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# Chapter 12

## Russian Renewable Energy

### Regulations and outcomes

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# 12
# RUSSIAN RENEWABLE ENERGY
## Regulations and outcomes

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### 1 Introduction

This chapter reviews the development of the legal framework for renewable energy in Russia and discusses the current state of renewable energy in the country. The Russian support scheme for renewable energy is elaborated in detail for both the wholesale and retail energy markets, and the outcomes of the policy are assessed based on the current state of renewable energy in Russia.

Russia has introduced an unusual scheme to promote renewable energy: compensating investments in capacity installed and guaranteeing investors a certain return on their investments. This instrument is known in the literature as a 'capacity-based mechanism' or simply a 'capacity mechanism'. The capacity mechanism also imposes some restrictions and incentives to motivate renewable-energy production and attempts to minimise the cost burden of the subsidies on the taxpayer. Renewable-energy investments in other countries are commonly supported by paying projects for the electricity produced, rather than the installed capacity. The Russian approach has practical relevance from the policymakers' perspective because, in contrast to conventional power plants that can be operated non-stop to produce electricity, many forms of renewable energy are not able to guarantee production on command. Paying for actual electricity production encourages investors to select appropriate sites for renewable energy generation. However, the Russian case demonstrates that renewables can also be supported through installed capacity.

In this chapter, we review the academic literature on Russian renewable energy policy, present a short overview of the various changes in policy and analyse the outcomes of the policy in terms of the current state of renewable energy in Russia, paying particular attention to the effect of the capacity mechanism.

### 2 Existing research on renewable energy in Russia

In this section, we provide an overview of studies focusing on both the regulatory aspects of renewables and on the investment climate for renewable energy in Russia. We cover mainly the period 2008–2019, as the legal framework for renewables in Russia changed significantly during that period, and the older literature is not so relevant any more. However, we also touch on some of the older works that are of particular interest.

The significant potential for renewable energy in Russia has been highlighted repeatedly in the literature. Among the early studies, Martinot[1] analysed market barriers for broad renewable-energy deployment in Russia and emphasised the importance of institutional incentives and market intermediation. Later, Martinot outlined and discussed business models for renewable energy that are also competitive without financial support, such as hybrid wind-diesel and biomass power plants for small settlements.[2] Joint ventures with foreign corporations are presented as tools to overcome some existing barriers and facilitate knowledge and technology transfer.[3]

In their book, Overland and Kjaernet[4] explore the potential for international cooperation in Russia's renewable-energy sector, focusing mostly on EU-Russian and Nordic-Russian partnerships. Based on extensive data gathered through interviews and field trips, the book presents a thorough analysis of both Russian strengths in the renewable-energy sector and barriers to the sector's development in Russia.

The first in-depth analysis of the Russian capacity mechanism is based on the pre-enactment legislative draft and was carried out by Boute,[5] who at the time of writing acted as a legal adviser to the Russia Renewable Energy Program of the International Finance Corporation/World Bank. His article highlights the uniqueness of the choice to support renewable energy through *capacity* remuneration rather than by supporting electricity *output*, as is common in other support schemes around the world. Boute shows that the capacity-based approach possesses stand-alone benefits, including more predictable cash flows for the investors and a reduced incentive to supply electricity to the grid during periods of low demand.

Boute warns of the potential problems of a capacity-based mechanism with regard to properly accounting for the typically variable electricity output from renewable energy projects. Conventional energy power plants can produce electricity throughout the year, whereas wind and solar power are dependent on the weather. Capacity-based support should be adjusted so that it does not favour the construction of renewable energy projects in locations with low resource availability or the building of plants that are left idle, leading to the waste of taxpayers' money. In this vein, Boute reviews the international experiences of how the variable electricity output of renewable energy has been handled in different capacity markets.

After the introduction of the law governing the Russian renewable-energy support mechanism for the wholesale market in 2013, the scholars showed a growing interest in Russian renewable-energy policy, and the volume of research surged (Figure 12.1).

1 'Energy efficiency and renewable energy in Russia: Transaction barriers, market intermediation, and capacity building' (1998) 26(11) *Energy Policy* 905

2 E. Martinot. 'Renewable energy in Russia: Markets, development and technology transfer' (1999) 3(1) *Renewable and Sustainable Energy Reviews* 49; Indra Overland. 'The Siberian Curse: A blessing in disguise for renewable energy?' (2010) 9(2) *Sibirica* 1

3 E. Martinot, 'Renewable energy in Russia: Markets, development and technology transfer' (1999) 3(1) *Renewable and Sustainable Energy Reviews* 49

4 *Russian Renewable Energy: The Potential for International Cooperation* (Routledge, 2009)

5 'Promoting renewable energy through capacity markets: An analysis of the Russian support scheme' (2012) 46(0) *Energy Policy* 68

In his book,[6] Boute presents a comprehensive overview and analysis of Russian electricity and energy-investment law. Vasilieva et al.[7] analyse the effect of the renewable-energy support mechanism on the prices of electricity and capacity in Russia and show that the effect is modest.

A description of the Russian capacity mechanism is provided by Kozlova and Collan,[8] who provide the first comprehensive presentation of the renewable-energy capacity price calculation procedure published in English. The paper presents the results of a numerical analysis of the effect of the Russian capacity mechanism for renewable energy investments on investment profitability. The results of this analysis indicate that the mechanism can reduce market risks for investors. The paper also discusses the requirements of the mechanism that steer investments towards capital costs control and the limits that the mechanism has on paying out subsidies. The capacity mechanism is crucial to enable renewable-energy investments at the wholesale market level as, without support, these investments would be unprofitable.[9]

Smeets[10] analyses the first two-year period of factual implementation of the capacity mechanism. The evidence suggests that investors were reluctant to offer wind-power projects in the first capacity auctions, whereas solar PV projects were offered actively. The reasons proposed by Smeets for the reluctance to offer wind-power investments include: (i) lack of local wind-turbine manufacturing facilities, which makes it impossible to meet the local

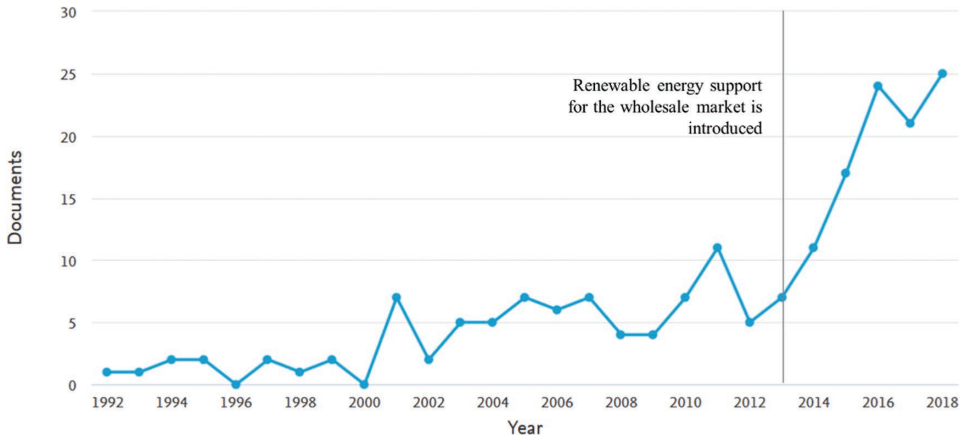


*Figure 12.1* Documents per year in Scopus, TITLE-ABS-KEY (“renewable energy” AND Russia AND (policy OR law OR investment))[a]

*Source*: Scopus bibliography statistics, modified by authors.

a SCOPUS bibliography statistics, modified by authors

6 *Russian Electricity and Energy Investment Law,* Volume 65 (Brill, 2015)

7 Evgeniia Vasileva et al., ‘RES support in Russia: Impact on capacity and electricity market prices’ (2015) 76(0) *Renewable Energy* 82

8 ‘Modeling the effects of the new Russian capacity mechanism on renewable energy investments’ (2016) 95 *Energy Policy* 350

9 Mariia Kozlova, Mikael Collan and Pasi Luukka, ‘Russian mechanism to support renewable energy investments: before and after analysis’ in P. Diez et al. *Computational Methods and Models for Transport. Computational Methods in Applied Sciences, Vol. 45* (Springer, 2017) 243

10 ‘Similar goals, divergent motives. The enabling and constraining factors of Russia’s capacity-based renewable energy support scheme’ (2017) 101 *Energy Policy* 138

content requirement of the capacity mechanism; (ii) depreciation of the rouble, which made the foreign share of capital costs too expensive; (iii) the possible bias of the design of the support mechanism in favour of solar power (the latter was shown not to be the case by the results of the four subsequent capacity auctions discussed in this chapter). Smeets[11] also shows that both the wind and solar projects selected through the auctions were later delayed.

The monograph by Boute[12] also covers the first two-year period of the implementation of the capacity mechanism. The limited success of the first auction is explained by the short timespan between the activation of the support mechanism and the auction, which left insufficient time for investors to prepare the required documentation. This study suggests that another reason for the partial failure of the two first auctions was simply the lack of investor confidence in the new scheme.

Lanshina et al.[13] emphasise the continuing gap between regulation and implementation of renewable-energy support in Russia, arguing that this is because fossil fuels constitute the main revenue of the Russian government and, thus, have priority for the Russian authorities. However, Smeets[14] argues that Russia's intention to remain an important energy exporter was a driving force for the development of the renewable-energy sector. Here there is an interesting parallel to the Arab Gulf states, though the Arabs went much further in the development of renewable energy than the Russians.[15] The United Arab Emirates, in particular, launched some of the world's largest solar-power projects, helping drive down the price of solar panels globally.[16]

Unlike the capacity mechanism, the electricity tariff scheme for retail markets introduced in Russia in 2015 has not received much academic attention. Boute[17] discusses the role of the regional authorities in developing renewable energy and analyses the barriers in the regulatory framework, one of them being the centralisation of political power. Boute[18] briefly reviews the legal prerequisites for the implementation of the scheme. Kozlova et al.[19] concisely present the newly introduced scheme and highlight the differences and similarities it has with the capacity mechanism. No detailed qualitative or quantitative studies have been carried out that focus on the retail-market support mechanism.

Finally, Russia has been found to have substantial renewable-energy potential, especially in remote areas where renewables are profitable without any support, mostly because they can function as substitutes for fossil fuels that must be transported great distances in small

11 ibid

12 *Russian Electricity and Energy Investment Law* (Volume 65 Brill, 2015)

13 'The slow expansion of renewable energy in Russia: Competitiveness and regulation issues' (2018) 120 *Energy Policy* 600

14 'The Green Menace: Unraveling Russia's elite discourse on enabling and constraining factors of renewable energy policies' (2018) 40 *Energy Research & Social Science* 244

15 A. H. Almasoud and Hatim M. Gandayh, 'Future of solar energy in Saudi Arabia' (2015) 27 *Journal of King Saud University – Engineering Sciences* 153

16 M. Jamil, Farzana Ahmad and Y. J. Jeon. 'Renewable energy technologies adopted by the UAE: Prospects and challenges – A comprehensive overview' (2016) 55 *Renewable and Sustainable Energy Reviews* 1181; Sgouris Sgouridis et al. 'RE-mapping the UAE's energy transition: An economy-wide assessment of renewable energy options and their policy implications' (2016) 55 *Renewable and Sustainable Energy Reviews* 1166

17 'Renewable energy federalism in Russia: Regions as new actors for the promotion of clean energy' (2013) 25(2) *Journal of Environmental Law* 261–291

18 *Russian Electricity and Energy Investment Law* (Volume 65 Brill, 2015)

19 'Renewable energy in emerging economies: Shortly analyzing the Russian incentive mechanisms for renewable energy investments' (International Research Conference 'GSOM Emerging Markets Conference – 2015: Business and government perspectives' Saint Petersburg, Russia 2015)

volumes at a high cost.[20] Boute[21] reviews the legal framework for supporting renewables in remote areas and focuses on hybrid wind and solar-diesel power in the Russian Arctic. Based on his review of the international experience and compatibility with Russian law, he suggests several alternative support mechanisms. Centralised policy coordination is noted to be an important requirement for such support.

## 3 Russian renewable-energy law and support mechanisms overview

Russia introduced a renewable-energy development strategy in 2009 (Energy Strategy of Russia to 2030).[22] The strategy sets a target of producing 4.5 per cent of electricity from renewable energy sources by 2020. The first real steps towards this target were taken four years later, with the introduction of the renewables support mechanism for the wholesale market.[23] Prior to this, the strategy was considered a failure.[24] However, two years later, amendments to the support scheme were introduced, triggering new investments in renewable energy.[25]

The Russian government also introduced a renewable-energy support scheme for retail markets.[26] This scheme provides a central tariff calculation methodology and delegates the responsibility for supportive measures to the regional energy authorities. The first two years after it was introduced, there were no projects under the scheme.[27] One reason given was the reluctance of the regional energy authorities to work out the regulatory framework for the support-mechanism procedures and formulate the actual contracts that would guarantee investors the promised tariff payments. However, by the end of 2018 there have been a couple of dozen small projects implemented under this scheme, however, their contribution to the overall Russian energy system is negligible.[28]

For all practical purposes, there has been no centralised support mechanism for renewable energy projects in remote areas and isolated energy systems.[29] This makes some sense insofar as renewable energy should be commercially viable without special support mechanisms in many areas. Conversely, a support mechanism could still be useful to help get the ball rolling on renewable-energy developments across Russia's vast northern and eastern

20 P. Lombardi et al., 'Isolated power system in Russia: A chance for renewable energies?' (2016) 90 *Renewable Energy* 532; Z. B. Namsaraev, A. M. Konovalov and G. V. Baturova. 'Study of feasibility of local renewable resources for substitution of fossil fuels in the Far North of Russia' (IOP Conference Series: Earth and Environmental Science, IOP Publishing, 2018) 012022; Indra Overland. 'The Siberian Curse: A blessing in disguise for renewable energy?' (2010) 9(2) *Sibirica* 1

21 'Off-grid renewable energy in remote Arctic areas: An analysis of the Russian Far East' (2016) 59 *Renewable and Sustainable Energy Reviews* 1029

22 8 January 2009 Resolution #1-r on the main directions for the state policy to improve the energy efficiency of the electricity sector on the basis of renewable energy sources for the period up to 2020

23 28 May 2013 Decree #449 on the mechanism of promoting the use of renewable energy in the wholesale market of electric energy and power 2013

24 Anatole Boute, *Russian Electricity and Energy Investment Law* (Volume 65 Brill, Boston 2015)

25 10 November 2015 Decree #1210 on the introduction of amendments to the certain legislative acts regarding the use of renewable energy sources in the wholesale electricity and capacity market 2015

26 23 January 2015 Decree #47 on amendments to some legislative acts of the Russian Federation on promotion of use of renewable energy sources in retail electricity markets 2015

27 A. Zhiharev, 'Renewable energy support on retail markets: Wake-up call' (in Russian). (2017) report by VYGON Consulting 36

28 Tatiana A. Lanshina et al. 'The slow expansion of renewable energy in Russia: Competitiveness and regulation issues' (2018) 120 *Energy Policy* 600

29 Anatole Boute. 'Off-grid renewable energy in remote Arctic areas: An analysis of the Russian Far East' (2016) 59 *Renewable and Sustainable Energy Reviews* 1029

territories. Such developments could, in turn, provide the basis for embryonic markets for renewable-energy equipment and services, which could later be built on as renewable energy spreads to the rest of the country.[30] Nevertheless, some regions have taken the matter into their own hands, developing local renewables by either supporting them with regional funds released from diesel purchasing[31] or by implementing over-sophisticated financing mechanisms for energy performance contracting.[32]

### *3.1 Wholesale market support*

The support mechanism for the wholesale market introduced in 2013[33] differs from renewable energy support schemes in the rest of the world. The Russian scheme originates in the capacity trading system of the Russian energy market. Unlike the electricity-only markets that most countries have, Russia has two commodities in one market, electricity and capacity. By selling capacity, electricity producers pledge that their plants will be available to produce electricity in the future. All wholesale market electricity buyers are obliged to buy a certain amount of capacity corresponding to their peak consumption. This way of organising the market allows for stability in electricity prices, and provides more reliability to the short and long-term electricity supply by providing less risky revenues for investors. Some other countries organise their markets in a similar way,[34] and some of these markets have adopted rules for allowing renewables to participate in the capacity trade.[35] However, the Russian case is the first one in which the capacity trade principle has been used as the foundation for creating a renewable-energy support scheme, rather than supporting renewables with other schemes and simultaneously trying to integrate them into capacity trade as in other jurisdictions.

In the Russian system, planned investment projects are submitted as bids to capacity auctions. The mechanism was set up to conduct annual capacity auctions during the seven-year period 2013–2019. Each auction is used as a mechanism to select the renewable-energy capacity to be installed for the coming four-year period. A total of over 7GW of renewable-energy capacity was planned for construction in Russia by 2024, including 4.4GW of wind power, 1.8GW of solar power and 0.9GW of small hydro power. Selected projects were to benefit

30 Indra Overland. 'The Siberian Curse: A Blessing in Disguise for Renewable Energy?' (2010) 9(2) *Sibirica* 1

31 Margarita Nifontova. 'Vozobnovlyaemaya energetika Yakutii, uravnenie so vsemi izvestnymi [Renewables of Yakutia, equation with all known]' (2019) www.1sn.ru/225334.html

32 N. Zhabin. 'Kamchatka planiruet sozdat' energouzel iz malyh GES na vostoke poluostrova [Kamchatka is planning to create a hydropower generation center in the East of the peninsula]' *neftegaz.ru* (2019) https://neftegaz.ru/news/energy/194234-kamchatka-planiruet-sozdat-energouzel-iz-malykh-ges-na-vostoke-poluostrova

33 28 May 2013 Decree #449 on the mechanism of promoting the use of renewable energy in the wholesale market of electric energy and power 2013

34 Christian Held and Jan Ole Voss. 'Legal limits for electricity capacity markets in the EU and Germany' (2013) 4 *Renewable Energy Law and Policy Review* 245; Benjamin F. Hobbs et al. 'A dynamic analysis of a demand curve-based capacity market proposal: The PJM reliability pricing model' (2007) 22(1) *IEEE Transactions on Power Systems* 3–14; B. Tennbakk et al. 'Capacity mechanisms in individual markets within the IEM' (2013) https://ec.europa.eu/energy/sites/ener/files/documents/20130207_generation_adequacy_study.pdf

35 Sergio Botero, Felipe Isaza and Adriana Valencia. 'Evaluation of methodologies for remunerating wind power's reliability in Colombia' (2010) 14(7) *Renewable and Sustainable Energy Reviews* 2049; Cynthia Bothwell and Benjamin F. Hobbs. 'Crediting wind and solar renewables in electricity capacity markets: The effects of alternative definitions upon market efficiency' (2017) 38 (*KAPSARC Special Issue*) *The Energy Journal*; Seyed Hossein Madaeni, Ramteen Sioshansi and Paul Denholm. 'Comparing capacity value estimation techniques for photovoltaic solar power' (2013) 3(1) *IEEE Journal of Photovoltaics* 407

from capacity payments for 15 years. The selection criterion in the auction is based on investment cost, and only the lowest investment cost projects are selected for subsidisation. Investment cost limits are set for each technology separately. The projects are obliged to use a prespecified share of locally produced equipment; this is called a localisation requirement. In the case of a project failing to fulfil the localisation requirement, the subsidy is to be substantially reduced, possibly making the investment unprofitable.[36]

However, if a project shows compliance with the rules and high performance, its profitability is secured even in the presence of a changing market. The remuneration in terms of capacity price is aimed at a 12 per cent return on investment. The compliance is checked for each project individually, project-specific factors include the project investment costs, localisation of equipment and an annually checked electricity-production performance (the capacity factor). If the average achieved capacity factor is lower than the pre-set target, the remuneration amount for that year is lowered. The critical capacity factor levels are 20 per cent for wind, 10 per cent for solar and 28 per cent for small hydro. This way, the capacity mechanism incorporates the variability of electricity production into the capacity-based support instrument. The capacity price is also annually adjusted based on electricity price variation, inflation and interest rates. This trait of the capacity mechanism reduces market risk for investors, but also ensures the cost-efficiency of the policy by avoiding over-subisidisation during favourable times.

In the first version of the mechanism, the requirements for small hydro and wind power appeared to be too strict. Few projects were offered in the first auctions. To solve this problem, the government introduced amendments with relaxed investment-cost limits and localisation requirements for small hydro and wind power projects.[37]

The next section studies the outcome of the implementation of the Russian support scheme for renewable energy investments and, in particular, the effects of the aforementioned amendments.

### *3.1.1 Retail markets support*

The capacity trade is limited to the wholesale market; therefore, another support mechanism had to be developed for the retail level. The tariff scheme that was introduced is a combination of a feed-in tariff scheme (in which projects are remunerated per unit of electricity produced), a tendering scheme (in which projects compete for funds) and a capacity mechanism (which is embedded in the tariff calculation and guarantees a certain return on investment).[38]

Demand for electricity generated from renewable sources is supported by obliging the electricity-distribution companies to compensate losses in the grid, primarily by using renewable-energy sources. Another principle of the scheme is that the tariff applied varies by region, as it is calculated based on competing investment costs and electricity-production performance. The rate of return on investment, and thus tariff in monetary terms, is calculated by taking the minimum of the pre-set limit and the project-specific planned investment costs. A similar principle is applied to the capacity factor; the maximums of the

36 Mariia Kozlova and Mikael Collan. 'Modeling the effects of the new Russian capacity mechanism on renewable energy investments' (2016) 95 *Energy Policy* 350

37 10 November 2015 Decree #1210 on the introduction of amendments to the certain legislative acts regarding the use of renewable energy sources in the wholesale electricity and capacity market 2015

38 23 January 2015 Decree #47 on amendments to some legislative acts of the Russian Federation on promotion of the use of renewable energy sources in retail electricity markets 2015

pre-set capacity factor and a planned project-specific capacity factor are used. This feature potentially accounts for differences in investment profitability due to differing access to equipment-manufacturing facilities and the availability of renewable resources in different locations.

An important feature of this scheme is that it supports only wind, solar PV and small hydro investments. The regional tariffs are designed for a wider variety of renewable energy sources, also including geothermal, biomass and some other forms of renewable energy.

Although the overall principles and the tariff-calculation methodology are established by central laws, the implementation of the scheme is delegated to the regional authorities. This is both an enabling[39] and a constraining factor.[40] The regional authorities can potentially develop renewable-energy more effectively than the central authorities because they have a more direct interest in local economic and technological development.[41] However, the lack of a more detailed regulatory framework and support procedures at the regional level is one reason for the slow implementation of the scheme[42]

## 4 Current situation of renewable energy in Russia

In this section, we present the outcome of Russian renewable-energy regulation in terms of existing and planned renewable energy projects. First, we discuss the results of the capacity auctions, followed by some data on all the operational renewable energy projects in Russia.

### *4.1 Renewable energy projects on the wholesale market*

The capacity mechanism discussed above enabled renewables to enter the Russian electricity wholesale market. The results of the capacity auctions reflect the growing role of renewables in the wholesale market and the success of the scheme. However, the specific annual targets for renewable-energy capacity to be built have not been reached as originally planned (see Table 12.1).

Approximately 90 per cent of the targeted renewable energy capacity has been selected in the auctions, with an 80 per cent shortfall for small hydro, a 10 per cent shortfall for wind and a 20 per cent overshoot of the target for solar power. Underperformance was concentrated in the first auctions (2013–2014) and was due to the short time available to prepare for the first auction after the announcement of the support mechanism in 2013 and, as mentioned above, overly strict cost limits and localisation requirements for wind and small hydro power, which were relaxed just before the 2015 auction.

Solar projects have benefited from the existence of domestic manufacturers, making it easier to meet local content requirements[43] and, therefore, reach the targets in 2015. The situation for wind power and small hydro is different. It appears that the capital cost limits

39 Anatole Boute. 'Renewable energy federalism in Russia: Regions as new actors for the promotion of clean energy' (2013) 25(2) *Journal of Environmental Law* 261–291

40 A. Zhiharev, 'Renewable energy support on retail markets: wake-up call' (in Russian). VYGON Consulting (2017)

41 Anatole Boute. 'Renewable energy federalism in Russia: Regions as new actors for the promotion of clean energy' (2013) *Journal of Environmental Law*

42 A. Zhiharev, 'Renewable energy support on retail markets: wake-up call' (in Russian). VYGON Consulting (2017)

43 Niels Smeets. 'Similar goals, divergent motives. The enabling and constraining factors of Russia's capacity-based renewable energy support scheme' (2017) 101 *Energy Policy* 138

*Table 12.1* Renewable-energy capacity targeted and auctioned by the planned years of commercialisation

| *Type* | *Capacity* | *2014* | *2015* | *2016* | *2017* | *2018* | *2019* | *2020* | *2021* | *2022* | *2023* | *2024* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wind | target, MW | 100 | 250 | 250 | 500 | 750 | 500 | 500 | 500 | 500 | 500 | 76 | ***3600**** |
| | auctioned, MW | 0 | 0 | 50 | 90 | 200 | 509 | 640 | 738 | 530 | 498 | 71 | **3326** |
| | auctioned, % | 0 | 0 | 20 | 18 | 27 | 102 | 128 | 148 | 106 | 100 | 94 | **92** |
| Solar | target, MW | 120 | 140 | 200 | 250 | 270 | 270 | 270 | 163 | 163 | 0 | 0 | ***1520*** |
| | auctioned, MW | 35 | 140 | 199 | 255 | 285 | 309 | 295 | 178 | 163 | – | – | **1858** |
| | auctioned, % | 29 | 100 | 100 | 102 | 106 | 114 | 109 | 109 | 100 | – | – | **122** |
| Hydro | target, MW | 18 | 26 | 124 | 124 | 141 | 159 | 159 | 36 | 36 | 36 | 0 | ***751*** |
| | auctioned, MW | 0 | 0 | 0 | 21 | 0 | 50 | 16 | 25 | 33 | 24 | – | **168** |
| | auctioned, % | 0 | 0 | 0 | 17 | 0 | 31 | 10 | 70 | 93 | 67 | – | **22** |
| Total | target, MW | 238 | 416 | 574 | 874 | 1161 | 929 | 929 | 698 | 698 | 536 | 76 | ***5871*** |
| | auctioned, MW | 35 | 140 | 249 | 366 | 485 | 867 | 951 | 941 | 726 | 521 | 71 | **5352** |
| | auctioned, % | 15 | 34 | 43 | 42 | 42 | 93 | 102 | 135 | 104 | 97 | 94 | **91** |

*Source*: Computed by the authors based on publicly available results of the renewable energy auctions)[a]

a Total target installed capacity is less than the sum of annual target volumes, it is the initially set objective of the policy according to the *Government of Russian Federation 28 May 2013 Resolution #861-r on amendments being made to Resolution #1-r 8.01.2009 on the main directions for the state policy to improve the energy efficiency of the electricity sector on the basis of renewable energy sources for the period up to 2020* (2013). The annual target volumes for later auctions were pushed higher to compensate for under-selection of earlier auctions.

and localisation requirements were too strict for these technologies initially.[44] Only after the aforementioned amendments in 2015[45] were more projects offered in auctions. This resulted in reaching the targets for installed wind capacity as from 2019 and an increase in installed small hydro as from 2021. The reason for the later fulfilment of the small hydro targets is the longer lead times for their design and construction.

It is also important to understand what happens at the auctions. How many, how big and by whom were the bids? We start the discussion by looking at the average size of the projects submitted in different years; see Figure 12.2.

The first auction saw relatively small projects. From the investor perspective, it made sense to first test the new and unfamiliar system with smaller projects and tie up less capital. As they gained confidence, investors proposed increasingly large-scale projects. The average capacity has had a steady upward trend over the years, except for the last auctions in 2018 and 2019. A number of factors, including the chosen site and land limitations, electricity demand, grid conditions, and so on, affect project size. The decreased average size of the projects proposed in 2018 and 2019 could be a sign that the various factors are reaching an equilibrium. With respect to wind-power investments, there were 19 relatively large projects of 38–39 MW each, but also six projects of 20 MW and one smaller 10 MW wind farm selected in 2018 and one huge 71 MW project in 2019. The size of solar power projects in the same year varies from 5–24 MW. The comparatively small size of hydro power projects

44 ibid

45 10 November 2015 Decree #1210 on the introduction of amendments to the certain legislative acts regarding the use of renewable energy sources in the wholesale electricity and capacity market 2015

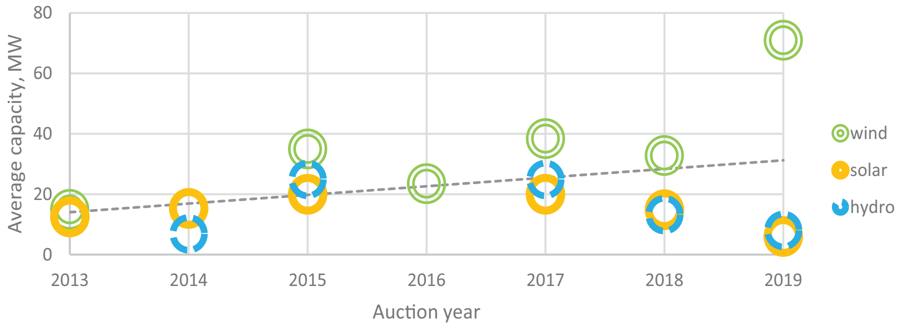


*Figure 12.2* Average capacity of projects per auction year

*Source*: Computed by the authors based on the publicly available results of the renewable energy auctions, available at: Trading System Administrator, 'Renewable energy auction results' (available only in Russian) www.atsenergo.ru/vie/proresults/index.htm

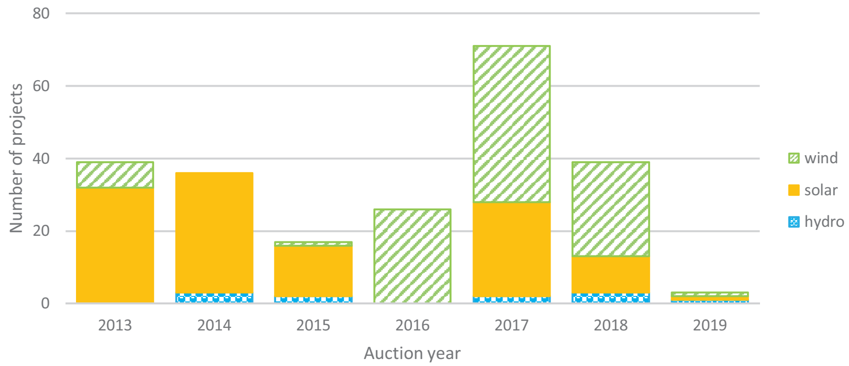


*Figure 12.3* Number of projects per auction year

*Source*: Computed by the authors based on the publicly available results of the renewable energy auctions, available at Trading System Administrator, 'Renewable energy auction results' (available only in Russian) www.atsenergo.ru/vie/proresults/index.htm

could be explained by the fact that they are proffered by companies that are new to the capacity auctions and are testing the waters. Often, a company will offer several projects in an auction, representing the consecutive construction stages of one larger, renewable-energy power plant.

The breakdown of the auction results by the number of selected bids indicates that there is great year-to-year variability in the volumes and types of projects; see Figure 12.3.

There are years with zero projects of a certain kind. For hydro and wind power, this can indicate that the requirements for capital costs and localisation are too strict. For solar, the opposite is the case; an overly successful auction the preceding year causes the administrator to restrict participation because the (longer-term) target capacity has already been reached. Only one project with each technology type was selected in the last 2019 auction, as the target capacities for the later years of the scheme had already been fulfilled.

Figure 12.4 shows the number of companies that participated in the capacity auctions. In total, about 20 different companies have participated in the scheme with the majority of them being involved in the solar-power sector. The entire list of companies and their shares in terms of total selected capacity are presented in Table 12.2.

The Russian wind-power sector is made up of a mix of Russian state-owned companies, foreign investors and Russian–foreign partnerships. The market leader is the Finnish company Fortum, followed by the Russian company VetroOGK (which along with VetroOGK-2 is part of the ROSATOM Group, which is mainly engaged in nuclear power). Vetroparki FRV is a joint company created by Fortum and RUSNANO, and it won capacity agreements for 24 wind farm projects with a combined capacity of 823 MW in the 2018 auction. The secret of their success is the achievement of the local content requirement and lower capital costs. This was made possible by a new Russian wind-turbine manufacturer founded by a partnership of RUSNANO and the Danish company Vestas,[46] the world's leading wind turbine manufacturer.[47] The wind farms are to be commissioned during the period 2019–2023. Both ROSATOM and RUSNANO are government-owned companies. Another entrant in the Russian wind-tech manufacturing market is German–Spanish Siemens Gamesa

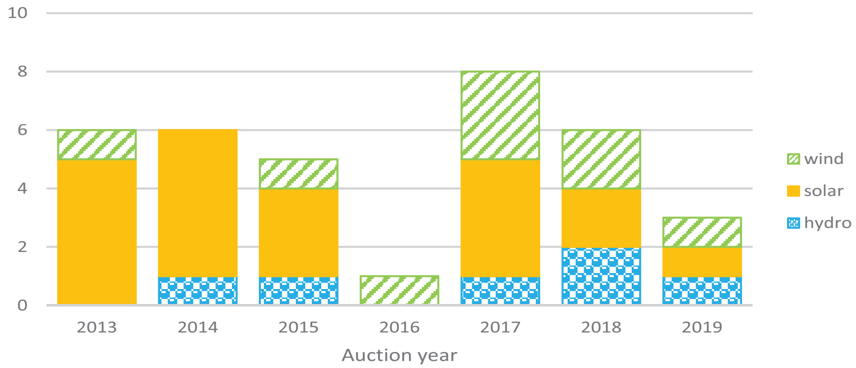


*Figure 12.4* Number of companies per auction year

*Source*: Computed by the authors based on the publicly available results of the renewable energy auctions[a]

*Table 12.2* List of companies that have participated in the auctions

| *Technology type* | *Companies* | *Origin* | *Share of the auctioned capacity of that technology type, %* |
|---|---|---|---|
| Wind | Fortum energy | Finland | 30 |
| | VetroOGK | Russia | 29 |
| | Vetroparki FRV | Russia & Finland | 25 |
| | Enel Rossia | Italy | 11 |
| | KomplexIndustriya | Russia | 3 |
| | VetroOGK-2 | Russia | 1 |
| | Fortum | Finland | 1 |

(*Continued*)

46 RUSNANO. 'Fond ROSNANO i Fortum poluchil pravo stroitelstva 823 MW vetrogeneracii [Fund of RUSNANO and Fortum received the right to construct 823 MW of windpower]' Press release (2018)

47 REN21, 'Renewables 2018 Global Status Report' (2019) www.ren21.net/wp-content/uploads/2018/06/17-8652_GSR2018_FullReport_web_-1.pdf

| *Technology type* | *Companies* | *Origin* | *Share of the auctioned capacity of that technology type, %* |
|---|---|---|---|
| Solar | Avelar Solar Technology | Russia | 25 |
| | Green Energy Rus | Kazakhstan | 16 |
| | MRC Energoholding | Russia | 13 |
| | Solar Systems | China | 12 |
| | T Plus | Russia | 11 |
| | KomplexIndustriya | Russia | 11 |
| | Fortum | Finland | 6 |
| | Kremnievye tehnologii | Russia | 4 |
| | Orenburgskaya generirujushaya kompaniya | Russia | 1 |
| | MEK-Engineering | Russia | 0.6 |
| | Krasnoyarskaya GES | Russia | 0.3 |
| Hydro | RusHydro | Russia | 42 |
| | NGBP | Russia | 30 |
| | Juzhenergostroy | Ukraine | 14 |
| | EnergoMIN | Russia | 10 |
| | EvroSibEnergo-Gidrogeneracia | Russia | 5 |

*Source*: Computed by the authors based on the publicly available results of the renewable energy auctions[a]

a Trading System Administrator. 'Renewable energy auction results (Available only in Russian)' atsenergo.ru/vie/proresults/index.htm

(the world's second-largest wind turbine manufacturer),[48] which won its first Russian contract to supply wind turbines for the Russian projects of Italian company Enel in 2017.[49]

In terms of the timeline, the first mover was KomplexIndustriya with a total 105 MW of wind-power projects offered in the 2013 auction. The second mover was Finnish Fortum, which seemingly tested the support scheme with 35 MW in 2015 and then offered a whopping 1,000 MW in 2017. The rest of the wind projects were submitted in the period 2016–2018.

A quarter of the solar power market is in the hands of Avelar Solar Technology, a subsidiary of the largest Russian solar panel manufacturer, Hevel Solar, founded by politician Anatoly Chubais and businessman Viktor Vekselberg, both Russian. Foreign investors involved in the Russian solar sector include Solar Systems founded by the Chinese Amur Sirius Power Equipment, Kazakh Green Energy and Finnish Fortum. A large Russian manufacturer of transformer stations and other electrical equipment, ElectronMash, which has been supplying electrical equipment to the solar projects of Avelar and the wind projects of Vetroparki FRV, is now constructing a solar-panel manufacturing plant.[50]

48 ibid

49 Siemens Gameza. 'Press release: Siemens Gamesa enters Russia with its first order for 90-MW Enel wind farm' (2018) https://www.siemensgamesa.com/newsroom/2018/10/20181005-enters-russia-with-its-first-order-for-90-mw-enel-wind-farm

50 Aleksey Dmitriev. 'Solnechnaya ekonomika. Peterburgskiy Electronmash zapuskaet proizvodstvo ustanovok solnechnyh elektrostanciy [Solar economy. Saint Petersburg's Electronmash starts manufacturing solar panels]' dp.ru (2018) https://www.kommersant.ru/doc/3306333

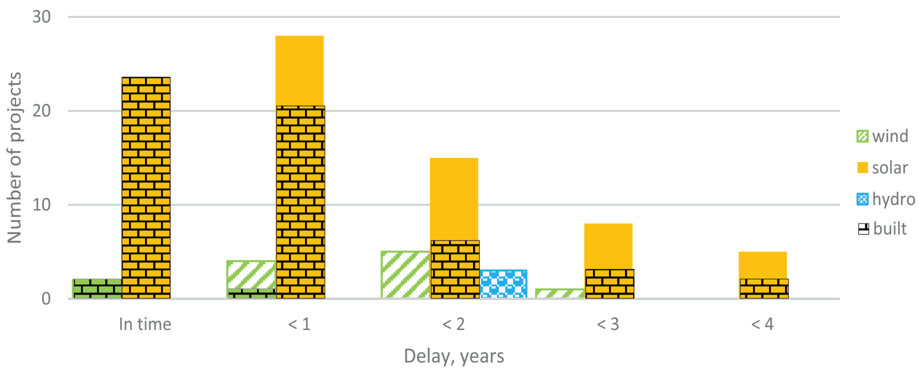


*Figure 12.5 Delays in commissioning renewable energy projects*

*Source*: Computed by the authors based on the publicly available results of the renewable energy auctions[a] and the registry of constructed projects[b]

a Trading System Administrator. 'Renewable energy auction results (available only in Russian)' <www.atsenergo.ru/vie/proresults/index.htm>

b NP Market Council. 'Vozobnovlyaemye istochniki energii. Perechen' kvalificirovannyh ob'ektov (Renewable energy sources. The list of the qualified objects)' <https://www.np-sr.ru/ru/market/vie/index.htm>

The bids for solar power projects are more evenly distributed among different companies than the bids for wind and hydropower projects, with the first two auctions receiving bids from five companies each (Figure 12.4).

Small hydro is the smallest renewable energy type in terms of installed capacity (see Table 12.1) and is represented by three Russian companies and one Ukrainian company. RusHydro and NGBP started to participate in the auctions early, in 2014 and 2015. Yuzhenergostroy and EnergoMIN entered the arena in 2018.

These results concern the auctioned renewable-energy projects. Many of them were to start delivering electricity to the grid by 2020. The list of renewable energy projects qualified by the Russian energy authorities[51] reveals substantial delays in the building of the power plants. Only 60 per cent of projects that were supposed to have been built were completed as of January 2020. Figure 12.5 shows the breakdown of the projects in terms of length of delay. The brick pattern indicates already-built projects, whereas the others are still not constructed as of January 2020.

Only 25 per cent of all planned projects were built on time and in accordance with the initial submission dates. The projects that have been constructed on time are the 19 solar projects of Avelar Solar Technology, 3 of T Plus and 1 belonging to Orenburgskaya generiruyushaya kompaniya. Even if the capacity auctions were quite successful for solar power generation, some companies have struggled to realise their plans. Komplexindustriya has not even started the construction of its solar-power projects in the Belgorod and Lipetsk regions, which were originally scheduled for completion in 2015–2016. Possible reasons behind these delays are poor planning of projects and unachievable, overly ambitious low capital costs.[52] In total, 31 solar projects have been built with delays, and 25 have not been built. Three

51 NP Market Council. 'Vozobnovlyaemye istochniki energii. Perechen' kvalificirovannyh ob'ektov [Renewable energy sources. The list of the qualified objects]' https://www.np-sr.ru/ru/market/vie/index.htm

52 Alexander Chizhenok. 'KomplexIndustriya pogasla v Lipecke i Belgorode [KomplexIndustriya faded out in Lipeck and Belgorod]' Komersant (2017) https://www.kommersant.ru/doc/3306333

small hydro power stations by RusHydro were planned to start operating in 2017 and were yet to be built as of January 2020. This was surprising given that RusHydro is a large and well-established actor, and the technology is well-known and simple. Two 25 MW wind projects by Fortum have been built on schedule and one 35 MW project with a minor delay, whereas 7 Komplexindustriya projects planned to start in 2016–2017 still had not been launched as of January 2020. The local media reported that the company was planning to sell the rights to build these windfarms. From 2019, the owner of these rights had to start paying monthly delay fees.[53]

The messy documentation of project implementation makes it difficult to get an overview.[54] In some cases, the owner of a power plant changes during the construction period and so a new one is specified in the list of built projects, but such changes reflect reality. However, errors in some project specifications, e.g., titles and in some cases even identification numbers, make it unnecessarily difficult to get an overview of the situation. Surprisingly, the list of completed renewable energy power plants includes 18 solar projects with a combined capacity of 235 MW that were never selected through the capacity auctions for the specified regions, though they have been assigned ID numbers under the capacity mechanism. It is possible that those projects were built to substitute for other projects that were abandoned somewhere else, but the publicly available documentation does not make it possible to confirm or deny this.

Even if the capacity mechanism for renewable energy was not been as successful as originally intended, it has boosted the development of the renewable-energy sector in Russia and also attracted foreign investors. However, the capacity mechanism ended with its last auction in 2019 and the last renewables to be built under the mechanism should be completed by 2025. Its prolongation is a subject of current political debate.[55] Anatoly Chubais argues that renewable energy investment in Russia will dry up if the support is discontinued. We think this is probably correct, unless a major Russian oil, gas or nuclear company decides to launch renewable projects of its own accord to keep up with international developments and emulate international peers. For broader development of the Russian renewable-energy sector, it is critical that the capacity mechanism is prolonged beyond 2025.

It is informative to contrast the role of foreign investors in the Russian renewables sector with their role in the Russian petroleum sector. In the latter, the law on strategic assets passed in 2008 bars foreign oil companies from taking on a dominant role in the development of oil and gas fields that are deemed to be strategic because of their size and/or location. However, the Russian authorities have also been keen to develop these fields in the hope of securing future income for Russia and have, therefore, warmly invited foreign companies to partner with their Russian counterparts in the development of such fields, as long as the Russian partner remains in control. This has especially been the case in the difficult offshore Arctic projects, where foreign companies are expected to contribute important technologies and experience from other parts of the Arctic.[56] Thus, in the petroleum sector, there is both a

53 Tatyana Dyatel and Sergey Titov. 'Vetryaki menyayut napravlenie [Wind turbines change direction]' (2018) https://www.kommersant.ru/doc/3527423

54 NP Market Council. 'Vozobnovlyaemye istochniki energii. Perechen' kvalificirovannyh ob'ektov [Renewable energy sources. The list of the qualified objects]' https://www.np-sr.ru/ru/market/vie/index.htm

55 Alina Gubaidulina. 'Anatoly Chubais: "Esli ne prinyat" reshenie po DPM-2, vozobnovlyaemaya energetika v Rossii zachahnet' ['Anatoly Chubais: "Without implementing DPM-2, renewable energy in Russia will wither away"']. *Realnoe vremya* (2018)

56 Indra Overland et al., 'Rosneft's offshore partnerships: The re-opening of the Russian petroleum frontier?' (2013) 49(249) *Polar Record* 140–153, https://www.researchgate.net/publication/259431566

push and a pull for foreign companies. By contrast, in the renewables sector, there is neither this push nor this pull. Because renewable energy resources are not seen as strategically valuable, foreign companies are more welcome to take on whatever roles they would like in their development; however, conversely, there is no enthusiasm for the involvement of foreign companies in this sector either. As a result, the involvement of foreign companies is much more natural and both unhindered and unaided in the renewable energy sector than in the petroleum sector in Russia.

### 4.2 Other renewable energy projects

The total of installed renewable-energy generation capacity in Russia is almost 3 GW, with the projects supported by the capacity mechanism already contributing 40 per cent of this figure. Only 2 per cent of the installed renewable-energy capacity is operating as autonomous power stations. However, they make up over half of the over 600 renewable-energy power plants in the country. Table 12.3 provides an overview of the currently operating renewable-energy power plants in Russia.

*Table 12.3* Operating renewable energy projects in Russia

| | *Wholesale market* (capacity mechanism)* | | | *Other grid connected*** | | | *Autonomous* | | |
|---|---|---|---|---|---|---|---|---|---|
| *Technology type* | *#* | *Average capacity, MW* | *Total capacity, MW* | *#* | *Average capacity, MW* | *Total capacity, MW* | *#* | *Average capacity, MW* | *Total capacity, MW* |
| **Solar PV** | 72 | 15.19 | 1072.70 | 52 | 12.65 | 530.94 | 156 | 0.02 | 2.08 |
| Lighthouses*** | | | | | | | 86 | 0.00 | 0.03 |
| Solar PV-diesel | | | | 5 | 0.03 | 0.13 | 6 | 0.10 | 0.62 |
| Solar PV-wind-diesel | | | | 4 | 0.17 | 0.68 | 5 | 0.03 | 0.13 |
| Solar PV-wind | | | | 4 | 0.00 | 0.01 | 26 | 0.04 | 0.41 |
| **Wind** | 3 | 28.33 | 85.00 | 33 | 6.81 | 159.83 | 12 | 0.17 | 1.49 |
| Wind-diesel | | | | | | | 16 | 0.02 | 0.33 |
| **Small hydro** | | | | 148 | 5.57 | 784.98 | | | |
| **Geothermal** | | | | 24 | 18.84 | 294.87 | 7 | 8.29 | 58.02 |
| **Tidal** | | | | 6 | 0.53 | 3.20 | | | |
| **TOTAL** | 75 | 15.72 | 1158 | 247 | 8.76 | 1774.65 | 314 | 0.21 | 63.12 |

* *The data on wholesale market projects are collected from*[a] *the rest of the data are from*[b]
** *Grid-connected, parallel to the grid, reserve, or no data*
*** *Solar PV panels on lighthouses*

a NP Market Council. 'Vozobnovlyaemye istochniki energii. Perechen' kvalificirovannyh ob'ektov [Renewable energy sources. The list of the qualified objects]' https://www.np-sr.ru/ru/market/vie/index.htm

b Research and Educational Center. 'Renewable Energy', Geographical Department of Moscow State University and Joint Institute for High Temperatures of the Russian Academy of Sciences, 'GIS renewable energy sources of Russia'. http://gisre.ru

On the wholesale market level, the participation of renewables is enabled by the capacity mechanism. Thus, the vast majority of these projects are recent, relatively large, with an average installed capacity of 15 MW per project, and so far quite scarce because the support mechanism was introduced so recently. Only wind, solar PV and small hydro power are supported by the capacity mechanism; therefore, no other types have entered the wholesale market.

Other grid-connected renewable power plants are more diverse in terms of technology used. In this group, small hydro, solar PV, geothermal and wind-power plants are present. All small hydro power plants in this group were built before the introduction of the capacity mechanism in 2013. The rest of the grid-connected plants include more exotic types of power, such as tidal power, and various combinations of solar PV, wind and diesel power plants, but their share is small.

Autonomous renewable power plants include a large proportion of geothermal plants with an average size of approximately 8 MW, mostly in the Russian Far East, and a mix of small solar PV, wind and various hybrid plants. Such small hybrid power stations are the single source of electricity for many remote villages in Russia. Combining solar panels and wind turbines with diesel generators can help ensure an uninterrupted power supply.[57] Although autonomous projects constitute a minor share of the total renewable energy installed capacity in Russia, their number exceeds all other renewable energy power plants. Despite the fact that there is no functioning support mechanism for autonomous projects or small distributed capacity, this niche seemingly develops without special incentives. However, more active support from the state could still accelerate the development of them. This would save the local authorities money for diesel and its transport, and improve the market base for renewable-energy actors in Russia.

## 5 Conclusions

In the global renewable energy landscape, the Russian case has a special place because of the unique instrument for supporting renewables. Originating in the capacity trade, this instrument is meant to secure return on investment for renewable-energy investors. The promise of profitable investments theoretically creates a strong incentive for investors to enter the market; however, in practice, the implementation of this support is more like a steeplechase. Some traits of the mechanism required finetuning and led to the introduction of amendments to the initial legislative document. During the seven-year period that the entire first phase of the capacity mechanism has been in operation (2013–2019), 90 per cent of the targeted capacity (5.9 GW) was auctioned, and to date only 60 per cent of the capacity due has actually been built which constitutes 1.2 GW of wind and solar power as a net current result of the capacity mechanism. However, the industry is gaining momentum, more local manufacturing facilities are being built, and more national and foreign investors are showing interest in the scheme.

The regional-level renewable-energy support has not been very successful, although the framework for it has been created at the national level. However, renewables are penetrating regional markets where they are commercially competitive (e.g., geothermal energy in parts of the Russian Far East or the numerous small autonomous solar or hybrid stations substituting expensive diesel-fired power in isolated or remote areas).

57 Indra Overland. 'The Siberian Curse: A blessing in disguise for renewable energy?' (2010) 9(2) *Sibirica* 1

The scale of renewables in Russia is still, however, negligible. The total 2.6 GW of renewable energy generation capacity built is just 1 per cent of the total Russian power capacity, and, for example, is comparable to the size of a single (though the largest) solar PV project in India. The slow development of renewable energy in Russia creates several risks for the country. First, Russian companies will fall behind in this sector just as it is growing exponentially internationally. Historically, the Russian photovoltaic sector was very strong due to, among other things, the Soviet space programmes, but now they lack a strong home market to buoy their development. The contrast to China is stark, with the Chinese acting highly strategically to secure as big a piece as possible of the rapidly growing global renewables markets. One of the main tools the Chinese are using for this purpose is strong support for domestic deployment of renewable energy. Secondly, the limited development of renewables in Russia means that less-traditional fuels are available for export. Thirdly, it creates a risk that Russian actors are not fully aware and up-to-date on renewable energy developments at the global level. This is because they lack the domestic interface where they can gain experience and exposure. For Russia, as the world's biggest energy exporter, this is a potentially serious concern.

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