LEAD STORY

Global Leader in 10 Years

Rosatom celebrated its 10th anniversary on 18 December. For no less than a decade on the nuclear market, it has become a recognized global technology leader, with no other market player having a similar portfolio of international contracts.

The Russian state-run nuclear corporation was founded on 18 December 2007. Its status, goals, functions and responsibilities are set out in Federal Law No. 317-FZ adopted on 1 December 2007. Rosatom Group comprises over 300 companies, including the world's only nuclear icebreaker fleet. Rosatom is Russia's largest electric power producer that generated 196.37 billion kWh (or 18.3% of total power output in the country) in 2016. The corporation has the world's largest portfolio of international projects each at a different stage of development (a total of 34 reactors in 12 countries), and the second largest uranium reserves. It is also a Top 4 uranium producer that accounts for 36% of uranium enrichment services and 17% of nuclear fuel supplies in the world.

For the decade that passed since its foundation, Rosatom has given a new lease of life to its engineering design and construction companies and established AtomEnergoMash, one of Russia's largest power engineering companies, having integrated all of its assets into a vertical value chain. Rosatom now controls the entire nuclear industry, from uranium production to spent fuel management and decommissioning of nuclear plants. As a result, the industry has a single responsibility center, which can be easily contacted by the government, consumers and communities.

"Just a decade ago, the Russian nuclear industry was associated with power

generation and weapons only. Now nuclear technologies have a much broader application. They are used in medicine, non-destructive testing and many other areas. Diversified applications add to the stability of Rosatom's business and enable it to increase revenue and profits already by 2030. Up to a third of the company's earnings will come from these new areas," says Sergei Kondratiev from the Economic Department of the Energy and Finance Institute Foundation. He stressed that Rosatom owed much of its success to the solid foundation laid by the Soviet Ministry of Nuclear Industry and Ministry of Mechanical Engineering, with their common history extending back almost 80 years. "Having preserved industry traditions, the nuclear corporation did not stick in the past and adapted to the market and global competition. It continues the work started by Soviet researchers, engineers and workers," the expert said.

Highlights 2016:

Uranium production: 7,900 tons, including 4,900 tons produced by foreign subsidiaries

Power generation by nuclear plants: 196.37 bn kWh (195.2 bn kWh in 2015)

NPP share in total power output in Russia: 18.3% (18.6% in 2015)

NPP capacity utilization in Russia: 83.1% (85.95% in 2015)

Nuclear reactor construction projects: 8 in Russia and 34 abroad

COOPERATION

Russia, Jordan to Cooperate on Small Modular Reactors

Rosatom and Jordan are expanding cooperation in the nuclear field. The parties have agreed to study the feasibility of constructing a small modular reactor in the country.

A memorandum of understanding to this effect was signed by Rosatom's subsidiary Rusatom Overseas and the Jordan Atomic Energy Commission (JAEC). The parties agreed to carry out a joint feasibility study for the construction of a Russian-designed small modular reactor (SMR) in Jordan. "Russia and Jordan have long been working together in the nuclear field. This memorandum of understanding on small modular reactors will expand and enhance our cooperation. Rosatom is ready to share its SMR expertise with

Jordan," said Evgeny Pakermanov, President of Rusatom Overseas.
Dr. Khaled Toukan from JAEC said, "The SMR program is key to the national nuclear strategy. JAEC and RAOS have achieved many milestones in years of cooperation, and this memorandum will further contribute to the SMR program".

Rosatom has extensive expertise in designing and constructing small modular reactors. In 2019, Russia will commission the world's first floating nuclear power plant Akademik Lomonosov. It is the first movable low-power reactor in a series of similar plants. The project employs time-

proven solutions that have been used in nuclear icebreakers for decades. The floating nuclear power plant (FNPP) is equipped with two KLT-40S reactors with a capacity of 35 MW each. The FNPP has been designed in full compliance with IAEA safety standards and is capable of withstanding extreme weather impacts, such as tsunami or other natural disasters. Apart from floating nuclear plants, Rosatom is working on the development of stationary low-power reactors. In addition to having a modular design, these small-size reactors can be used for multiple purposes, such as water desalination and heating.

FOR REFERENCE

The cooperation on nuclear technologies between Russia and Jordan started in 2011 when the Jordan Atomic Energy Commission tendered out the contract to build Jordan's first high-power nuclear plant and invited Rosatom to take part in the bidding process. In late 2013, Jordan informed Russia that AtomStroyExport, which proposed to build two 1,000 MW reactors, was selected as a potential vendor. On 24 March 2015, the parties signed a framework agreement to construct and operate a nuclear power plant in Jordan. The project is currently in its pre-investment phase that will result in making a joint decision on the form of investments in the nuclear power plant.

EXPANSION

Russia and Saudi Arabia to Cooperate in Nuclear

Late last week the two countries signed a road map to jointly promote peaceful uses of nuclear power.

The King Abdullah City for Atomic and Renewable Energy (KACARE) and Russian nuclear corporation Rosatom signed a road map for peaceful uses of nuclear power. The document was signed by Dr. Maher Bin Abdullah Al-Odan, Chief Executive of the KACARE Atomic Energy Sector, and Evgeny Pakermanov, President of Rusatom Overseas (a Rosatom Group company promoting Russian nuclear technology on foreign markets).

The road map provides for a series of measures that will enable implementation of the Russian-Saudi Program for Cooperation on Peaceful Uses of Nuclear Energy. The Program was signed on 5 October 2017 in Moscow during the history-making visit of King Salman bin

Abdulaziz bin Abdulrahman Al Saud to Russia.

Saudi Arabia and Russia plan to jointly work on low and medium power reactors that can be used for electricity generation and water desalination. Other plans are to establish joint education courses for employees who will develop the Saudi national nuclear program and nuclear infrastructure. Russia and Saudi Arabia will also analyze prospects of building a nuclear science and technology center based on a Russian-designed research reactor in the country.

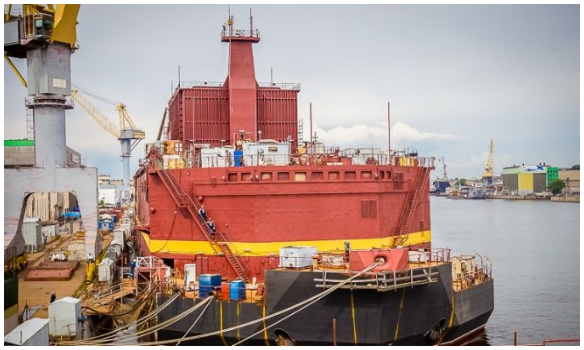
In June 2015, Russia and Saudi Arabia signed a civil nuclear cooperation

agreement in Saint Petersburg. This document was the first in the history of the Saudi-Russian relations to create a legal framework for the two countries to cooperate across all sectors of the civil nuclear industry.

According to Rosatom's Annual Report 2016, construction of two nuclear reactors in Saudi Arabia is on the list of projects that can be started before 2030.

Earlier Saudi Arabia announced its plans, unprecedented for the region, to build 16 nuclear power reactors to satisfy its power demand. In September, Rosatom's CEO Alexei Likhachev told reporters on the margins of the IAEA General Conference in Vienna that the Russian nuclear corporation and its Saudi partners were negotiating a 'broad range of projects, from a large-capacity nuclear power plant with desalination facilities to low and medium capacity power sources, including floating nuclear plants'.

CONSTRUCTION



Landmark Reached in FNPP Project

The world's first floating nuclear power plant is approaching its startup phase. The steam turbine rotor was put on barring gear for dry cranking tests.

Akademik Lomonosov floating nuclear power plant (FNPP) undergoes scheduled harbor acceptance tests in Saint Petersburg. Engineers of the Baltic Shipyard put the rotor of the right steam turbine plant on barring gear to rotate the turbine shaft at a low speed of seven revolutions per minute.
This is required to ensure that turbine is properly mounted in accordance with specifications.

Putting the turbine on barring gear is an important landmark in preparing the FNPP for operation. The dry cranking test is needed to check whether all the wheelspace components are correctly assembled and whether turbines and generator shafts are properly aligned. Before barring the rotor, engineers performed a number of mechanical and electrical checks on the turbine auxiliaries, including lubrication systems. After the turbine is put on barring gear, the turbine plant and its auxiliaries are ready for further harbor acceptance tests.

The plans are to perform the same operation on the second steam turbine plant by the year end (the FNPP has two STPs on board). Tests will then continue to check design parameters of the both STPs. After the harbor acceptance tests and preparations for transportation are completed, the FNPP will be tugged to Atomflot (a Rosatom Group company based in Murmansk) in the spring of 2018 for fuel loading and reactor startup.

In full compliance with IAEA standards

The project employs time-proven solutions that have been used in nuclear icebreakers for decades. The floating nuclear power plant (FNPP) is equipped with two KLT-40S reactors with a

capacity of 35 MW each. The FNPP has been designed in full compliance with IAEA safety standards and is capable of withstanding extreme weather impacts, such as tsunami or other natural disasters. The FNPP is a totally autonomous power unit that can be transported to any part of the world. The capacity of the plant will be sufficient to sustain life in a city of 100,000 people. Having two KLT-40S reactors, the floating power unit is based on the design of a nuclear icebreaker reactor, the reliability of which was proven in long-time operation in the Arctic region. The FNPP has a 40-year service life divided into three 12-year operating cycles. After each cycle, the floating power unit will be transported to a special dock for intermediate maintenance and nuclear fuel reloading.

IN BRIEF

WANO: Novovoronezh Practices Can Be Used at Other NPPs

WANO experts completed their technical support mission to the Novovoronezh Nuclear Power Plant. The mission was devoted to the protection of the plant's systems against ingress of foreign objects. The experts identified four practices that deserve to be replicated at other nuclear plants in Russia and abroad. They include information posters at the entrance to nuclear facilities, equipment simulators for employees to learn how to prevent foreign objects from getting into open systems, additional measures against ingress of fine particles, and training courses for municipal college students who will works as supervisors at the plant. The WANO mission consisted of nine experts from Russia, Belarus, Armenia and Ukraine. "Novovoronezh left us with a very positive impression. As a representative of the nuclear power plant under construction, I find this mission to be extremely useful as I had an opportunity to see an operating plant. I think results of the mission can be used during the equipment installation phase of our project. They should be carefully examined and implemented. Many of the practices I saw at Novovoronezh will be introduced at our plant in Belarus," said Sergei Bylchinsky, a WANO expert representing the Belarus Nuclear Power Plant.

Rusatom Service Supplied Equipment for Armenian NPP and Signed Contract to Supply Machinery to Kozloduy

On 10 December, the first of two generators was delivered to the Armenian Nuclear Power Plant by Rusatom Service. The new machine will replace the old generator manufactured in the 1970s. Along with the turbine generator, the contractor will replace auxiliary systems as provided for in the nuclear plant life extension contract. The turbine generator was produced by Power Machines, the world's Top 10 company in terms of machinery installed. The second turbine generator will be delivered to the nuclear power plant in December 2018. In addition, Rusatom Overseas signed two contracts with Bulgaria's Kozloduy NPP to supply systems and equipment for Units 5 and 6 in 2018. The scope of delivery includes spare parts for the reactor rod control systems (RCS). The function of RCS is to control fission reaction in the core and, consequently, reactor power. Rusatom Service will also deliver spare parts for the instrumentation and control (I&C) systems and the centralized radiation measurement and control systems to be used during the forthcoming preventive repairs. These systems ensure safe operation of the nuclear power plant and monitor radiation doses and exposure.

Repairs Completed at Armenian NPP

The Central Research Institute for Machine Building Technology (a subsidiary of AtomEnergoMash, Rosatom's engineering division) has completed repairs on the reactor island of Armenian NPP Unit 2. The work was done in full compliance with the time schedule and quality requirements. The Armenian NPP is a key power generator accounting for 40% of total power output in the country. Pursuant to the framework agreement between Russia and Armenia, a contract was concluded between the Armenian plant and Rusatom Service to assess the reactor's condition after long-time operation and perform repairs. Earlier this year Rusatom Service selected the Central Research Institute for Machine Building Technology as a general contractor and a single service provider under this contract. In its turn, the institute subcontracted RosEnergoAtom, OKB Gidropress and ECHO+ to deliver the project. Up to 40 employees of the subcontractors were simultaneously working on the customer's site. The Central Research Institute for Machine Building Technology developed technical documents for the project, procured and supplied welding materials and equipment, provided technical staff, and, in association with ECHO+, performed non-destructive testing on the reactor systems.