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Asian Markets Welcome Us

Taking part in the Eastern Economic Forum (EEF) held in early September, Rosatom Director General Alexey Likhachev spoke about cooperation with Asian countries and logistics prospects for the Northern Sea Route.

Held for the ninth time, the EEF aims to strengthen ties between the Russian and international community and promote the development of the Far Eastern region of the Russian Federation. This year's forum brought together over 7,000 guests from 75 countries, resulting in more than 300 agreements signed.

"We feel very comfortable in Asia," Alexey Likhachev said with assurance at the forum. He cited as an example the visit of Russian President Vladimir Putin to Mongolia, which took place during the first days of the EEF. "In Mongolia, we once again saw much interest in our technologies and projects, ranging from uranium mining to construction of nuclear power plants, and also a high level of trust from our partners. Nuclear technologies can bring our bilateral relations with

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Mongolia to a new level," Rosatom chief was confident. The technical design of an SMR nuclear power plant for the country is about to be approved. The power plant is supposed to supply power to the city of New Kharkhorum, which the Mongolian authorities plan to establish on the site of the ancient capital of Genghis Khan's empire.

Rosatom also has far-reaching plans to expand its relations with China, India, and Bangladesh. "As a rule, once every six to seven years we conclude framework agreements on mutually beneficial terms. They provide, on our part, for the supply of nuclear power plants, equipment, and fuel. In turn, Rosatom gets involved in the development and localization of new technological solutions. This is how our interests are balanced. We know what the roadmap in our relations with China, India, and Bangladesh looks like for today, and we are working on a roadmap for tomorrow," Alexey Likhachev said.

Negotiations are underway with a number of countries to establish a nuclear industry. These are, for example, Thailand, the Philippines, and Myanmar. "The time will come when we will move from shared intentions to down-to-earth action," Alexey Likhachev expressed his confidence. Basically, these countries are interested in small-scale generation facilities, both onshore and offshore, as they are located on islands or have a long coastline. Offshore solutions are extremely attractive to potential customers as they can save on infrastructure. In addition, offshore nuclear generation facilities offered by Rosatom have a refueling interval of about 10 years. "This is a kind of nuclear battery that lasts for years," Rosatom Director General explains.

Young people are getting increasingly more involved in Russian nuclear projects, and

more effort is being made to provide appropriate professional education and training. Many young talents from other countries study at Russian universities under Rosatom quotas. "Even in the countries where the nuclear seed has not yet sprouted, a nuclear elite is already being formed. There are examples when guys from Myanmar work in Bangladesh, and guys from Bangladesh are involved in our Turkish projects," Alexey Likhachev said.

"Asian markets welcome us despite all the attempts to cut Russia off from the global markets. I am sure that we will be able to spur the development of these markets and, most importantly, give them game-changing technology. The comprehensive decision to embark on a nuclear program will bring their economy, education, medicine, research and agriculture to a totally new level," Alexey Likhachev summarized.

Great NSR

The head of Rosatom also outlined the nuclear corporation's strategy for the development of the Great Northern Sea Route. This

is a commercial sea lane to link Far Eastern ports with Kaliningrad and St. Petersburg. Improving port facilities and infrastructure on this route will solve three tasks.

First, this will ensure uninterrupted freight transportation within Russia. Second, this will contribute to export-oriented Arctic projects. Asian and East Asian markets are interested in energy resources and metals mined in the Arctic. "Russian mining projects are now under strong pressure from sanctions. The growth in freight shipments might sometimes be decreasing, but we are working hard to already see a return to previous growth rates," Rosatom chief pointed out. The third task is international container transit.

"Three functions tie together in a complementary way: on the one hand, we ensure year-round navigation with our growing fleet of advanced nuclear icebreakers. On the other hand, the Northern Sea Route administration has spent the past few years doing its best to improve navigation safety and long-term planning on the route. In addition, our partners from South-East Asia, East Asia, the People's Republic of China and the Arab Emirates, as well as Russian operators, make a direct contribution to the growth of freight traffic," Alexey Likhachev concluded.

Through Festival to Atoms

In mid-August, Yangon, the capital of Myanmar, hosted the Science Festival, a joint event between Rosatom and the Myanmar Ministry of Science and Technology. For three days, Myanmar students and schoolchildren listened to lectures, took part in competitions and, most importantly, learned about Russian nuclear technologies, which are of growing interest to them.

This is the second time the Science Festival has been held in Myanmar, attracting increasingly more visitors. The festival was held at three venues: Information Center for Atomic Technology (ICAT), Yangon Technological University, and the Singapore-Myanmar Vocational Training Institute. Speaking at the opening ceremony, Dr. Myo Thein Kyaw, Union Minister of Science and Technology of the Republic of the Union of Myanmar, said that students' interest in science and engineering professions was growing, which

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contributed to the development of human resources in the research-intensive and nuclear-related sectors.

Among the first events of the festival was a lecture titled 'Nuclear Power Around the World: Myths and Facts'. First, professors from Russia's National Nuclear Research University (MEPhI, Rosatom's backbone university) demonstrated a video with the most popular questions and answers about nuclear technologies, such as the design of nuclear power plants, ionizing radiation in agriculture and medicine, and the role of nuclear in the development of science and technology. The audience could then ask the Russian lecturers their questions. According to one of the lecturers, Dmitry Samokhin, young people were interested in how safe present-day nuclear generation facilities are and what methods exist for handling waste generated during the operation of small modular reactors. It should be recalled that Russia and Myanmar are considering the possibility of building an SMR nuclear power plant in this Asian country as part of the intergovernmental agreement on cooperation in peaceful uses of nuclear energy signed by the two countries in February 2023.

This year's HackAtom, a hackathon for student teams competing in nuclear technology, not IT, was also aimed at diving into the SMR theme. The idea of HackAtoms was proposed by MEPhI professors. Last year, the hackathon participants had to come up with the most effective ways of promoting nuclear technologies in Myanmar. This time, they started with listening to introductory lectures on nuclear power and SMR specifics (based, of course, on Russian examples), including economic, environmental and social aspects of the construction and operation of small-scale nuclear generation facilities, on the first day of the festival. On the next day, 12 teams from different universities had 24 hours to choose the best site for an SMR nuclear power plant in Myanmar (students know their country from inside) and explain their choice, said MEPhI Associate Professor Alexander Nakhabov, one of the HackAtom organizers. "Of course, this task will be solved by specialized, professional institutes and organizations, but we wanted to interest and fascinate the guys," Alexander Nakhabov explains.

This approach worked. Many teams elaborated their proposals in depth, taking into account the future power needs in different regions, local seismic hazards, and access to water. "It is interesting that different teams proposed different sites," Alexander Nakhabov noted. All the participants of HackAtom received certificates, and the winners were awarded prizes.

No less interesting was the festival for schoolchildren. During the festival, MEPhI lecturers told them about nuclear technologies. The children learned from a competitive game how to improve their scientific knowledge and what specialists will be needed for the nuclear industry in their country.

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An interactive quiz was held for schoolchildren at the ICAT. Its participants learned about peaceful uses of nuclear technology, had their knowledge tested, made guesses about professions of the future, and even simulated a chain reaction with dominoes. At a workshop, the children made boats of a certain size from improvised materials. The boats had to carry a predetermined load and float in the aquarium. Another event was the Strength of Materials for Dummies paper show. "We showed, for example, how to turn an A4 paper sheet into a gate through which a person will pass. Then the kids used paper sheets and paper tape to build a chair with a backrest that could support the weight of a person. Most of the products broke under the weight of a man, but one survived, and the team of its makers received the main prize," said Larisa Matveeva, the head of the Information Center for Atomic Energy of Chelyabinsk and an organizer of competitions in Myanmar.

The ICAT also hosted a public discussion with Myanmar university professors and a panel discussion on nuclear technology. "Myanmar needs nuclear technology for its development. And we need young people, the main driving force of the country, to step in and take full advantage of this technology. It is important to foster young talents so that they can participate widely in the use of nuclear technology," said Deputy Minister of Science and Technology Aung Zeya.

The festival also featured a talk show with women who have dedicated their lives to science and research. Prof. Yi Mon Nai from the Yangon Technological University and Daw Nae Zi Tyry Naw from the Mandalay Technological University spoke to students and schoolchildren about their work and career paths.

"The main idea behind the Science Festival is to demonstrate the capabilities of nuclear technology in an easy-to-grasp and interesting form, bring young activists together, and give them a chance to immerse themselves into the fascinating world of innovations and scientific discoveries in an informal and friendly atmosphere. I am sure that there are children among the festival participants who will want to become engineers and designers and who will implement nuclear projects, promote energy solutions, create new materials, and participate in the development of nuclear medicine," said Andrey Timonov, Acting Director for Communications at Rosatom.

Practice proves this approach to be effective. As Alexander Nakhabov noted, the students who participated in last year's HackAtom and won it have applied to study in Russia this year.

A joint program has been adopted to train personnel for Myanmar's nuclear industry: students first study for a bachelor's degree in Myanmar universities and then seek a master's degree in Russia. The educational program also provides that Russian professors will semi-annually hold intensive training courses (lectures and exams) at Myanmar universities on core nuclear disciplines, focusing on Rosatom's technology and solutions.

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Necessary Balance

The balanced nuclear fuel cycle (Balanced NFC) is a new product line developed by Rosatom's subsidiaries TENEX and TVEL. Rosatom's unique proposition that no other country has, the Balanced NFC offers cutting-edge approaches to the management of spent nuclear fuel.

Representatives of the Russian nuclear corporation made two presentations on the new product line at the KazAtomExpo forum held recently in Kazakhstan.

The Balanced NFC is based on the concept of recycling nuclear fuel. The fact is that uranium, which is the primary component of nuclear fuel, does not fully burn out during the reactor operation. In addition, neutron reactions produce plutonium, another fissile material that can also be used as a nuclear fuel component and generate heat. When extracted from spent nuclear fuel (SNF), these elements can be turned into fresh fuel, thus drastically reducing the need for natural uranium and the amount of waste sent for ultimate disposal. This is the essence of reiterated fuel reprocessing within the Balanced NFC.

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The Balanced NFC as a product offered to customers comprises four services. These are, first, SNF reprocessing and high-level radioactive waste fractionation; second, production of uranium-plutonium fuel; third, destruction of minor actinides in fast reactors; and fourth, systems for long-term storage and transportation of SNF and high-level waste. These four services cover the entire spectrum of tasks related to the management of spent nuclear fuel from commercial reactors. Customers can order either individual services or the full package. The services are designed for the operators of water-cooled water-moderated reactors (suitable for different modifications of VVERs, PWRs, BWRs, etc.). Specific designs may be customized to meet the customer's needs and constraints.

How it works: SNF removal and reprocessing

Spent nuclear fuel cooled in the spent fuel pool is packed into leak-proof transportation and handling containers. As the amount of SNF increases, it is reloaded into higher-capacity storage overpacks. When the number of overpacks is enough to form a convoy, they are shipped to Russia for reprocessing at Rosatom's facilities. This is where the most interesting transformations begin as spent fuel is separated into fractions (fractionated). First, uranium (about 96% of the total fuel mass) and plutonium (about 1.2%) are extracted and can be used to make new portions of different types of fuel. Then minor actinides — neptunium, americium and curium — are extracted and sent to fast neutron reactors for destruction. Finally, the so-called 'short-lived fraction', mostly strontium and cesium, is vitrified and sent for ultimate disposal.

Fabrication of fresh fuel

The nuclear power plant operator can order fuel made of the materials recovered from spent nuclear fuel. Thermal neutron reactors can use either fuel made from regenerated uranium or REMIX fuel, which contains a mixture of uranium and plutonium. It has the same geometry as uranium fuel but differs in neutronic parameters. If the customer does not want to use this option, regenerated uranium and plutonium will be used to fabricate fresh fuel for the reactors in Russia.

Transmutation of minor actinides

This is actually the most uncommon service in the Balanced NFC package. It has no alternative in the market since Rosatom is yet the only company in the world to have brought to life the idea of burning minor actinides — long-lived and highly radiotoxic transuranic elements — in fast neutron reactors. In July 2024, three fuel assemblies with minor actinides added to the fuel composition were for the first time ever loaded into the BN-800 reactor at the Beloyarsk Nuclear Power Plant.

We wrote about this event in detail in our previous issue.

When loaded in a fast reactor, americium and neptunium are converted into short-lived or stable elements, whose radioactivity will decrease to the level of natural uranium ore in around 300 years. This is an achievement of paramount importance as it significantly reduces the amount of radioactive waste sent for disposal and its hazards. For comparison, spent nuclear fuel, if untreated, remains potentially hazardous for at least 700,000 years.

Storage and transportation

When ordering removal and recycling services, the customer can also purchase transportation containers, high-capacity storage overpacks, and container storage facilities to house them all. All these components will make fuel handling, storage and transportation safe and secure. Akkuyu is the first nuclear station to have ordered this service. In February of this year, Rosatom delivered its pilot transportation and handling container TUK-137T.A1 to the site.

For the customers ordering the Balanced NFC service, Rosatom will hold the short-lived high-activity fraction for about 30 years. It will then be transported to the customer's country and placed into the near-surface repository together with medium-activity waste for ultimate disposal. There is another option available: the short-lived high-activity fraction will be extracted and placed into high-capacity storage overpacks at the customer's site, where they will be held for 30 years until SNF radioactivity reaches the level suitable for disposal.

Customer benefits

With the Balanced NFC, the customer will minimize the amount of waste generated. According to preliminary expert estimates, a nuclear station with two VVER-1200 reactors will generate 7,000 cubic meters of spent nuclear fuel (including packaging) during 60 years of its service life. Seven times less SNF remains after reprocessing. The entire amount of medium-level waste (the matrix included) will fit into 30 high-capacity storage overpacks. Infrastructure costs for temporary storage and ultimate disposal of radioactive waste will be reduced by about 23%. Another important advantage is the possibility of using 'green finance' as the Balanced NFC meets all the latest sustainability criteria. In general, the introduction and broad use of the Balanced NFC services will make it possible to cut down on spent fuel accumulation and reaffirm the status of nuclear as a clean and renewable energy source.

The presentations made at KazAtomExpo raised many questions and positive feedback from the visitors. The questions were primarily related to the solutions for high-level waste fractionation and transmutation of minor actinides, which are still unfamiliar to the broad audience. Positive feedback was related to the fact that Rosatom has created a convenient product that relieves nuclear operators of concerns about the long-term fate of spent nuclear fuel. NL

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Russian Atoms Join European Nuclear

The World Nuclear Performance Report 2024 produced by the World Nuclear Association considers the state of affairs in the global nuclear industry as at 2023. Europe, whose nuclear generation has been in decline for many years, turned into a leader in terms of new nuclear connections. Two reactors came online in 2023, one at Slovakia's Mochovce NPP and the other in Belarus, both of Russian design. On the whole, the nuclear power industry was actually treading water by each key indicator in 2023.

Generation and operation

Nuclear reactors around the world generated 2,602 TWh of electricity last year, up 58 TWh from 2,544 TWh in 2022, but down 51 TWh from 2,653 TWh in 2021. France was the major contribution to last year's 58 TWh recovery, having increased its electricity genera-

tion by 42 TWh and thus offsetting about half of the reduction in output that was caused by extended outages of the French reactors.

In Asia, generation also continued to grow strongly in 2023. Total generation in other regions was broadly similar to the previous year.

The total number of reactors in operation remained unchanged from 2022, standing at 437, but their installed capacity decreased by 1 GW over the year to 392 GW. Some reactors, such as in Japan and India, have an operable status but do not generate electricity. Overall, the capacity of reactors that produced electricity in 2023 was 368 GW, up 3 GW on the previous year.

Capacity factors in 2023 were broadly in line with those achieved in the previous five years. The global average capacity factor in 2023 was 81.5% (vs. 80.4% in 2022), remaining approximately at the same level since 2000. "There has been a steady improvement in average capacity factors in each decade since the 1970s. The high-capacity factors achieved in the 2010s have continued from 2020 onwards," the report says. Commercial fast neutron reactors and light-water graphite reactors (the both reactor types are operated in Russia only) improved their performance. For instance, the capacity factor for LWGRs surpassed 80% in 2023.

There is no overall age-related decline in nuclear reactor performance, according to the report. It was found that the reactors younger than 20 years of operation and those exceeding 45 years of operation have higher than average capacity factors. By contrast, the 'medium age' reactors demonstrated lower than average capacity factors.

Grid connections

Five reactors were connected to the grid in 2023, one in each of China (Fangchenggang 3), South Korea (Shin-Hanul 2), the US (Vogtle 3), Belarus (Ostrovets 2) and Slovakia (Mochovce 3). The reactors at the Mochovce and Ostrovets plants are of Russian design. Mochovce Unit 3 with a VVER-440 reactor was brought online on January 31, 2023. Reactors of this type were among the most frequently built nuclear generation facilities in Eastern Europe in the last century. Its design and performance proved so efficient that Slovakia considered it a good thing for the country to finish the construction of Mochovce 3 and 4, which was suspended back in 1990. Construction works resumed in 2015. Unit 4 is currently being prepared for first power.

Unit 2 of the Belarusian NPP was brought to first power on May 13, 2023. This unit, like the first one, operates a Generation III+ VVER-1200 reactor, and the two of them are the first units with VVER-1200 reactors built outside Russia. Electricity they produce accounted for 30% of total power consump-

tion in Belarus in 2023. To date, this share has reached 40%. “In December 2023, the energy minister Viktor Karankevich said that the country was considering building either a second nuclear power plant or a third unit at Ostrovets. In October Russia’s TVEL and the Belarusian Organization for Radioactive Waste Management entered into an agreement to develop infrastructure for radioactive waste in Belarus, and to train personnel for the operation of a near-surface waste disposal facility,” the report says.

Reactors under construction

In 2023, construction started on six reactors. One of them, El Dabaa Unit 3, is being built by Rosatom. Another five reactors will be built in China.

El Dabaa Nuclear Power Plant will have four VVER-1200 reactors. The site is situated 140 km away from Alexandria, on the Mediterranean coast. Construction works are currently underway at each of the four reactor units (first concrete at Unit 4 was poured on January 4, 2024). In late August, Rosatom Director General Alexey Likhachev and Egyptian Prime Minister Mostafa Madbouly discussed the progress of the project. El Dabaa NPP is of special importance for the country, Mostafa Madbouly emphasized in the discussion, as it is included in the national energy diversification program, which provides for broader use of new and renewable energy sources by 2030. The Egyptian Prime Minister reiterated the commitment of Egypt’s government agencies to supporting the project, given its importance in providing clean electricity to the country.

According to the WNA, the total number of units under construction reached 61. Rosatom is a global leader in terms of reactor units under construction abroad.

In Bangladesh, Rosatom is building the Rooppur Nuclear Power Plant with two VVER-1200 reactors. The construction of Unit 1 started in November 2017; first concrete for Unit 2 was poured in July 2018.

Once completed, the two reactors of the nuclear power plant are expected to provide about 9% of the country’s electricity. Nuclear fuel for the first load was delivered to Bangladesh in October 2023, which officially made the Rooppur NPP a nuclear facility. Pre-license training of the Rooppur personnel was finished in 2024. At present, construction works on the site are fully on schedule. Unit 1 is expected to be put in operation in 2025.

In China, Rosatom is currently involved in the construction of Units 7 and 8 at the Tianwan NPP and Units 3 and 4 at the Xudabao NPP. These four units are being built to the Russian design and will feature VVER-1200 reactors. Rosatom’s scope of supply includes engineering design, technical documents, equipment for the nuclear island, and related

services. Four units with VVER-1000 reactors built earlier at the Tianwan NPP are in operation and supplying electricity to China.

In Hungary, Rosatom is preparing for the first concrete pouring at Paks II. A construction license for two power units with VVER-1200 reactors was issued by the Hungarian Atomic Energy Authority (HAEA) in August 2022. In April 2023, the Hungarian government confirmed its intention to continue the project. In May of the same year, the European Union approved an amended contract with Rosatom. Preparatory earthworks on the site began in July 2023. First concrete for Paks II Unit 1 is expected to be poured by the end of this year.

In India, Rosatom is building four power units (Units 3–6) at the Kudankulam NPP. These units will be equipped with VVER-1000 reactors. The first two power units of the Kudankulam NPP were connected to the grid in 2013 and 2016, respectively.

In Turkey, Rosatom is building a nuclear power plant in the south of the country, 120 km to the southwest of Mersin. The plant will have four VVER-1200 reactors. Construction of Unit 4 started in August 2023. The first unit entered a pre-commissioning stage in April 2024. All the four reactors are expected to be commissioned in the period from 2025 till 2028.

Finally, Rosatom is also building four power units in Russia. These include two VVER-1200 reactors at the Kursk NPP, one VVER-1200 reactor in the Leningrad Region (first concrete was poured in March 2024), and a lead-cooled fast neutron reactor BREST-OD-300 in Seversk. The report specifically mentions that Russia completed the first refueling of the world's first floating nuclear power plant, Akademik Lomonosov, in November 2023.

Besides, in June 2023, Rosatom signed an agreement with TSS Group to build several floating power units with a capacity of at least 100 MW and a service life of up to 60 years. The company plans to sell electricity from aboard the floating units in the Middle East, Southeast Asia and Africa.

Reactor shutdowns

Five reactors were permanently shut down in 2023. Germany led the process, having shut down its three last operating reactors at the Emsland, Isar and Neckarwestheim nuclear power plants. Belgium and China shut down one power unit each (Tihange 2 in Belgium and Kuosheng 2 in Taiwan). However, with five reactors grid-connected in 2023, there was no net change in the number of operable reactors worldwide. The diagram of grid connections and shutdowns shows no clear trend, whether positive or negative.

Plans for the future

Political support for nuclear is growing, WNA Director General Sama Bilbao y León writes in the concluding remarks to the report. At the COP28 climate change conference in Dubai in December 2023, leaders from 25 governments signed a ministerial declaration committing to the tripling of global nuclear energy capacity to achieve net zero by 2050. A similar statement, the Net Zero Nuclear Industry Pledge, was signed by over 120 companies, Rosatom included.

"[…] a significant increase in new nuclear construction is necessary if the tripling goal

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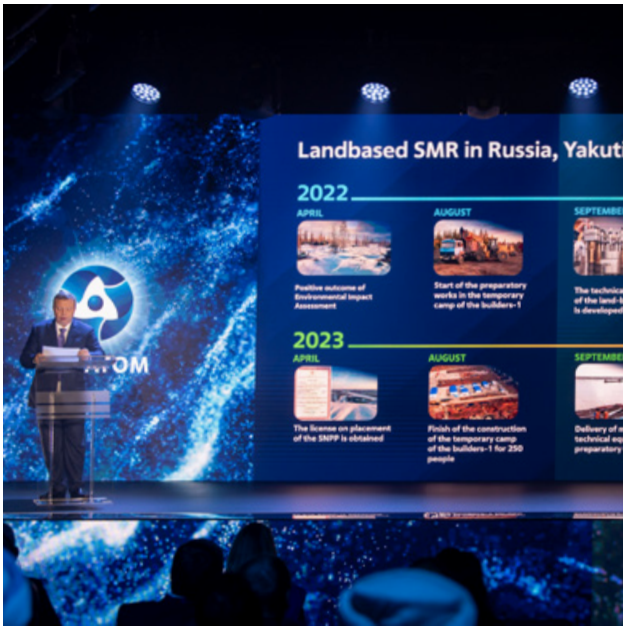

is to be achieved. This level of construction depends on the nuclear industry rising above the financing, supply chain and regulatory challenges faced by new projects, particularly in the Western world," Sama Bilbao y León noted.

The World Nuclear Association expects more governments and companies to sign the declaration to triple global nuclear energy capacity. "Additionally, we anticipate increased collaboration with other industries. Now is the time for the nuclear industry to capitalize on this momentum and deliver the full potential of nuclear energy for people and planet," the WNA Director General concluded.

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Akkuyu: Unparalleled Experience

Construction works are in full swing at the Akkuyu NPP. In early September, the construction site was visited by Energy and Natural Resources Minister Alparslan Bayraktar. Other countries take interest in the unparalleled experience gained from building Turkey's first nuclear power plant.

Construction news

In early September, a delegation of Turkish energy sector officials headed by Alparslan Bayraktar visited the Akkuyu site. They inspected the reactor containment of the first unit, currently under pre-commissioning, held an extended meeting with the project stakeholders, and were reported on the progress of construction works.

"We received the necessary information on the Akkuyu nuclear power plant project, which will be the beginning of a new energy era for Turkey. It is now the world's largest

nuclear construction site, with over 34 thousand employees engaged and the works going full tilt. Full-scale pre-commissioning operations are underway at the first power unit. Works are also on schedule at Units 2, 3 and 4, each planned to be brought online in a one-year interval after the commissioning of the first unit," Alparslan Bayraktar said.

Also in early September, the workers finished concreting the foundation for the turbine at Unit 3. The solid foundation is able to withstand and evenly distribute heavy loads caused by the turbine operation. The concreting task was preceded by the erection of a space reinforcement frame measuring 58 m by 20.4 m and five meters high. The frame was assembled from horizontal and vertical steel bars connected to each other with threaded couplings. These connections significantly reduced installation time and labor costs.

After the concrete slab cures as designed, Akkuyu NPP engineers will proceed with the installation of a turbine generator.

In late August, the builders finished installing the lower dome section of the outer containment shell (OCS) at Unit 1 of the nuclear power plant. It took 10 hours to install this large-sized metal structure at the height of 63 meters. Measuring 50.8 meters in diameter, the structure weighs 340 tonnes.

"After the successful installation of the lower section of the outer containment shell, the next step will be to erect the OCS dome. When assembled, this large-size reinforced concrete structure will protect the reactor unit from external impacts during the entire lifetime of the nuclear power plant," said Sergey Butskikh, CEO at Akkuyu Nuclear.

Meanwhile, the fourth tier of the inner containment shell (ICS) was installed at Unit 3. It is an intermediate element between the cylindrical and dome parts of the containment. The fourth tier is a ring-shaped welded metal structure weighing 396 tonnes and 6.5 meters high. It was pre-assembled on a special site near the power unit under construction and lifted to its intended place by a crawler crane. The fifth tier of the ICS consists of 12 reinforced sections. Assembly of the sections began long before the installation. Sergey Butskikh said: "We pre-assembled the fifth tier of the containment shell as early as the end of 2023. The installation of cantilevers, to which the polar crane rail track is attached, is usually done at height after the tier is fixed in place. This time, in order to optimize the timing of further construction and installation works, we decided to mount the cantilevers while the tier was still on the ground, and lift the entire assembled structure to its design position," Sergey Butskikh explained.

Sharing experience

With four advanced powerful reactors built simultaneously on the site, Akkuyu is one of

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the largest nuclear construction projects in the world. This experience arouses interest worldwide, and the plant builders are happy to share it.

In late August, a delegation of reporters, public figures and experts from Kazakhstan visited the construction site. The guests toured the reactor hall of Unit 1, Eastern cargo terminal, training center for the operating staff, and other locations. They were told about the status of the project, involvement of local suppliers, and its impact on social and economic development of the region.

"It is the first time we have passed through every single stage of the nuclear plant construction process, including through engineering surveys, licensing, creating a legal framework, drafting an environmental impact report, building supplier chains, and so on. We are glad to share this experience with our guests and potential partners of Rosatom," Sergey Butskikh said.

Members of the Kazakhstan delegation also met with representatives of local authorities and visited the construction site of residential quarters for the Akkuyu NPP personnel. Construction of the first part of the residential cluster designed to accommodate 10 thousand people, is nearing completion, with the first residents to move in there in 2025. The delegation from Kazakhstan also visited local farms and an innovative fruit-drying factory.

"I was impressed with the scale and significance of this project, and also with the beauty of surrounding nature. I was particularly amazed by the conditions created for workers, which demonstrates Rosatom's social commitments. Along with building advanced nuclear power facilities, the Russian nuclear corporation makes a huge contribution to the development of the entire city," said Shyngys Ilyasov, Advisor to the Minister of Energy of Kazakhstan.

The Akkuyu project has created 34,000 jobs at the site and has become a turning point for over 150 Turkish contractors. Güven Yılmaz from Gersan Elektrik, one of Turkey's largest power companies and a supplier for the Akkuyu project, emphasized the importance of the Akkuyu Nuclear Power Plant for Turkish industry. A new window of opportunity has opened for local companies participating in the project, DHA news agency quoted him as saying. "This is a huge and prestigious project. It will definitely be a source of pride for Turkish companies to work for this project and showcase this prestigious experience to other countries and every company in the sector after the project is completed," Güven Yılmaz said.

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With Safety at Heart

A core catcher arrived at Paks II to mark one of the key events that have occurred on the construction site in recent months. A know-how of Russian nuclear engineers, it is an essential element of the nuclear plant's passive safety system.

The molten core catcher, or 'melt trap', is a cone-shaped vessel made of heat-resistant steel. It is installed at the bottom of the concrete pit, right under the reactor, and filled with the so-called 'sacrificial material'. In case of a core meltdown, the core catcher retains corium fragments and keeps them securely inside the reactor containment. However, the probability of such accidents is extremely low and, according to expert estimates, stands at one in a million.

Core catchers are included in the design of every nuclear power plant with VVER-1200 reactors. By contrast, foreign reactor designs, even those belonging to Generation III+, do not boast such safety devices.

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Right on schedule

The parts of the core catcher were delivered from Volgodonsk, Russia, by water. The route passed through the Don, the Azov and Black Seas, and the Romanian port of Constanta, from which a canal to the Danube flows. The port facilities on the bank of the Danube near Paks were upgraded to receive the cargo. In total, the core catcher traveled 3,200 kilometers in 48 days. It comes with accompanying documents that total almost 24,000 pages.

"It is deeply symbolic that the first piece of large-size equipment that arrived at the Paks II construction site is an element of the plant's safety system. The foundation for safe and reliable operation of the country's new nuclear station is therefore laid long before it is connected to the grid. We are doing our best so that late this year or early next year we can go ahead with the construction of power units and subsequent installation of the core catcher," said AtomStroyExport Vice President and Paks II construction project director Vitaly Polyanin.

Preparations for the start of construction works at Paks Unit 5, for which the core catcher is intended, are proceeding right on schedule. Soil stabilization operations are about to be finished to prepare the site for pit excavations to the pre-designed depth of 23 meters. This, in turn, will signal the beginning of preparations for the foundation slab casting. According to Alexander Tupitsyn, deputy director of the Paks II construction project, 22,000 ten-meter columns will be built to form a reinforced soil body under the foundation slab. Then the work will begin to erect the new power facility.

"We have passed important stages as last year we finished the installation of a 2.7-kilometer impervious blanket, are continuing soil stabilization activities, and have conducted tests that precede excavations to the pre-designed depth. We are increasing the pace of work on the site and at the construction yard. Currently, there are 900 workers engaged in on-site operations," said Gergely Jákli, Chairman and CEO of Paks II Zrt.

The arrival of the core catcher coincided with the anniversary of Hungary's only nuclear power plant. Its construction began 50 years ago, on August 1, 1974.

The Paks NPP with four VVER-440 reactors was built in 13 years. At present, it produces over 50% of electricity in the country.

At top level

The Paks II construction project is in the center of attention of Rosatom executives and Hungarian top officials. Rosatom Director General Alexey Likhachev and Hungarian Minister of Foreign Affairs and Trade Peter Szijjártó noted the substantial progress in the project implementation during the talks held recently.

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The Russian and Hungarian officials emphasized the importance of continuous dialogue and affirmed that both project stakeholders and international partners were very much interested in delivering the project.

"The vicissitudes of the past energy policy have repeatedly pointed out that the countries are in a safe situation only when they can produce most of the energy they need," Peter Szijjártó later wrote on social media. NL

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Atoms Unite

Construction of the first Egyptian nuclear power plant remains in the focus of attention of the country's top officials. Rosatom chief Alexey Likhachev and Egyptian Prime Minister Mostafa Madbouly met in late August to hold negotiations. The parties praised the pace of construction works at the power units.

Alexey Likhachev expressed gratitude to Mostafa Madbouly for his consistent support of the El Dabaa NPP project. He also mentioned the talks he had with Egyptian Minister of Electricity and Renewable Energy Mahmoud Esmat during his current visit to Egypt. "Today Mr. Esmat and I had a meaningful dialogue. This was our first meeting after he assumed the post of Minister of Electricity and Renewable Energy. El Dabaa NPP is among Rosatom's priority overseas projects," Alexey Likhachev said.

According to Mostafa Madbouly, the El Dabaa project is of special importance for the country and is included in the national energy diversification program, which provides for broader use of new and renewable energy sources by 2030. He noted the progress of the El Dabaa NPP project and reiterated Egypt's commitment to providing all possible assistance to accelerate the project delivery in cooperation with Rosatom, given its priority as a source of clean energy.

Guests from Egypt and Sudan in Russia

In late August, students from African countries, including Egypt and Sudan, visited several Russian nuclear sites. The tour was given as an award to the winners of the Atoms Empowering Africa video contest organized by Rosatom.

The contestants had to make a short video on the benefits of nuclear power for Africa and present the potential of nuclear power on the continent. The videos were posted on social media and assessed by a panel of international experts. This year's winners, hailing from South Africa, Nigeria, Kenya, Uganda, Egypt and Sudan, have demonstrated exceptional creativity and dedication in showcasing the potential of nuclear energy on the African continent.

One of the highlights of the winners' itinerary was Obninsk, renowned as the birthplace of the nuclear industry and Russia's premier nuclear technology hub, which has celebrated this year the 70th anniversary of the launch of the world's first nuclear power plant. In Obninsk, the guests visited the first nuclear station and Rosatom's Technical Academy. The students were told about the educational domains of the academy and were demonstrated technical training facilities for the nuclear industry personnel. They also visited a prototyping unit for 3D visualization of nuclear station buildings, 'operated' a nuclear power plant using an analytical multifunctional simulator, visited special-purpose laboratories, and were shown a model of a hypothetical nuclear facility.

"Stepping into the realm of Obninsk NPP and the technical academy was a profound moment of enlightenment. Witnessing the operational excellence and meticulous training of nuclear engineers at the academy, where engineers of the El Dabaa nuclear power plant are trained, was truly awe-inspiring. This experience not only deepened my understanding of nuclear energy, but also instilled in me a sense of responsibility for what I have to learn about operational excellence and safety in nuclear energy," said Yasmin Ehab, a participant from Egypt.

The African students also visited Moscow. They toured the main sights of the Russian capital, the Red Square and the Kremlin, and visited the Atom pavilion built with support from Rosatom. It is an unparalleled popular

science site. Occupying more than 25,000 square meters, the exhibition tells the story of nuclear energy development and presents advanced nuclear technologies. In addition, the guests toured the Space pavilion, where they learned about the achievements of space exploration.

"The tour not only deepened our understanding of nuclear energy and how it touches daily lives in Russia, but also highlighted the importance of practical education. We are grateful for the opportunity to witness firsthand the future of nuclear energy and its impact on our world," said Ahmed Abdel Rahman, a winner from Sudan.

"The Atoms Empowering Africa contest is a testament to Rosatom's commitment to empowering African youth and promoting the benefits of nuclear energy. The high number of winners from Egypt underscores the nation's robust dedication to embracing nuclear technology, paving the way for a brighter and more sustainable energy future for the country. We are proud to support and nurture the next generation of innovators who will drive Egypt and Africa's energy sector towards greater efficiency and sustainability", said Murad Aslanov, Director of Rosatom Regional Office in Egypt, emphasizing on the significance of the competition for Egypt.

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Nuclear Construction Continues Apace

A containment airlock for the second power unit has been delivered to the construction site of the Rooppur NPP in Bangladesh. It belongs to the nuclear fuel handling route of the nuclear power plant.

The airlock is an essential structure of the reactor containment. It is a cylinder-shaped chamber with two airtight doors, one inside and the other outside the containment area. When assembled, the airlock weighs 235 tonnes and is 12.7 meters long and 10 meters in diameter. Its primary function is to hold radioactive substances inside the containment area and provide fire protection. When the nuclear power plant is in normal operation, the airlock serves as a gate for the delivery of maintenance parts and materials and fresh nuclear fuel and removal of spent fuel.

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The containment airlock was transported from the Rooppur NPP port to the site of Unit 2 using a Goldhofer self-propelled module. The next step is to lift the airlock to its planned position at Level 25 with the help of a powerful crane Liebherr LR 11350. Then it will be installed and fixed in place in the reactor building. This operation is considered to be one of the most precise and labor-intensive in building a power unit.

"The Rooppur project is moving forward as we are continuing with construction works and delivery, installation and commissioning of equipment. This allows us to say with confidence that Rosatom effectively fulfills all of its obligations assumed and guarantees safety and reliability of its technology for the well-being of future generations," said Alexey Deriy, Vice President for Bangladesh Projects at AtomStroyExport.

Other news from the site

On September 2, employees' children held a ceremonial line-up in honor of the Day of Knowledge. Ruslan Masagutov, ASE Director in Bangladesh, congratulated the children on this important event. Then a teleconference was held and children from Egypt and Hungary, where Rosatom is also building nuclear stations, joined it online. Children and adults exchanged congratulations and performed poems, songs and even theatrical sketches.

Student construction teams from Rosatom's backbone universities made their contribution to the Rooppur NPP project. They spent two summer months doing construction and installation works, cataloging and keeping records of design and engineering documents, and inspecting incoming equipment and materials delivered to the site.

The same teams worked at two of Rosatom's other construction sites abroad, El Dabaa in Egypt and Kudankulam in India. Over the past 15 years, more than 17,000 students have been involved in nuclear industry projects at 29 construction sites, 22 of which are in Russia and seven abroad (Turkey, Belarus, China, India, Egypt and other countries). NL

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