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Rosatom Takes on Challenges

Rosatom signed several agreements with major energy companies at the Russian Energy Week (REW) International Forum. Rosatom's top managers talked about corporation's innovations and offered energy market players a partnership in high-tech industries.

The first agreement signed at REW was between Rosatom and RusHydro, a company operating 70 hydro power plants in Russia and abroad. The agreement provides for the cooperation in development and application of composite materials. The two companies will join expertise to develop new materials for the machinery and components to be used in small hydro power plants, wind generators

and externally bonded reinforcement systems. In this partnership, Rosatom will be represented by its subsidiary UMATEX, Russia's largest producer of carbon-based composite materials.

The second cooperation agreement was signed with Rosseti, an operator of Russian power grid and one of the largest electrical grid companies in the world. Rosatom and Rosseti will cooperate in three areas. First, the companies will work together on overseas power plant construction projects. Customers will have an option of ordering the development of a power distribution model and get a new grid infrastructure ready for the commissioning of a nuclear power plant. According to Rosseti, this service could be useful in countries which cannot develop a power distribution scheme on their own. The second area of cooperation between the two companies is participation of Rosatom in Rosseti's digitalization program. The nuclear



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corporation will use its competencies to assist in predictive analytics and development of digital twins. The third part of the agreement provides for cooperation in the development of new materials for composite core cables and transmission towers. Like RusHydro, in this area Rosseti will work directly with UMATEX.

The third agreement signed at REW was a trilateral between Russian TITAN-2 (the main contractor for Hanhikivi 1 in Finland), French Framatome SAS and German Siemens AG. As commented by Siemens, Framatome will supply main I&C systems for the nuclear island, while the German company will supply main I&C for the turbine island. However, firstly the parties will prepare the documents needed to obtain licenses for the construction project. As our readers remember, Rosatom and Fennovoima Oy signed an EPC contract in 2013 to build a single-unit nuclear power plant Hanhikivi 1 with a Russian-designed VVER-1200 reactor. Rosatom will be a co-owner of the plant since its subsidiary RAOS Voima Oy has a 34% stake in the project.

Kirill Komarov, First Deputy Director General of Rosatom, who was a signatory to the contracts with RusHydro and Rosseti, noted that the very principles of cooperation between a customer and a contractor were changing. According to him, purchase

and sale of ready-made solutions has been replaced by a different approach: the contractor stays in close contact with the customer to understand tasks, challenges and problems faced by the customer and offers potential solutions. This constructive dialogue helps shaping a clear idea that meets price and technology requirements of the customer. The result of cooperation is, according to Kirill Komarov, **“a product that can win the market”**.

Role of wind energy reviewed

Another important topic discussed at the Russian Energy Week was the potential and limits of renewable energy sources. The key issue is that the power industry loses balance. A large share of renewables in the energy mix with no reserve capacity are fraught with rolling blackouts like those observed in the United Kingdom this August. As you probably know, about a million people were affected by the power loss at the country's largest wind farm (800 MW) and a gas-fired power station. After the investigation of the incident, Secretary of State for Business, Energy and Industrial Strategy Andrea Leadsom said that the power outage was not linked to the variability of wind power, but admitted that the country needed a diverse energy mix. It was also found that an increase in renewable generation did not necessarily lead to reduction in carbon emissions. Growing end-user tariffs, like those in Germany, put forward another argument against extensive expansion of renewables.

REW provided a perfect opportunity to see how attitude towards renewable energy sources was shifting in favor of nuclear. Before the beginning of the session dubbed Investment in Sustainable Development





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of Energy Sector: New Opportunities and Current Obstacles, attendees were asked in which energy industry segments they would invest their own money. Initially, renewables came first (36.6%) followed by nuclear (16.9%). However, after the session was over and speakers voiced their arguments, the situation changed dramatically. Now 32.7% of the attendees said that they would invest in nuclear energy, while the share of those who voted for renewable sources decreased to 22.5%.

Strictly speaking, breeders (fast neutron reactors) also belong to renewable energy sources, which was confirmed by Mikhail Chudakov, Head of IAEA Department of Nuclear Energy. He said **“Breeder produce materials that can be used in chain reaction. Fast reactors are also needed to burn man-made minor actinides.”** At present, Russia is the only country in the world to operate commercial fast neutron reactors.

If breeders are recognized renewable sources of power, this will help raise finance in the West, particularly in Europe, where banks are allowed to finance construction of renewable energy sources.

Present Continuous for nuclear plants

Attendees of the session dubbed Nuclear Energy as Integral Element of Sustainable Future Agenda came to the conclusion that nuclear energy possessed an impressive list of advantages. Moreover, its disadvantages are mainly perceived. According to Rosatom's Director General Alexey Likhachev, today customers are ready to pay little more during the first five to seven years after the start of the project in order to have reliable power

supply at a guaranteed price for at least 30 years. Alexey Likhachev called on colleagues to stand up for the advantages of nuclear energy, **“We should fly this flag, move away from defense tactics, when we just speak about acceptability of nuclear technology, and start an information offensive speaking about relevance and indispensability of a nuclear component in the global and national energy mixes”**. Nuclear energy ensures stability of energy tariffs in the long term, zero greenhouse gas emissions, development of grid and digital infrastructure, creation of new materials, and so on.

Péter Szijjártó, Minister of Foreign Affairs and Trade of Hungary, agreed with Alexey Likhachev, **“The nuclear power plant in Hungary is viewed by us not just as a construction project but rather as a general driver of economic development in the country. I am sure that the decision to build Paks II has been one of the best economic decisions of the last years.”** ^{NL}



«Today Russia has one of the greenest low carbon energy mixes in the world. Hydro and nuclear power account jointly for a third of total generation in the country, with 50% of power coming from gas.»

President Vladimir Putin

Rusatom Cargo to Secure Deliveries to Nuclear Stations Overseas

International logistics is a new business for Rosatom. This will be a focus area for a newly established company, Rusatom Cargo. Its task will be to facilitate and optimize cargo deliveries to overseas nuclear power plants under construction and organize commercial freight transportation between Europe and Asia on the Northern Sea Transport Corridor.

Rusatom Cargo was established in June 2019. Its sole shareholder is AtomEnergProm (a Rosatom Group company). The purpose of Rusatom Cargo is to develop Rosatom's logistics business across two focus areas.

Optimal planning

The first area is cargo delivery for nuclear power plants constructed by Rosatom in foreign countries. This presumes performing two specific tasks.

One is to cut down shipment costs by analyzing information about upcoming cargo deliveries to nuclear stations under construction and optimal utilization of chartered ships. Building long-term relationships with carriers and, as a result, receiving better offers also saves money.

Rusatom Cargo expects delivering around 150,000 tons of cargo annually. Cargo



deliveries to new nuclear plants will peak in 2022–2025, so the new company has enough time to get ready and carefully plan its activities.

The second task is to make logistics profitable. Since Rusatom Cargo plans to charter ships anyway, it will be able to provide freight services from Russia and abroad to third parties. When performing this task, Rusatom Cargo will act as a forwarding agent for potential customers.

Breaking a path for trade

The second focus area for Rusatom Cargo is container transit between Asia and Europe along the Northern Sea Transport Corridor (NSTC). NSTC is the route from the ports of Northern Europe to the harbors of East Asia. The Northern Sea Route has a length of approximately half of the NSTC. The ultimate goal is to make NSTC competitive as compared to the Southern sea route. The key advantage of NSTC is that it is shorter and thus faster and cheaper. In addition, Rusatom Cargo is considering the possibility of cutting transportation tariffs.

Rusatom Cargo's team has analyzed freight traffic and made a conclusion that 30 million tons of cargo per annum is doable.



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Rosatom Cargo will work in close cooperation with the Northern Sea Route directorate which task is to ensure the year-round navigation on the Northern Sea Route (NSR). As our readers probably remember, Rosatom has been appointed the NSR operator in late 2018. Its main short-term task is to increase freight traffic on the Northern Sea Route up to 80 million tons by 2024. To ensure year-round navigation on NSR, Rosatom is expanding its icebreaker fleet. It should include nine icebreakers by 2035, including five 60 MW Project 22220 vessels and three 120 MW Lider-type vessels. ^{NL}



Female Face of Nuclear Industry

Gender equality is one of the UN Sustainable Development Goals. It is obvious that women's contribution to the nuclear industry is no less important than the contribution made by men. The Women in Nuclear Foundation is at the forefront in supporting initiatives aimed at achieving gender balance in Russia.

As a serious challenge of our age, overcoming gender inequality was included in the 17 Sustainable Development Goals put forward by the United Nations.

According to the International Atomic Energy Agency (IAEA), women make 22.4% of the nuclear industry employees globally (this share is higher in Rosatom: as of 2018, women made 34% out of 255,400 people employed by the nuclear corporation). Late IAEA Director General Yukiya Amano repeatedly expressed his concern about this issue, **“Women played an important role in nuclear science even in its early days. But they are still underrepresented in the industry. I would like to see more women working in the IAEA.”** Amano used to stress the need to achieve gender parity in the agency by 2021.

There are many women in various fields of nuclear industry, but experts point to a shortage of females in the management.

Gender studies uses two specific terms to describe the challenges females encounter in the labor market: “sticky floor” meaning the impossibility of climbing the career ladder and “glass ceiling” meaning difficulties in rising to the top positions. For example, according to the Women in Nuclear Foundation, the share of men and women among Rosatom's top managers as of January 1, 2019, were 79.9% and 20.1% respectively. Angelika Khaperskaya, Co-Founder of the Women in Nuclear and senior manager at the Rosatom's spent nuclear fuel management PMO, is sure that achieving gender parity is a vital task, **“Training professionals for the nuclear power industry has become a challenge in the 21st century, and increasing a share of women is one of the solutions to the problem. A broader**



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involvement of women in the nuclear industry is now a global trend.”

Women united

A number of organizations supports women’s initiatives on the global scale. One of them, Women in Nuclear Global, was co-founded by Agneta Rising, Director General of the World Nuclear Association. Under her leadership, the number of members in the organization grew four-fold. **“Women are extremely important for effective development of the global nuclear industry. There should be programs targeted at involving and hiring women, otherwise they will not be able to capitalize on the competitive advantages they have thanks to their talents,”** Rising said.

Founded in 1992, Women in Nuclear Global (WIN Global) is an international organization uniting more than 35,000 women professionals and activists from 109 countries.

Russia is not an exception. An independent organization called the Women in Nuclear Foundation was established in 2018 to support and promote women’s initiatives. The Foundation cooperates with WIN Global and other associations and formulates its mission



as to **“unite women employed in the nuclear industry, form an industry community of women professionals and promote business cooperation to achieve social goals for the benefit of society and development of the nuclear industry”**.

The objectives pursued by the Foundation include professional support of women in nuclear (mentoring and training programs, legal support, etc.) and social activities, such as support of families with many children, health initiatives, and so on. The founders of the Foundation are sure that it will become a means of social mobility helping women climb the career ladder. **“We will support women by providing them with necessary information, developing their competencies and laying the ground for professional and career growth,”** explains Margarita Udalaya, co-founder of the Foundation and a senior employee of the Nuclear Legacy Management Department at Rosatom.

The Foundation launched an IT platform for women activists to communicate with each other and with mentors and have online access to educational courses. Women from eight Russian regions attended the first



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National Women in Nuclear Conference held in late September. Addressing the attendees, Marina Belyaeva, a member of the Foundation's Board and Director of Rosatom's International Cooperation Department, stressed the importance of developing competencies among women in nuclear, **“Women are interested in good education, professional career and success in business. This has a positive effect on the industry development since professionally educated, active and socially minded people are the most valuable capital and a powerful resource for the development of the nuclear power industry”**.

The Conference discussed sustainable development of the nuclear power industry, raising public awareness of nuclear energy, spent nuclear fuel and radioactive waste management, and social responsibility of the industry. Health was another important topic of the Conference. Representatives of RESHMA Medical Center of the Federal Biomedical Agency spoke at the Conference about the importance of cancer prevention and forming a healthy lifestyle culture.

Following the Conference, action groups were established in eight nuclear host cities across Russia. [NL](#)

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On the Verge of Imbalance

The situation in Germany and other developed countries is the perfect example of problems arising out of the shortage of baseload power generation. Unreliable power supply, rolling blackouts, volatile energy prices, to name but a few. An energy mix should meet two criteria, being both green and reliable. These are entirely met by nuclear, which is able to supply green and reliable power but needs political support.

Germany has set a target of reducing carbon dioxide emissions by 40% by 2030 and

80–95% by 2050 as compared to the 1990 level. To achieve this target, the German government has been supporting the development of renewable power sources since the 2000s. The Renewable Energy Sources Act (EEG) adopted in 2000 declared renewables to be a primary tool to reduce greenhouse gas emissions.

At Easter 2019, Germany was happy to learn that renewables generated over 40% of all electric power supplied to the national grid. The results of 2018 and the first half of 2019 were, however, far from being that optimistic.

In September 2019, consulting company McKinsey published its regular semiannual report analyzing Germany's success in achieving its climate targets in 2018. The verdict was damning: Germany did not meet



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most of its targets, including those in cutting emissions.

According to McKinsey, only six out of 14 target indicators in question had been either stable or changed positively since 2012. One is a share of renewables in the total power consumption (37.8% in 2019 vs. 2020 target of 35%). The number of jobs in the renewables segment remained relatively flat at around 338,000. Energy prices for industrial consumers had decreased since 2014 and were only 6.2% higher than the European average as compared to 14.2% in 2012. The report emphasized, though, that CO₂ emissions in 2018 were still 116 million tons above the target despite a 4.5% reduction in 2017. Emissions from power generation alone decreased 15%. It means that the growing share of renewables in power generation (from 23.5% in 2012 to 37.5% in 2018) accounted for only 7% of cuts in carbon dioxide emissions.

The situation evolving over the past few years makes it very unlikely that drastic changes will occur.

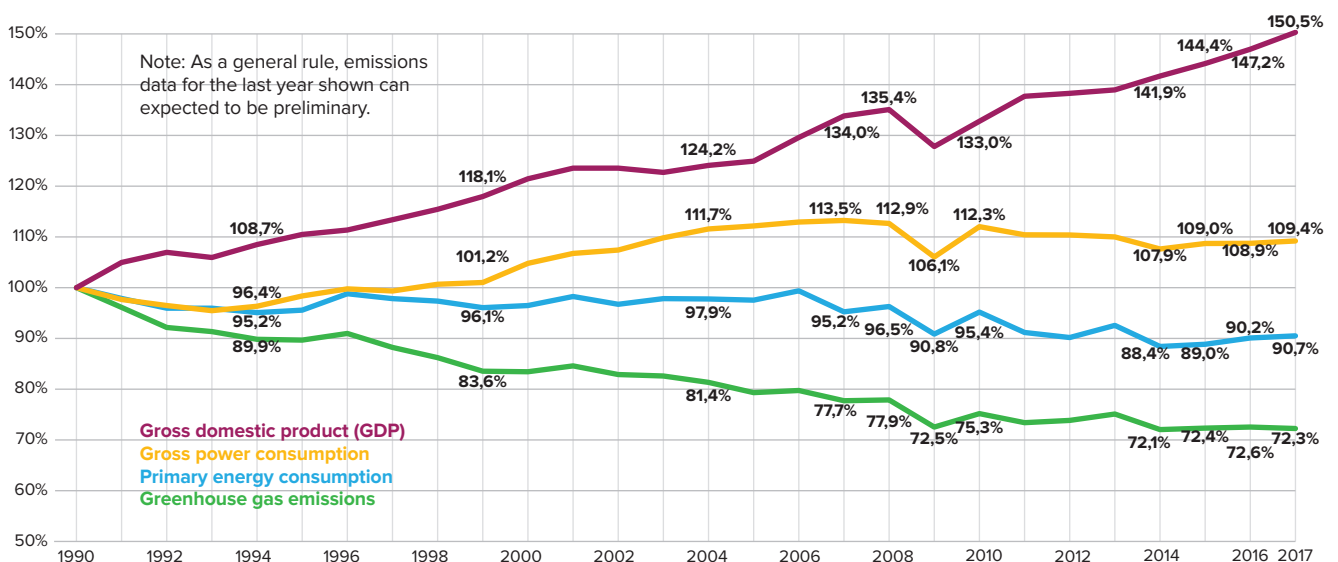
The report concluded that carbon dioxide emissions in power generation could not be reduced with only a broader use of renewable power sources. Measures in other industries like transport and heating are necessary. This is easily proved by comparing the charts of GDP, emissions and power consumption growth. They demonstrate a clear correlation between the growth of GDP and growth of energy – specifically, electrical energy – consumption.

Initiating changes in the transport segment turned out to be a real challenge. The package of measures introduced by the German government to increase tariffs on transport and heating fuel was criticized as not providing sufficient incentives.

The decisions made thus far assume that the remaining seven nuclear power plants with a total power capacity of little more than 10 GW (PRIS data as at October 17, 2019) will be shut down by 2022. Coal generation will be reduced by 29 GW by 2030, with the remaining capacity (17 GW) to be shut down by 2038.

ECONOMIC GROWTH, POWER & ENERGY CONSUMPTION, GHG EMISSIONS 1990-2017

Data: BMWi 2018, UBA 2018.





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The report contains another, perhaps a more important conclusion. **“Reliability of supply will be put at risk in the medium term after phasing out nuclear energy and coal unless the phased-out capacity is replaced and grid infrastructure expands faster”**.

According to McKinsey analysts, reliability of power supply in Germany is under threat left without compensatory measures. **“Based on model calculations, Germany will need 17 GW of new capacity by 2030 to compensate for shut-down capacity and fluctuations of renewable energy output, and relieve peak loads. Otherwise ‘bottlenecks’ will appear already in the middle of the next decade, with the situation to get worse by 2030,”** the report reads.

It is not just McKinsey that is concerned with the ongoing government’s measures, as it is not unlikely that conventional power plants will be disconnected from the grid even earlier. Professor Harald Schwarz from the Brandenburg University of Technology analyzed a report prepared by an expert group, which is often called the Coal Commission, established by the federal government in the spring of 2018. The report was submitted to the government in late January 2019. One of its provisions stipulates that not only nuclear power plants but also coal-fired stations (12.5 GW) might be switched off by 2022.

“Unfortunately, the Coal Commission has not investigated the relevant technical parameters to ensure a secured electric power supply based on Germany’s national resources,” Schwarz wrote in his article *Will Germany Move into Situation with Unsecured Power Supply?* published in *Frontiers in*

Energy in September 2019. He warned that only 10 out of 366 pages in the report were devoted to security of supply. There are three points made in the report. First, security of supply is important for Germany; second, each European country had used to satisfy its domestic demand independently; and third, the new concept of secured supply, as it is viewed by the German Ministry of Economy and which is likely to become a long-term strategy, is based on the so-called loss-of-load expectation.

“Instead of using only national parameters of peak load and secured generation capacity, this model will take also into account free generation capacities in neighboring countries, which possibly will be traded on the energy market,” the professor says. Harald Schwarz is upset that the Coal Commission did not analyze whether Germany would be able to cover a cold season (November to February) shortage of electric power when other European countries were also at the peak of consumption.

Professor Schwarz is also surprised at Germany’s plans to increase the share of renewables to 65% of the energy mix. According to him, there was no public discussion of how the share of renewable energy could be increased to the level declared, with stability of the system maintained. **“The fact that generation has to follow the demand minute by minute due to the lack of large energy storages in the electric power system, as well as the missing grid capacities to absorb the temporarily huge renewable overproduction, is simply neglected in the public discussion and in the above mentioned governmental Coal-Commission,”** he stressed.



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The key point is that ‘installed capacity’ and ‘secured supply’ are totally different things. If the new plan to increase the share of renewables to 65% is adopted, the retiring ‘conventional capacity’ can be easily replaced with new ‘installed capacity’. Luckily, power consumption in Germany is relatively stable, with a slight growth owing to the Trade and Services segment. Such a situation is typical for developed countries, for example the USA.

The problem is different, though. According to Professor Schwarz, renewable energy sources have a very low security of supply. For example, solar farms have a zero level of secured power supply. Just to compare, nuclear power plants offer the highest security of power supply among ‘conventional sources’ of electric power (93%). In other words, one can build ten solar farms, but neither of them will be able to reliably supply industrial facilities, electric vehicles and electric heat pumps with power on a cold winter evening.

Situations like this have happened in other countries and have dealt painful blows for both consumers and power producers. One

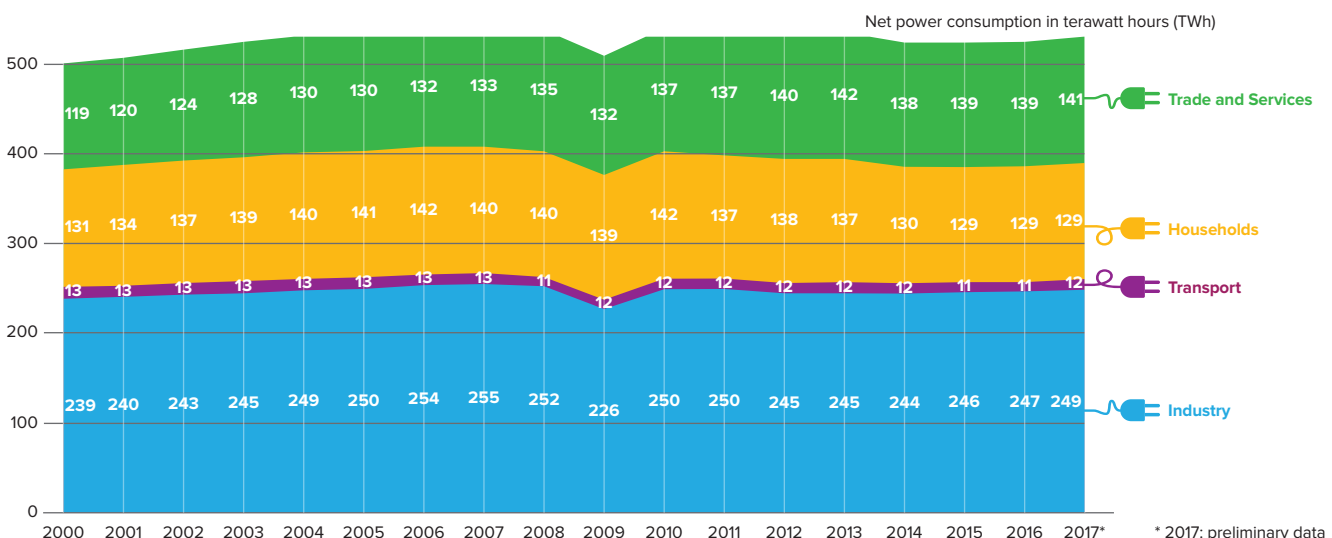
happened in the UK last August as a result of power loss at a wind farm and a gas-fired power station. Around one million people were left in the dark. **“The system operator, already under investigation by the energy watchdog, faces criticism from within the industry that it has not done enough to guard against the risk of blackouts,”** The Guardian wrote.

Another blackout occurred in Texas. **“Texas power prices jumped from less than \$15 to as much as \$9,000 a megawatt-hour this month as coal plant retirements and weak winds left the region on the brink of blackouts during a heat wave,”** Bloomberg said.

Near-blackouts have happened in Germany, too. **“Technical experts are simply terrified and ask, ‘What will we do after the remaining seven reactors are stopped in 2022?’ They are still supporting renewables, but it is already a disaster what is happening in the grid,”** Mikhail Chudakov, Head of the IAEA Department of Nuclear Energy, told Rosatom Newsletter’s correspondent.

NET POWER CONSUMPTION BY CONSUMER GROUP 2000-2017

Data: BDEW 2018





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A Nuclear-free Price

An imbalanced energy mix can cause power costs to fluctuate. **“We expect the highest price hike to happen in 2022 when the last nuclear reactor in Germany will be shut down,”** says Jörg Steglich from strategy consulting firm Oliver Wyman. According to the forecast, the price may rise from EUR 40 to EUR 65 per megawatt-hour. Experts from Friedrich–Alexander University Erlangen–Nürnberg are even more pessimistic: the wholesale price of electric power may reach EUR 136 per MWh (13.6 eurocents per kWh) by 2023.

It is not yet clear what technology Germany will use to solve the problem of safe and secure power supply and emission cuts. According to the media, Germany can either increase natural gas-based generation (but gas-fired power plants emit carbon dioxide) or increase solar generation and build hydrogen energy storage facilities (other media say, though, that projects involving hydrogen storage have been postponed). McKinsey assumed that the country had three options. First, Germany can negotiate power supply from neighboring countries. The second option is to rely on its own resources even if it requires large capital investments because new renewable power plants will be built on less attractive (in economic terms) sites. **“It is worth mentioning that extending the lifetime of nuclear power plants in Germany (no new builds) would reduce overall system cost, but it would not overcome the challenge in the long term since all existing German nuclear power plants would be decommissioned by 2050,”** says the report. The year 2050 is mentioned here because even if the decision to phase out nuclear by 2022 is reversed and the service life of Germany’s existing nuclear



stations is extended to 60 years, the newest station (Neckarwestheim 2) will have to be decommissioned in 2050, analysts explain. The third option is a combination of the other two.

Political will

The example of Germany shows how a large share of renewables affects the power industry, and so do examples of other countries that have already experienced power outages. In order to avoid emergencies, one should not bring the energy system to the brink of imbalance. Renewable sources of power have proved to be a tool to reduce carbon dioxide emissions, but they do have known limitations. Taken separately, renewable generation does not tackle the problem of emissions, for example, from vehicles. Besides, renewable sources are not yet capable of securing power supply and need power stations that can be reliable generators of base load electricity. This is where nuclear power plants are the most effective.

International practice shows that decisions in the power industry are politically motivated. The nuclear phase-out in Germany by 2022




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was a political decision, just like the other one to increase end user tariffs on electric power from renewable sources. These decisions change the structure of entire industries and areas of expertise on the national scale. One of the problems that Germany faces today is a growing shortage of industry professionals able to maintain the decommissioned nuclear power plants properly.

A life-and-death struggle over each nuclear station is taking place in the USA. The latest example is a situation in Ohio where the state government decided to support nuclear generation. **“In late July 2019, Ohio became the fifth state in the United States to enact policies that provide for compensation or other assistance for in-state nuclear generating plants. Connecticut, Illinois, New Jersey, and New York have implemented similar support programs for some of their nuclear power plants since 2017,”** reads a press release published by the US Energy Information Administration in early October 2019. The power plants operated by FirstEnergy Solutions were on the verge of bankruptcy (the company filed for bankruptcy protection in March 2018).

The new governor of Ohio saved it by signing a nuclear subsidy bill.

Situations like this do not occur every day. Much more important is the widespread and continued recognition by top government officials that nuclear energy can be a carbon-free and secure source of electric power. If it is in place, ways to finance development of the industry will be found. **“The future of nuclear energy is not limited to the dilemma of whether “the government provides finance” or “the government does not provide finance”. It is important to create conditions that will support the development of nuclear. It is up to each country to decide what support measures will be taken. The UK has introduced the so-called contract for difference. Turkey has signed an agreement with Rosatom that the country will be purchasing a certain amount of electric power from Akkuyu NPP at a fixed price. Some other countries sign agreements to jointly support new build projects. There are many options, but involvement of the government is necessary,”** Rosatom’s First Deputy Director General Kirill Komarov said in an interview to Rosatom Newsletter. 

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