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NEW BUILD

Fuel Loading Started at Tianwan-4

On August 25, 2018 the first fuel assembly (FA) was loaded into the reactor core of Tianwan NPP Unit 4 in China. In total, 163 FAs are to be loaded into the VVER-1200 reactor.

“Fuel loading is the commencement of the unit’s first criticality procedures. Unit 4 will then enter the start-up stage to be connected to the power grid of China. We are planning to complete all the main stages by the end of the year, in accordance with the schedule,” Alexey Bannik, director for JSC ASE EC projects in China said.

Once the fuel loading and the starting up and adjustment works are complete,

For reference:

Tianwan NPP is the largest facility built within the framework of the Russian-Chinese economic cooperation. The first stage of Tianwan NPP (Units 1, 2) was commissioned in 2007. The start-up of Tianwan NPP Unit 3 took place in December 2017. Currently, three VVER-1000 power units constructed under the Russian design are operational at Tianwan NPP.

On June 8, 2018 a strategic package of documents determining the main areas of cooperation between Russia and China in the field of nuclear power for the forthcoming decades was signed in Beijing. In particular, four new power units with VVER-1200 Gen 3+ reactors will be built: Units 7 and 8 of Tianwan NPP with VVER 1200 reactors and 2 power units at the new site Xudapu.

the unit will be brought to minimum controllable power level (MCL). After that, the reactor will be gradually brought to 100% capacity. ^{NL}



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For reference:

The Generation III+ VVER-1200 reactor is constructed at Novovoronezh-II NPP Unit 2 site. It is the reference project for Rooppur NPP, built in Bangladesh. The unit provides for the highest level of operational safety and fully meets all post-Fukushima requirements. Its main feature is a combination of active and passive safety systems, which do not require the NPP personnel's intervention.

Turbine About to Start

The turbine was put on barring gear at Unit 2 of Novovoronezh-II NPP, marking the completion of another pre-operational stage.

This is a final step in a series of operations, which include connection of turbine components to each other and high precision alignment. The goal is to check whether all the wheelspace components are correctly assembled and whether turbines and generator shafts are properly aligned. During this step, the turbine is dry-cranked for the first time, with oil-jacking, lubricating, cooling and heating systems examined and tested.

According to Oleg Shperle, ASE Vice President and Manager of Novovoronezh Project, the cranking operation proved high quality of the turbine assembly. The next step is to build up vacuum in the turbine while on the barring gear to make it ready for operating under pressure, he said. 



Turbine Assembled

All the main equipment of the turbine building of Leningrad-II NPP Unit 2 is installed. The work inside the turbine building is executed on schedule, Rosenergoatom (owns and operates all Russian NPPs) reported.

The stator, separators, moisture separator-reheaters, the deaerator, turbine condensers, high and low pressure heaters, and heat exchangers are put to the design places. The turbine shaft has been aligned; three travelling cranes have been successfully operated. Four locations within the turbine building, with total area of almost 25 thousand square



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meters, are filled with more than 5 thousand tons of pipelines and almost 4 thousand units of valves that are being assembled.

According to Kiril Mazurin, Rosenergoatom's Deputy Chief Engineer for Construction and Installation at the Capital Projects Division, the construction in the turbine building of Unit 2 is almost complete: only a few final steps are left.

Construction, installation and finishing works at the new power units are conducted simultaneously. This means that the contractors not only stay on schedule, but are even ahead of it in some areas. ^{NL}

For reference:

Leningrad-II NPP is located in the town of Sosnovy Bor, 40 km west of St. Petersburg on the shore of the Gulf of Finland. Two units with VVER-1200 reactors are built there. They are going to replace the Leningrad NPP, which is Russia's first plant with RBMK-1000 reactors (thermal-neutron heat-pipe cooled uranium-graphite nuclear reactors).

FINANCE

Rosatom Revenue Grew by 10.2% in 2017

According to Rosatom's annual report, its revenues increased up to 967.4 billion RUB (approximately 14,4 billion USD) in 2017.



As per International Financial Reporting Standards (IFRS), in 2017 revenues increased by 10.2% up to RUB 967.4 billion. International revenues reached US \$6.1 billion (up by 9.4% compared to 2016), the report states.

GLOBAL EXPANSION

In 2017 Rosatom signed 11 intergovernmental agreements and reached 16 large-scale inter-agency arrangements. The volume of the state corporation's overseas contracts for the next 10 years is estimated at 133.5 billion USD. The key events in 2017 expansion were the signing of the general framework agreement between Russia and India for the construction of Kudankulam Units 5 and 6 and entry into force of the contract package for the construction of the four-unit El Dabaa NPP in Egypt.

During the reported period, the implementation of contracts for construction of NPPs abroad continued. Unit 3 of Tianwan NPP (China) was commissioned; "first concrete" was poured at Units 3, 4 of Kudankulam NPP (India) and at Unit 1 of Rooppur NPP (Bangladesh). The construction works at Bushehr NPP II (Iran) also started. A ceremony dedicated to the start of full-scale construction works at Akkuyu NPP took place in Turkey.



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DOMESTIC GENERATION

Nuclear generated 18.9% of Russia's total electricity. Construction and commissioning of new capacities continued in 2017. Unit 1 of Leningrad-I NPP II and Unit 4 of Rostov NPP have been put in operation. Unit 1 of Novovoronezh-II NPP has been put in commercial operation. With that, as in previous years, all nuclear facilities operated safely and reliably. There were no reported departures from Level 2 and higher as per the International Nuclear Event Scale (INES) (departures from Levels 1 and 0 do not pose any danger to the personnel, general public and environment).

DOMESTIC NEW BUSINESSES

The portfolio of Rosatom's wind power facilities to be commissioned in Russia by 2020 has grown to 970 MW (43% of the projected volume of the national wind power market). The state corporation is going to build wind farms in a number of regions in the Russian South.

In 2017, Rosatom started to provide nuclear medicine services in cooperation with regional medical institutions of Chelyabinsk region (South of the Ural Mountains). The development of a domestic X-ray therapy complex based on a linear electron accelerator has started with the joint financing of the Ministry of Education and Science of Russia.

In the reported period Rosatom was designated as one of the Competence Centers under the governmental program "Digital Economy of the Russian Federation". The digital transformation of the nuclear sector started; promising

For reference:

Rosatom's Annual Report was prepared according to requirements of key international standards: International <IR> Framework, Global Reporting Initiative (GRI SRS), AccountAbility Series Standards as well as with the close interaction of stakeholders. In particular, two public hearings were held on the priority topics and the draft report.

Rosatom (the full name: State Atomic Energy Corporation "Rosatom") is a Russian state-owned corporation and one of the leaders of the global nuclear technology market. It incorporates assets in nuclear power, design and construction of NPPs and power machine engineering. Rosatom is the largest generating company in Russia. It holds the world's 1st place in the size of foreign orders portfolio (35 power units at different stages of implementation in 11 countries); 2nd place in the world in uranium resources; and the 3rd place in their extraction volume. The state-owned corporation holds 36% of the world uranium enrichment services and 17% of nuclear fuel market. Rosatom incorporates over 300 enterprises and organizations, including the world's only nuclear icebreaker fleet.

projects associated with supercomputers, additive technologies, lifecycle management of complex engineering facilities are being implemented.

LOOKING FORWARD

"The achieved results demonstrate our contribution to improvement of people's life and creation of new opportunities while preserving nature and environment.



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We supply the world with clean, safe and affordable energy and innovations based on nuclear technologies. Speaking about the priorities for 2018, I would like to highlight the importance of the multilateral cooperation and partnerships. We are open to constructive cooperation at both national and global levels with governments, businesses, international organizations, the general public and other stakeholders.

I am sure that we can achieve major results for the planet's sustainable development only together, merging and multiplying competences of each other," said Rosatom Director General Alexey Likhachev. [NL](#)



Financing Projects in Eurasia

Rusatom International Network (RIN) and the Eurasian Development Bank (EDB) signed a memorandum of cooperation. The parties plan to finance projects in Eastern Europe, Transcaucasia and Central Asia.

The document was signed by Alexander Merten, President of RIN, and Vsevolod Smakov, Head of EDB Project Department.

The memorandum provides for the cooperation in Rosatom's projects related to renewable power sources, heat generation, nuclear medicine, use of irradiation technology in industry, agriculture and food treatment, construction of nuclear and other facilities, and nuclear services.

"The Bank is ready to support Rosatom in implementing its hi-tech energy and industrial projects in Armenia, Belarus and Central Asia. We pin much hope on our joint projects," Vsevolod Smakov said.

Alexander Merten noted in his turn that the memorandum "laid a foundation for future progress in the projects involving Rosatom Group companies as machinery suppliers or service providers to local private and public companies". [NL](#)

For reference:

Rusatom International Network is a Rosatom Group company managing and developing a network of Rosatom's regional offices around the globe. Its primary goal is to promote Russian nuclear products and services on the global market, foster communications, and assist Russian nuclear companies in obtaining finance.

The Eurasian Development Bank is an international finance institution established by Russia and Kazakhstan in January 2006 to promote economic growth in its member states, extend trade and economic ties among them. The EDB member states are Armenia, Belarus, Kazakhstan, Kyrgyzstan, Russia and Tajikistan.



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EDUCATION



Hot Work

Indian Engineers will learn heat treatment from Rosatom's experts in material studies

On August 22 Indian engineers started an advanced training course in heat treatment in Ranchi, India. The course is taught by experts from the Central Research Institute for Machine Building Technology (a subsidiary of Atomenergomash, Rosatom's mechanical engineering division).

The education process is organized in the Center for General Engineering and Technical Training (CGETT). Representatives of Indian engineering enterprises will spend 1.5 weeks learning about heat treatment technologies in the production of heavy machinery and power generating equipment. CGETT certificates to be issued to course graduates will be recognized in India as advanced training certificates.

This is the second out of nine courses developed by the Central Research Institute for Machine Building Technology for CGETT.

The agreement was concluded in 2015 between the Central Research Institute for Machine Building Technology and India's Heavy Engineering Corporation Limited.

A set of courses is designed to upgrade skills of Indian engineers in steel making, electro-slag remelting, non-destructive and destructive testing, and gear drive design and manufacturing. The courses range 1.5 weeks to four months in duration. The next course is scheduled for late September. [NL](#)

INNOVATION



TVEL to Support Startups

Rosatom's TVEL Fuel Company created a startup accelerator to promote new ideas.

TVEL's startup accelerator targets projects in chemistry, engineering, metallurgy of special alloys, additive manufacturing, and green energy technologies. Its model is based on providing partial financing for the best projects by raising money from venture funds



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and development institutions. TVEL’s options for participating in investment projects range from acquiring a share in a startup to employing the originators of a new idea as a project team.

“The reason behind the startup accelerator was TVEL’s strategic goal of multiplying its non-nuclear revenue by 2030. With this project, we aim to reduce the time to market for new products from the current five to two years. Another task is to keep new ideas flowing in and tailor them to market needs,” Yakov Kop, TVEL Senior Vice President for Strategic Development and Operations Efficiency, said.

At the pilot stage of the project, 16 applications were pre-selected from over the 40 that were initially submitted. [NL](#)

EVENTS

Rosatom to Partner with Russian Energy Week

Rosatom will become the general nuclear partner of the Russian Energy Week 2018.

Russian Energy Week 2018, a major international event, will take place on October 3–6, 2018 at the Moscow Manege Exhibition Hall. The forum’s business program includes a round table meeting of Rosatom’s top managers to discuss the current trends in development of the global energy industry and nuclear technologies.



The exhibition will feature a collective stand representing diverse nuclear companies.

Russian Energy Week helps to highlight the main areas of development for the global power industry and fulfill the potential of international cooperation. At last year’s event, Rosatom held a round table discussion devoted to the present and future role of nuclear power in the global energy mix. [NL](#)

For reference:

The forum brings together heads of states, ministers of energy, managers of international power companies, and global experts represented by researchers, media, and civil activists. In 2017, the forum attracted a total of more than 10,000 attendees, with 150 companies from Russia and 76 ones from abroad taking part in the business program.

Full House at NucKids Show

NucKids 2018, an international creative project for children organized by



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Rosatom, wrapped up with a show in Moscow.

On August 15 and 16, the NucKids musical “Lomonosov’s Scroll” ran at Moscow’s Et Cetera theater. The show brought together 56 kids from Russia and 24 from Bangladesh, Belarus, Great Britain, Hungary, Egypt, India, China, Turkey, and Croatia.

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The rehearsals began on July 5, 2018 in Tolna (Hungary), ending up with a premiere on August 4 in Hungary’s city of Szekszárd. Afterwards, the NucKids 2018 team traveled to a number of Russian cities, including Moscow. [NL](#)

For reference:

NucKids (Nuclear Kids) is a charity-supported international creative project for children initiated by Rosatom’s Communication Department 10 years ago. The project is aimed at developing friendship between children of nuclear engineers, with talented kids annually selected for staging an original musical directed by adults.



TRENDS



World Nuclear Performance in 2017

([World Nuclear Association report](#) overview)

GENERATION RISES

Nuclear power plants performed well in 2017. They produced a total of 2506 TWh of electricity, up from 2477 TWh in 2016. Compared to 2012, nuclear generation rose by 160 TWh. **Therefore 2017 became the fifth successive year that nuclear energy output has grown.**

“Much needs to be done to deliver the Harmony goal (bringing the nuclear share in global electricity supply to 25% in 2050 — Rosatom Newsletter), but good progress has been made, both in terms of global reactor performance and new

nuclear capacity additions,” World Nuclear Association’s Director General Agneta Rising said.

The global average capacity factor in 2017 was 81.1%, up from 80.5% for 2016. This maintains the high level of performance observed since 2000 following the substantial improvement seen over the preceding years. In general, a high capacity factor is a reflection of good operation performance. However, there is an increasing trend in some countries for nuclear reactors to operate in a load-following mode. The mean capacity factor for reactors over the last five years shows no significant variation regardless of their age.

In 2017 the total net capacity of nuclear power in operation grew to 394 GWe from 391 GWe in 2016. These figures are higher than the end of year capacity as they include those reactors that were closed during each year. The global capacity at the end of 2017 was 392 GWe, up from 390 GW in 2016.



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Usually only a small fraction of operable nuclear capacity does not generate electricity in a calendar year. However, since 2011, most of the Japanese reactor fleet has been awaiting restart. Two reactors were restarted in 2017 and more are expected in 2018. **“Japan reaffirmed its target for nuclear energy to supply 20-22% of the country’s electricity by 2030,”** Agneta Rising underlined.

The net capacity of nuclear plant that generated electricity in 2017 was 352 GWe. The PWR continues to be the predominant reactor type in use, with all four reactors connected to the grid and four construction starts being based on PWR technology.

“In 2017 nuclear plants brought benefits to local communities, supported national economies and helped meet our growing global need for clean and reliable electricity. Through our Harmony program we are outlining the steps needed to allow nuclear generation to make its full contribution to our sustainable energy future,” Agneta Rising explained.

NEW BUILD

“The nuclear industry’s Harmony goal requires 1000 GW of new nuclear build by 2050. A path to that target is for 10 GW of nuclear capacity to be added each year between 2016-2020. After 2015 and 2016 each saw nearly 10 GWe of new nuclear capacity start up, a more modest 3.3 GWe was connected to the grid in 2017. However,

in 2018 and 2019 more than 26 GWe of new nuclear capacity is scheduled to come online, meeting the overall target for this first five-year period,” World Nuclear Association’s Director General Agneta Rising explained.

With four construction starts (three of them with Russian-designed VVER reactors – Rosatom Newsletter), two reactor construction cancellations and four reactors being grid connected, the total number of reactors under construction fell by two to 59 over the course of 2017.

In 2017 four reactors were grid connected (one of them is VVER at Tianwan-3 – Rosatom Newsletter) and five were permanently shut down, although two of these were previously in long-term shutdown.

The median construction time was 58 months, down from 74 months in 2016, and equaling the lowest five-year median construction time achieved in 2001-2005.

“New countries are choosing nuclear energy to meet their future energy needs because of the many benefits that it will bring. Nuclear new build will offer opportunities for host country supply chain businesses to participate in the construction of the reactors. Host regions can benefit from investment in local infrastructure. **Many jobs will be created, both during construction and operation of the plant,”** Agneta Rising stated. ^{NL}



TRENDS

Looking to the Future

(Extracts from Agneta Rising's Concluding Remarks)

There is no sustainable energy future without nuclear energy. To meet the growing demand for reliable, affordable and clean electricity, we will need all low-carbon energy sources to work together. Nuclear capacity must expand to achieve this.

The pace of capacity additions required to meet the Harmony goal needs to accelerate in the next decade, eventually reaching an average of 33 GWe of new nuclear capacity added each year.

Action is needed in three key areas to allow nuclear generation to grow at its full potential. There needs to be a level playing field in energy markets, where nuclear energy is treated on equal opportunity with other low-carbon technologies and recognized for its value in a reliable, resilient low-carbon energy mix that optimizes existing low-carbon energy resources already in-place and drives investment in future clean energy. Harmonized regulatory processes are required in order to provide a more internationally consistent, efficient and



AGNETA RISING,
Director General of World Nuclear Association

predictable nuclear licensing regime, to facilitate significant growth of nuclear capacity, without compromising safety and security.

And there needs to be an effective safety paradigm focusing on genuine public wellbeing, where the health, environmental and safety benefits of nuclear are better understood and valued when compared with other energy sources.

Governments are now renewing their recognition of the importance of nuclear energy in achieving a sustainable low carbon energy supply. The launch of the Nuclear Innovation: Clean Energy Future (NICE Future) initiative at the Clean Energy Ministerial in May 2018 put nuclear energy back on an even footing with other low-carbon solutions already discussed within the Clean Energy Ministerial process.

The NICE Future initiative will play a crucial role in multilateral dialogue and engagement of policymakers on the role of nuclear energy as part of a low-carbon mix contributing to sustainable development. ^{NL}

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BANGLADESH



Core Catcher for Rooppur

A molten core catcher is being installed at the Rooppur NPP in Bangladesh.

The installation of a molten core catcher, a device meant to curb the effects of a nuclear meltdown, in the unlikely event of its occurrence, began at the site of the Russian-designed Rooppur NPP Unit 1 in Bangladesh.

The molten core catcher is a unique safety device developed by Russian nuclear engineers. Its cone-shaped body is placed under the reactor pressure vessel and filled with a special material, which mixes up with the reactor core materials in case of a meltdown.

The catcher is the first piece of large-size equipment (about 200 tons) to be installed

For reference:

Rooppur NPP with two VVER-1200 reactors and the total capacity of 2400 MW is being constructed under the Russian design, in accordance with the General Contract, signed on 25 December 2015. Atomstroyexport, the Engineering Division of Rosatom State Corporation, is implementing the project as the General Contractor.

The “first concrete” ceremony for Unit 1 took place on November 30, 2017, marking the beginning of main construction phase. The “first concrete” ceremony for the Unit 2 was held on July 14 of the current year.

Each stage of Rooppur NPP construction is stringently monitored by IAEA and the Bangladesh Atomic Energy Regulatory Authority (BAERA).

in the reactor building. The installation is scheduled to be completed within half a year. 



BANGLADESH

From Theory to Practice

The staff of Bangladesh's Rooppur NPP will be trained in capital construction basics in Russia.

Rosatom Technical Academy (Rosatom Tech) based in Obninsk (Kaluga Region, Russia) began training manpower for the Rooppur nuclear power plant under the Capital Construction Administration Program. The course will last for 4.5 months, during which the trainees will acquire knowledge about administration, construction, and specifics of equipment acceptance and installation. The associated internship will take place at Novovoronezh-II NPP, which serves as a reference project for Rooppur.

The contract to train the Rooppur operations team was signed on December 22, 2017 and provided for instructing over 1,400 trainees. Rusatom Service (see For reference) represented the Russian party.

“Qualified employees constitute a core value in any industry. One of our tasks is

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For reference:

Rusatom Service JSC is a member of the «Electric Power» division of Rosatom. The company provides a full range of services and supplies required for maintenance and repair of foreign nuclear power plants that operate VVER-type reactors. The company has been present on the market in almost every country with existing VVER units outside Russia.

Rusatom Service holds leading positions in the markets of China, Iran, Bulgaria and Armenia and acts as a general contractor for works for lifetime extension, implementation of scheduled preventive maintenance and upgrading the equipment at VVER nuclear power plants.

to train and develop nuclear manpower. Having broad expertise in the field, Rosatom offers a full range of services in vocational training, career enhancement and organizing internships at companies within the group,” said Evgeny Salkov, CEO of Rusatom Service. ^{NL}