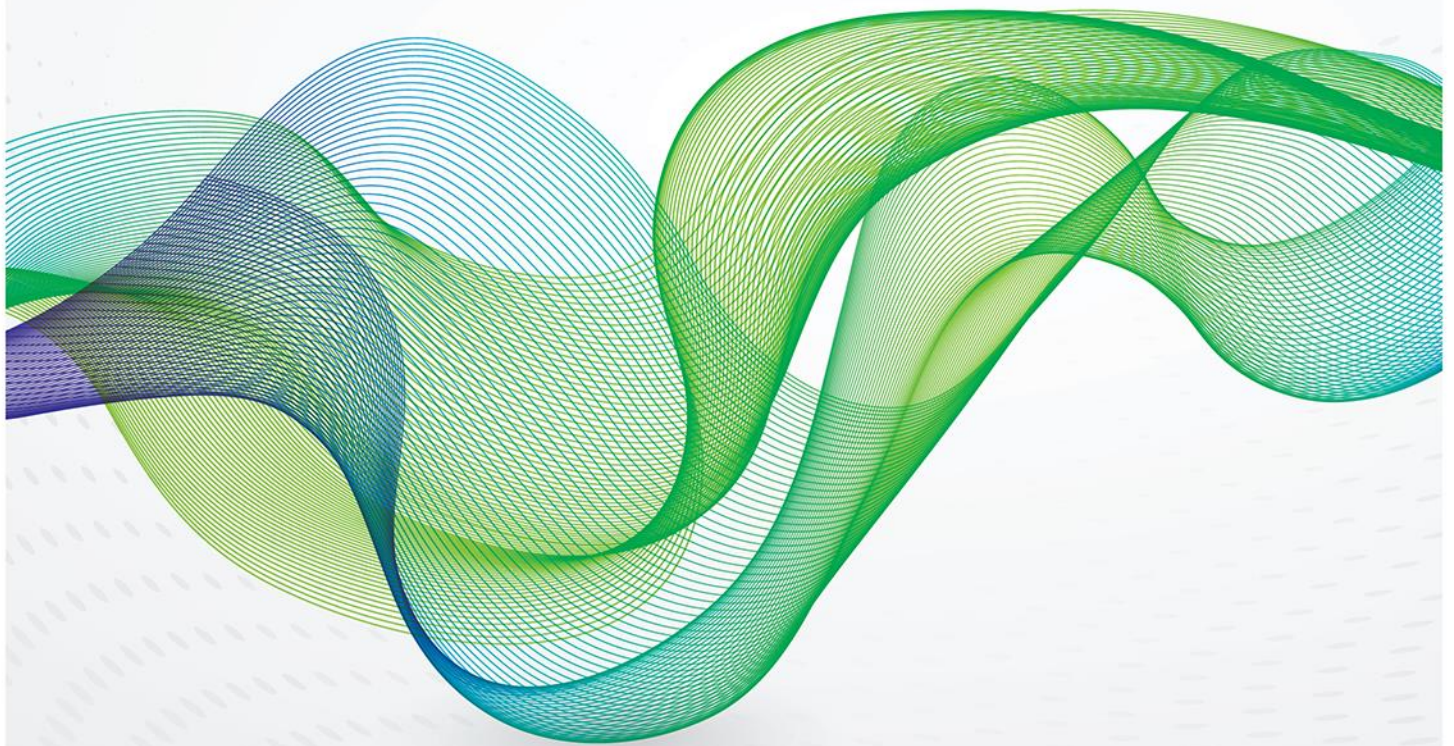


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# Market liberalization and decarbonization of the Russian electricity industry: perpetuum pendulum





Looking back at the last 20 years of electricity sector development in Russia, one can see serious attempts being made by this country to address trends in both market liberalization and renewable generation. As has often been the case with reforms in other sectors, outcomes of these efforts remain rather controversial, while many of the early initiatives have been reversed.

## Electricity market liberalization and power sector reform

After the break-up of the Soviet Union Russia experienced a significant fall in industrial production, and as result electricity consumption decreased by 25 per cent between 1991 and 1998. In addition, industry was plagued by an inability to collect cash payments – in 1998 only 85 per cent of electricity and heat supplied were paid for by consumers, while just 20 per cent of payments were in cash (the remainder were made using barter and other non-cash clearing schemes). Employees did not receive their salaries in time – delays were reaching five to eight months. Generation assets were ageing while investment levels were inadequate to renew or replace existing infrastructure. In order to address this challenge and implement anti-crisis measures, Anatoliy Chubais was appointed as Director General of RAO 'United Energy System of Russia' in 1998. Mr Chubais was a well-known Russian market reform leader who, several years earlier, had served as chief architect of Russia's national asset privatization programme. RAO 'UES' at that point was a state-controlled dominant Russian monopoly that controlled over two-thirds of generation capacity (except for four regions and all nuclear stations) and over 95 per cent of transmission and distribution volumes.

By around the turn of the century, the situation in the Russian economy had significantly improved – economic growth started to pick up and the newly appointed management of RAO 'UES' began foreseeing an upcoming deficit of power, unless some measures could be taken to attract investment into new generation capacity. In this context a massive liberalization reform of the Russian power sector was launched that, by 2008, had resulted in a complete restructuring of the industry and the liquidation of RAO 'UES'. The strategic objective of the reform was to transform electric power into a sustainable development industry, enabled by advanced technologies and market-based regulations that would ensure reliable and economically efficient satisfaction of demand for electricity and heat, both in the short and long term.

One of the main outcomes of the reform was the splitting of RAO 'UES' into an array of new companies, while distinguishing regulated entities (these included: an independent system operator, an administrator of the trading system, federal transmission, and several regional distribution companies) from competing market players in the generation and retail sectors. The latter were sold off to private investors – both domestic and international – that included companies like EON, Enel, and Fortum.

Although overall industry restructuring was successful (in the areas of privatization and the attraction of private investment, for example) the concentration level has gradually increased over time. Currently just 10 companies control over 80 per cent of installed generating capacity in Russia, while over half the country's capacity belongs to utilities where the state is a majority shareholder (RusHydro, Inter RAO, Gazpromenergoholding, and Rosenergoatom). The development of competition in the retail portion of the market has also faced some challenges. Most legacy companies retained a dominant position in their historic territories. Although state influence in this sector is less significant than in power generation, the concentration level here is also high – six companies control over half of national energy consumption.

Another critical component of reform has been the creation of competitive wholesale and retail markets for both electricity and capacity. This was a lengthy process that took several years and created a rather complicated set of market rules and procedures. The free market gradually expanded and in 2011 the wholesale segment was fully liberalized, with the exception of residential consumers who were protected by regulated prices. At the same time, government regulation of the transmission and distribution components of electricity pricing and of fees to retail companies, and to system and market operators, continued. Around 2008/9 demand and supply forecasts for electricity in Russia indicated an urgent need to attract investment into new capacity expansion. This need brought challenges to the newly established liberalized markets.

Government was looking for a tool that would both ensure the new generation owners were responsible for investing in this necessary new generation capacity (and for bringing it into the power system within a certain timeframe) and provide them with a guaranteed rate of return on these investments. The solution came in a form of ‘capacity supply agreements’ – a type of formal obligation placed on generation companies to build new power generation units requested by the government. In return, the companies were given compensation above regular capacity market prices for the new capacity supplied, at a level that would cover their investment, plus a certain rate of return on invested capital. Although electricity sector liberalization reform was almost complete in 2008/9, the expected urgent need for new capacity, together with uncertainty around the behaviour of new generation companies’ owners, forced the Russian government to follow this direct administrative approach rather than utilizing a market mechanism. It is also fair to mention that at this point the capacity market had not yet started functioning. Capacity supply agreements were launched in 2010 and during the course of the following nine years under this regime, over 100 investment projects were implemented across Russia; this brought about 30 GW of new generating capacity to the system. Apart from the direct impact of renewing ageing power sector assets, this programme also had a positive effect on the energy equipment manufacturing and construction industries that supplied factories, engineering, and construction firms with a significant volume of new orders. Since new power plants were using more efficient technologies, the fuel consumption index has fallen across the country by an average of 6 per cent between 2008 and 2016. Overall, application of this new mechanism in the Russian power sector has enabled massive capital inflow into this industry which, in contrast with the crisis and underinvestment of 1990s, has been a very positive achievement.

At the same time, capacity expansion under capacity supply agreements has had some major drawbacks. The first issue relates to the highly overoptimistic forecast for electricity demand that was officially approved by the government in 2008, and which was later taken as a basis for the subsequent capacity expansion programme. Under a base scenario, the CAGR for demand growth from 2006 to 2020 was estimated at 4.1 per cent, while under an optimistic scenario electricity consumption was expected to double during this period from 980 billion kilowatt hours (kWh) in 2006 to 2000 billion kWh in 2020, with a CAGR of 5.2 per cent. However, in recent years economic crisis in Russia has resulted in the stagnation of economic growth and the forecast has not been achieved – actual consumption of electricity grew much more slowly. Between 2006 and 2017 the CAGR reached only 0.7 per cent and in 2017 electricity consumption was 1060 billion kWh. Fortunately, not all the proposed new capacity had been realized (the plan had called for an additional 186–236 GW of new capacity between 2008 and 2020). Yet even the 30 GW that were eventually added contributed to a surplus capacity in the system of between 30 and 50 GW. Consumers complained that they had to pay excess capacity fees, while utilities ended up with lower utilization of their assets.

Another negative consequence of capacity supply agreements was distortion of the market. Decisions on where to build new power plants and how much to pay for them were not coming from the capacity market, but instead were made by the government. While at that point the capacity market was not yet ready and the risks of power deficits were considered too high, this initial experience has created a precedent that has continued to be used in other situations – for example in support of renewables, new nuclear power plants, development of power generation in certain regions of Russia, and even in support of waste treatment technologies. Capacity supply agreements have provided a way for the regulator to easily address certain needs in the energy system while guaranteeing outcomes; they also provide some clarity to the stakeholders involved. They have thus provided the government with a high level of control over the situation, reminding them of the lost advantages dating from the ‘good old era’ of central planning. However, they have also harmed the system’s flexibility and its ability to provide market-based signals. As the share of payments under capacity supply agreements has expanded over time, the market-driven portion of the final price of electricity has shrunk to 30–40 per cent.



## Renewable energy sources policies and measures for support

The basic concepts and terminology around renewable energy sources were defined in the core legislation on the electricity industry structure in 2007. Two years later, the Russian government approved 'Key elements of state policy in the area of energy efficiency on the basis of renewable energy sources until 2024'. This document set the first national targets for renewable energy: 4.5 per cent of annual electricity production and consumption by 2020 (later this milestone was shifted to 2024). This target excluded large-scale hydro power plants over 25 MW – large hydro plants have historically played an important role in the country's generation mix (in 2016 they generated 17.4 per cent of the electricity supply). In 2009, electricity generation from renewable sources in Russia was below 1 per cent of total electricity production and the newly adopted legislation highlighted certain actions in order to overcome existing barriers: economic superiority of fossil fuel generation sources, the absence of laws supporting renewables, and a lack of infrastructure such as scientific research, qualified personnel, and access to information.

The most important mechanism was fully described in the federal legislature and finally launched in May 2013; its design was similar to that of the 'Capacity supply agreement' scheme that had been previously used for new thermal generation capacity. Utilities were invited to submit bids within predefined quotas for solar, wind (over 5 MW for both sources), and small hydro (from 5 to 25 MW) capacity to be deployed during subsequent four-year terms. The projects would compete primarily on the capital expenditure required, but the level of local content was also an important criterion.

Winners would be compensated over a period of 15 years with a rate of return of 12 per cent (in local currency – rubles) for the investment incurred; this would be done by receiving payments in the national capacity market under capacity supply agreements. Later, this approach was heavily criticized for its main concept – to compensate utilities for renewable capacity, rather than for the actual electricity produced – as none of the qualified renewable energy sources (wind, solar, and hydro) are technically capable of supplying guaranteed capacity due to their intermittent nature. The reason for selecting this approach was simple – similar agreements had recently been successfully implemented for new fossil fuel power plants and all the required legislation, market infrastructure, and procedures were readily available.

In total 5.5 GW of renewable capacity will be supported under this programme up to 2024. The majority will come from wind projects (3351 MW – 61 per cent) and the rest from solar (1759 MW – 32 per cent) and small hydro (425 MW – 8 per cent). After five annual tender rounds in 2013–17, approximately 77 per cent of the overall renewable capacity quota had been awarded with almost the entire amount of solar achieved (1704 MW – 97 per cent of the target), almost three-quarters of the wind target (2452 MW), and just 28 per cent of small hydro (120 MW) awarded.

Various utilities have shown a gradual increase of interest in participating in these tenders, especially in the wind sector in 2016 and 2017 (during these two years over 90 per cent of all potential projects attracted proposals). The first mover was the Russian nuclear state corporation Rosatom, which had decided to diversify its generation portfolio and enter the wind business. In 2016 it was the only tender participant and it won 610 MW of capacity. In 2017 competition intensified as two new players, Finnish utility Fortum and Italian giant Enel, entered the race (both companies already owned and operated fossil fuel generation assets in Russia). As a result, proposed average capex has decreased this year by 12 per cent, while for some individual projects it reached approximately US\$1500 per kW of installed capacity – a competitive level by worldwide benchmarks. A record 1651 MW of wind capacity were awarded to these three utilities in 2017.

The main barrier facing companies wishing to enter this sector was the high localization rate required to receive the full capacity payment. For wind generation this increased gradually from 25 per cent in 2015 to 65 per cent in 2019, while for solar PV it went up from 50 per cent in 2014 and 2015 to 70 per cent, starting from 2016. In the solar PV sector, the first Russian integrated player capable of producing solar modules was the Hevel Group, which was cofounded by the diversified private firm Renova Group and the state company Rusnano in 2009. It operates an R&D facility and a plant producing 160 MW of solar PV panels per year, as well as providing construction and operation

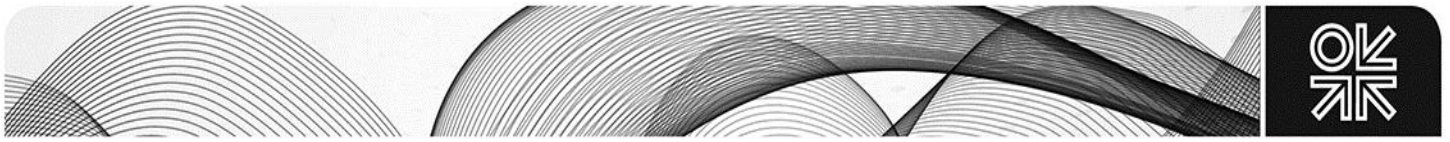


services for solar power plants. Another active participant in the Russian solar PV market – Solar Systems – opened a PV module production facility in 2017, with an annual capacity of 160 MW. In the wind generation segment, all three utilities with significant stakes in the game have also managed to attract technology partners who agreed to localize a necessary portion of equipment manufacturing. Rosatom signed a cooperation agreement and formed a JV with Dutch wind turbine manufacturer Lagerwey, Fortum went with Vestas Wind Systems, and Enel Russia selected Siemens Gamesa as its technology partner.

While this programme has become Russia's first important step in supporting renewable generation sources, it also had certain drawbacks. First, its overall size of 5.5 GW over the course of 10 years is very small relative to global dynamics in this sector – about 150 GW of new solar and wind capacity were added globally in 2017 alone. The programme will not allow Russia to achieve its renewable generation targets by 2024; if the entire announced quota is met, it will bring solar and wind capacity to only 2 per cent, while electricity production from these sources will remain below 1 per cent of the overall national volume. The support scheme was also heavily criticized for the fact that it focused on capacity and capex – not just because of the intermittent nature of renewable sources – and also for the fact that it resulted in a very high cost of electricity per kWh for consumers. Three factors contributed to this outcome. First, capital expenditure is the highest component of the overall cost for both wind and solar generation. Second, high localization requirements forced utilities to organize production from scratch on the basis of very limited existing competences – thus increasing initial investment in this field. Finally, the high cost of capital in Russia has raised the expected rate of return (factored into capacity payments) to the double-digit level – significantly multiplying the financial burden passed on to consumers through capacity payments. In the context of overall capacity surplus, many consumers (especially large and medium-sized industrial and commercial enterprises) were not happy to take on this extra load. Expected value from the ability to export solar and wind equipment to other countries is somewhat unclear, as global competition in these markets is extremely high while Russian manufacturers will be still very small in 2024.

Speaking at the State Council in December 2016, Russian President Vladimir Putin stressed the importance of ensuring the environmentally sustainable development of Russia on the basis of, among other factors, the energy efficiency of the Russian economy and the development of renewable energy sources. For the first time, he mentioned renewable micro generation and ordered the Russian government to develop a set of measures for its support. Micro generation was defined as: small-sized renewable generation sources of less than 15 kW. This mostly targets rooftop solar PV and the small wind turbines used by residential consumers for electricity self-generation. This sector has been practically non-existent in Russia due to high installation costs, absence of any state support, and a lack of technical procedures allowing owners of such generation to feed excess power they produce into the central grid. Government is currently working on legislation updates that would at least remove existing barriers that prevent the connection of micro renewable generation sources to the grid, and also set up rules to compensate their owners for excess electricity provided. Such a new law will also provide income tax incentives for micro generation owners who will receive payments for such excess electricity. Although many people in Russia live in multi-apartment buildings (which are currently excluded from micro generation support measures) there are still approximately 17 million individual houses, representing a potential base for rooftop solar PV. Unfortunately, it is difficult to imagine that current measures would be sufficient to boost any significant developments in the renewable micro generation segment. Any electricity that residential consumers receive from the central grid, or that they self-generate using fossil fuels (mostly natural gas), will remain cheaper than electricity from rooftop solar PV systems, because no tax credits or other forms of support would be offered to offset at least some portion of initial capex, and any excess of power produced would be compensated at the wholesale price.

Yet another opportunity for the development of renewable energy sources lies within remote territories of Russia that are located mostly in the north of the country. Such territories occupy a large proportion of the country's land mass, have a population of 10–20 million, and are served by isolated energy systems. In many cases the primary fuel for electricity generation in such places is diesel, which is very difficult and costly to supply in remote areas. As result, the cost of electricity generated in such remote locations can reach US\$3–4 per kWh. Under these circumstances, local hybrid energy



systems that combine renewable power (solar and wind) with batteries and back-up diesel generators can become economically feasible. While several such projects have been launched, they have not yet achieved massive scale rollout.

## Current developments and new cycle launch

During the second half of 2017 and the first months of 2018, a new debate has sparked in Russia over the topic of the national power system's future. While the construction of new thermal power plants, carried out under capacity supply agreements, was being completed, large utilities have raised the issue of old and ageing assets. Most of the existing gas and coal-fired plants currently in operation (accounting for 68 per cent of national capacity) were constructed back in the Soviet era between 1960 and 1980. Therefore, the owners have claimed that these assets require deep modernization, but the current system of capacity market pricing is not sufficient to fund it. Otherwise, the alternative would be to allow the gradual decommissioning of these old plants (approximately 70 GW up to 2035) and this would lead to a capacity deficit within the next five to seven years. In this case the expected need for new capacity could only be fulfilled by new power plants, which would be significantly more expensive than the modernization of existing assets. Thus, generation companies called for a second wave of capacity supply agreements aimed at the modernization of fossil fuel plants. This idea was supported by the ministry of energy, which proposed to start the modernization of approximately 40 GW of old thermal plants in 2022 and expand it until 2035. At the end of 2017 President Putin gave the concept his support, but asked the Russian government to refine it, taking into account a requirement that electricity prices shall not exceed the inflation level while other priorities (such as nuclear and renewable energy, grid development, and supplies to remote territories) would have to be accounted for. Although large industrial consumers and some other industry players have expressed concerns over such an approach, the chances are very high that it will be approved in the next two to three months. Owners of other power generation plants – nuclear, renewable, and hydro – have also increased their lobbying activities in order to get their share of the 'investment pie'. Over the course of these intensive debates, the most critical criteria have been around cost – either capex or using a broader LCOE parameter. So far, the idea of modernizing old fossil fuel plants has been considered as a first priority by the government. Since the renewable generation initiative was mainly launched for the purpose of developing national competences in this sector (localization of OEM and R&D) rather than of decarbonizing the fuel mix, it clearly has a lower chance of coming out of the race as a winner. Renewables might in fact get a certain level of support, but it would be lower than that seen during the first wave of this programme. Some experts also propose changing the approach by shifting to a kWh scheme rather than one using capacity quotas.

Therefore, both market liberalization and decarbonization have yet to gain support in Russia. It might happen through economic efficiency as the old traditional system becomes obsolete and expensive to maintain, while elements of a new energy system (such as decreasing cost of renewables and distributed energy sources, and consumers gaining power by becoming prosumers) gradually transform the landscape of the industry over time, despite the lack of direct support from a regulator.