of microgeneration in Germany, the UK and Norway. For Germany and the UK, decarbonization has been a significant driver of growth in this area. In Norway, low economic support and low electricity prices have limited the number of prosumers. Nevertheless, the decline in prices for solar power plants contributes to the growth of microgeneration inputs. At the same time, electricity prices and feed-in tariffs play an even less significant role compared to the cost of microgeneration facilities [Pearce, Slade, 2018]. The presence of feed-in tariffs only contributes to the earlier development of microgeneration, which would grow in any case, since its prices will continue to decline in the long term.

In turn, the authors [Balcombe et al., 2014] also recognized the economic aspects of project implementation as the most significant barriers to the development of microgeneration based on RES: high capital costs, inappropriate configuration of the house, insufficient potential benefit, as well as the risk of losing money when moving to another house. The second most important obstacle to the development of microgeneration is the difficulty in finding reliable information necessary for making a decision.

Similar conclusions regarding the importance of having accessible and reliable information on microgeneration can be found [Palm, 2018]. From 2008 to 2014, the photovoltaic system market in Sweden grew thanks to the introduction of subsidies. However, since 2014, barriers have emerged that have seriously slowed down the pace of microgeneration development in the country, such as an increased administrative burden and difficulties in finding reliable information, including what reliable professional installers are and how much a household will receive when selling electricity in network.

These conclusions are supported by other authors who note that access to reliable information is important [Simpson, Clifton, 2015; Hakon et al., 2018], and the growth of the microgeneration market stimulates the provision of expertise and technical solutions to facilitate the involvement of new households in the microgeneration market [Korsnes, Throndsen, 2021].

Table 1
Factors of considerable importance for the development of microgeneration based on RES

Main factors	Possible instruments of state policy	Effects
Economic incentives such as reduced capital and installation costs	Subsidizing equipment manufacturers	Development of the domestic industrial RES cluster
The prospect of obtaining additional financial benefits	Tax incentives for end consumers	Stimulation of demand for microgeneration based on RES
Availability and reliability of information on microgeneration	Informing about existing economic incentives and opportunities for the use of renewable energy	

According to the results of the study of international experience in table. Table 1 shows the most significant factors that have a significant impact on the development of the microgeneration market based on RES, and possible public policy tools that can stimulate the development of this sector of the economy, ensuring economic growth and achieving carbon neutrality.

2. Instruments for stimulating the development of microgeneration based on RES used in Russia

In December 2019, the Federal Law on Microgeneration №471[3] came into force, establishing the right of any individual or legal entity owning a microgeneration facility to supply excess electricity to the grid. At the same time, the energy sales organization is obliged to buy this electricity.

On March 2, 2021, Decree of the Government of the Russian Federation No. 299 was issued, defining the features of the legal regulation of relations regarding the operation of microgeneration facilities and their interaction with grid and energy retail companies[4].

According to the adopted documents, the owner of the microgeneration facility must perform the actions shown in Fig. 1.

When implementing technological connection, the grid company installs a metering device free of charge - a special bidirectional meter, which should provide hourly measurements of active and reactive energy in AC networks and thanks to which the power supply company will be able to remotely analyze the amount of energy consumed and generated by the microgenerator.

The payment for technical connection for microgeneration facilities is currently preferential and involves a fee only for "paper" in the amount of not more than 7.6 dollars, provided that the distance from the site boundaries to the power grid facilities is no more than 300 m in cities and no more 500 m - in the countryside[5].

The mechanism of operation of the microgeneration facility is based on the fact that the generated electricity is primarily used to cover the load of the consumer, and the part of the electricity that turned out to be “extra” at that moment goes to the external network, which in this case plays the role of an external huge energy storage. Then the consumer at the right time "takes" his surplus on the terms of netting (balancing) or implements it and receives payment for it.

As an supplementary incentive mechanism, in addition to the possibility of reducing the volume of purchased electricity and selling the resulting surplus until 2029, the sale of energy by the owner of a microgeneration facility is not subject to personal income tax (depending on the income of an individual - 13 or 15%).

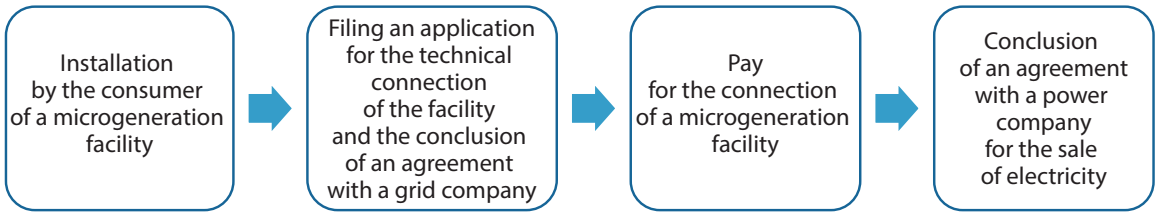
A serious drawback of the implemented mechanism for the development of microgeneration is that it does not apply to apartment buildings.

It was expected that the introduction of the considered mechanism for stimulating microgeneration would lead to its explosive growth. But this did not happen - for the most part due to insufficient awareness of the population about the benefits of this tool.

3. Assessment of the development potential of the microgeneration market in Russia

It is rather difficult to reliably assess the current level of development of the microgeneration market based on RES in Russia, given that all its players are small companies that do not publish their data, and state statistics on commissioning microgeneration facilities is not kept. According to available rough estimates, up to 100 MW of solar power plants were installed in this sector in 2014-2020 (and the domestic market is represented mainly by photovoltaic installations). At the same time, the main volume of commissioned microgeneration based on RES fell on 2020 and amounted to 50–60 MW [Lanshina, 2021]. A large share of this volume

Fig. 1. Procedure for obtaining the microgeneration status



[3] Federal Law No. 471 of December 27, 2019 “On Amendments to the Federal Law “On the Electric Power Industry” in Part of the Development of Microgeneration”. . URL: http://publication.pravo.gov.ru/Document/View/0001201912280019.
[4] Decree of the Government of the Russian Federation from 02.03.2021 No. 299 “On Amendments to Certain Acts of the Government of the Russian Federation in Part of Determining the Peculiarities of Legal Regulation of Relations with the Operation of Microgeneration Facilities”. URL: http://publication.pravo.gov.ru/Document/View/0001202103060015.
[5] Decree of the Government of the Russian Federation from December 27, 2004 No. 861 “On Approval of the Rules for Non-Discriminatory Access to Electricity Transmission Services and the Provision of These Services…”. URL: http://www.consultant.ru/document/cons_doc_LAW_51030/.

is installed at the facilities of legal entities, 10–15 MW fall on individuals[6].

To date, microgeneration in Russia has not yet become widespread, however, the potential of the microgeneration market based on RES is assessed as very significant, despite the fact that there is no understanding of the real scale of the installed capacity of already implemented projects.

According to expert estimates, starting from 2021 and over the next five years, the volume of commissioning of microgeneration based on renewable energy sources in Russia will amount to 150–200 MW per year, and the market turnover will reach about $140 million [Renewable energy market.., 2021]. According to other estimates, RES-based microgeneration can provide an additional 0.6 GW of generating capacity [Khokhlov et al., 2018]. In total, the achievable potential of the microgeneration market based on RES without a negative impact on the energy system is estimated by experts up to 15 GW [Rozhenko, 2018; Losse et al., 2019]. At the same time, the Russian Ministry of Energy expects a slight increase in microgeneration volumes - in the amount of 15–30 MW per year[7].

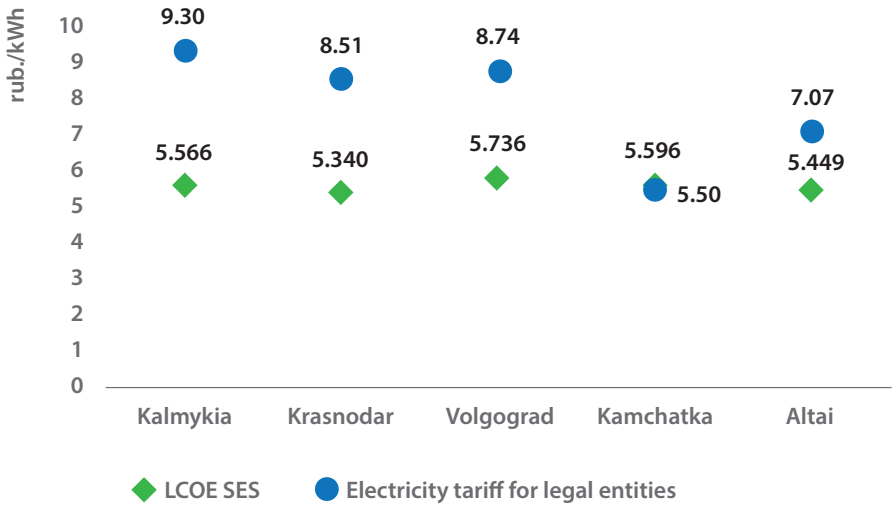
The main growth drivers of the microgeneration market in Russia are the increase in electricity prices and the reduction in the cost of renewable energy equipment. According to the Association of Guaranteed Suppliers and Energy Retail Companies, the total cost of electricity in Russia, depending on the region, is in the range of 0.08–0.15 USD/kWh.[8] By 2025, in some regions, tariffs may increase to $0.2/kWh [Lanshina, 2021]. This encourages consumers of electricity to look for alternatives to energy supply, one of which is the construction of their own microgeneration based on renewable energy sources.

In the Krasnodar Territory, Kalmykia, Altai, Volgograd Region, the price of electricity for small and medium-sized businesses on low-voltage networks is in the region of 0.8–0.12 USD/kWh. And the price of electricity (Levelized Cost of Electricity, LCOE), generated using microgeneration based on photovoltaic cells, according to our estimates, is about 0.08 USD/kWh. In the long term, this gap will only increase due to rising prices for electricity from the energy system and a decrease in the cost of renewable energy equipment (Fig. 2).

Taking into account the noted trends in the domestic market of microgeneration based on RES, additional mechanisms to stimulate its development on the part of the state will be required only if there is an interest in higher rates of decarbonization of the housing and communal services sector and the implementation of an industrial policy aimed at strengthening the Russian sector of the renewable energy industry.

Given that tax incentives for owners of microgeneration are already provided. In order to achieve these goals for decarbonization and ensure economic growth, industrial policy should include the tools to subsidize the domestic renewable energy industry, reduce transaction costs associated with finding bona fide suppliers, as well as informing consumers about advantages of using own microgeneration based on RES.

Fig. 2. Value of solar power and electric power from the grid in Russian regions in 2021



[6] Shakhrai I.S. There is simply no market – it needs to be created (2021). *Kommersant,* 57. URL: https://www.kommersant.ru/doc/4753144.
[7] The sun of our roofs (2021). *Kommersant,* 57. URL: https://www.kommersant.ru/doc/4753266.
[8] Electricity tariff base. URL: https://time2save.ru/calculaters/nereguliruemie-ceni-na-elektroenergiu.

Conclusion

The analysis of the potential for the development of microgeneration based on RES in Russia indicates that this sector can become one of the tools for reducing CO_2 emissions in the housing and communal sector and the Russian economy as a whole. In addition, the use of tools to stimulate the development of the microgeneration market based on renewable energy sources, which have shown their effectiveness in foreign markets, will significantly accelerate the decarbonization of the domestic economy and ensure the economic growth of the national economy.

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About the authors

Lilia K. Babicheva
Analyst, Russia Renewable Energy Development Association (Moscow, Russia).
Research interests: energy transformation of domestic and foreign economies, electricity and power markets, renewable energy sources, photovoltaic, energy storage systems, distributed generation.
lilia.babicheva96@gmail.com

Elena V. Neprintseva
Candidate of economic sciences, associate professor at the Department of Economics and Enterprise Management Moscow State University of Technology "STANKIN" (Moscow, Russia).
Research interests: macroeconomics, industrial policy, antitrust regulation, electricity.
elvin-a@list.ru

Stanislav A. Shubin
Candidate of economic sciences, associate professor at the Department of Management and Innovations of Financial University under the Government of the Russian Federation (Moscow, Russia).
Research interests: electricity and power markets, heat supply and housing and public utilities, industrial policy, antimonopoly regulation.
sashubin@fa.ru

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