ROSATOM [360]

01.

STORIES

Closer Ties with Vietnam
Young Innovators Take Center Stage
Advanced Reactor News





02.

TRENDS

Nuclear Fleet: Guidance for Expansion



Closer Ties with Vietnam

During Vietnamese President To Lam's official visit to Russia, the Vietnamese delegation enjoyed an extensive engagement program organized by Rosatom. The parties reached agreements on conducting research at Russia's unparalleled MBIR reactor, collaborating in quantum technologies, and establishing an additive manufacturing center in Vietnam.



Petrovietnam has signed an agreement with TVEL, Rosatom's Fuel Division, on joining forces to establish an Additive Manufacturing Center in Vietnam. The document provides for the supply of SLM (Selective Laser Melting) and L-DED (Laser Directed Energy Deposition) metal 3D printers manufactured by TVEL, and other Russian-made equipment. The agreement also establishes the framework for organizing metal powder production in Vietnam.

"The center will enable the rapid manufacturing of complex parts for drilling and pumping equipment, reduce downtime through rapid prototyping, and introduce advanced additive technologies for the restoration and repair of equipment and large-scale components. This goes beyond simply adopting 3D printing; it is a strategic tool for addressing the practical challenges of the fuel and energy sector," said Phan Tu Giang, Vice President of Petrovietnam.

Looking ahead, TVEL is open to discussing the local production of 3D printers in Vietnam. "We have already gone through a similar process with our partners in Belarus: in 2025, we transitioned from simply supplying 3D printers to jointly assembling them and delivering them to third-party customers," said Ilya Kavelashvili, Director for Additive Technologies at Rosatom's Fuel Division.

Other technologies

3D printers are not the only equipment that Rosatom has helped bring into local production in a partner country. At the Innoprom. India international industrial exhibition in New Delhi, Rosatom showcased a locally produced 3D scanner developed by RangeVision, the Fuel Division's technology partner in 3D scanning. The device was manufactured at the Indian partner's facility. This will enable the product to secure "Make in India" certification.

Additionally, the JET Engineering and Technical Center (part of Rosatom) signed a distribution agreement with India's Syngient Technologies for the Repeat Vision platform, which enables end-to-end design and modeling of complex industrial systems. The Giredmet Institute, also part of Rosatom, signed a contract with India's Alt Metals Private Limited to establish a pilot production facility for titanium sponge.

MBIR: unique research opportunities

The Vietnam Atomic Energy Institute (VINATOM) has been designated as the lead organization for Vietnam's participation in the MBIR International Research Center. This was announced at the Russia-Vietnam Science and Technology Forum on Cooperation in Strategic Technologies. Joining the MBIR International Research Center will give Vietnamese scientists access to an unparalleled research facility — the 150 MW multipurpose fast-neutron research reactor currently under construction by Rosatom.

Vietnamese scientists are interested in testing structural materials, specifically investigating radiation damage, creep, and the corrosion resistance of structural alloys exposed to fast neutron flux and high temperatures. They also plan

to evaluate the reliability of equipment and components by conducting in-pile qualification of sensors, instrumentation, and mechanical systems under intense irradiation. This will allow them to obtain experimental data for multiphysics modeling, as well as to validate and verify calculation codes for safety assessments and licensing support in nuclear projects. Another area of interest is the development of nuclear fuel and coolant types and the study of their behavior. Finally, Vietnamese scientists plan to research the transmutation of minor actinides and explore ways to reduce the volume and activity of radioactive waste.



"This is an opportunity for us to expand our capabilities by gaining direct access to unique research infrastructure. It is a strategic step toward developing the expertise of our physicists and nuclear engineers in peaceful uses of nuclear energy. We look forward to a long-term technology partnership," said Dr. Tran Chi Thanh, President of VINATOM.

At the quantum level

The Vietnam Academy of Science and Technology has reached an agreement with Rosatom to develop and subsequently implement a roadmap for the advancement of quantum science and technologies. A quantum technology center and associated laboratories are planned to be established in Vietnam. Workforce training is another key area of cooperation. "This is a significant and highly complex task: we will build a new high-tech industry in a very short period of time," said Ekaterina Solntseva, Director for Quantum Technologies at Rosatom, speaking at the Russia-Vietnam Science and Technology Forum.

Since 2020, Rosatom has been in charge of rolling out Russia's Quantum Computing roadmap, which involves 19 research institutes and universities. In Russia, seven processor prototypes have been developed across four platforms: ions, atoms, photons, and superconductors. Three of these have already reached a capacity of over 70 qubits. Current development efforts are focused on improving processor performance and solving applied problems, including those in the nuclear sector. Since 2026, Rosatom has also been involved in the development of quantum sensors.

Photo by: Consortium Leader of MBIR Reactor International Research Centre LLC; TVEL JSC; Rosatom Quantum Technologies

Young Innovators Take Center Stage

In September, Yekaterinburg hosted the International Youth Festival (IYF) 2026, bringing together 10,000 young people from 191 countries. Rosatom served as the event's general partner.



Rosatom organized business sessions, scientific discussions, masterclasses, and cultural events at the festival, featuring over 50 speakers and experts from the nuclear industry and media sector. The finals of three major international competitions were also held during the festival. The nuclear corporation's international youth delegation included nearly 300 members.



The Rosatom Student Community, ambassadors of Russian nuclear education, and youth councils at Rosatom enterprises helped deliver the company's festival program. At Rosatom's stand, these young people introduced nuclear technologies to festival participants and senior executives from major companies, sharing personal stories of how they joined Rosatom and built their lives around it. They also ran workshops for schoolchildren.

Competitions

The final of the Global HackAtom student championship brought together over 80 winners of national stages from 15 countries. The Russian team *Beyond the Mind* took first place with their futuristic concept of *Electromorsk*, an offshore smart city powered by an integrated small modular nuclear reactor. Second place went to a team from the University of Zululand in South Africa, which proposed a concept for a "nuclear city" in southeastern Africa. Third place was awarded to the *Nuclear Nomad* team from Kyrgyzstan for their concept of an autonomous floating city.

A total of 2,500 candidates aged 18 to 35 competed for a spot on the Icebreaker of Knowledge 2027 research expedition. The winners in the expert category were representatives from Spain, India, Russia, and North Macedonia. The first six participants of the Atom 2050 initiative were also selected, hailing from Brazil, Indonesia, Lebanon, Russia, and Uzbekistan. The full team will comprise 100 members, with the rest to be selected later. In 2027, the team will embark on technical tours of Rosatom's facilities, meet with experts, and visit knowledge laboratories. The goal of this initiative is to answer a complex question of what the world could look like by 2050 and what role nuclear and related technologies would play in its development.

Outreach initiatives

Rosatom and Russia's Znanie (Knowledge) Society organized the *Knowledge.First* marathon featuring Dmitry Nikitin, captain of the Yakutia nuclear icebreaker. The Moscow State Institute of International Relations (MGIMO) hosted a session titled "Skills of the Future: Dialogue Without Ties," where Rosatom representatives discussed the skills in demand across diplomacy, business, and technology. They concluded that critical thinking is the most crucial skill in the age of artificial intelligence.

The festival also hosted the open stage of the *Nuclear Dictation 2026* international educational initiative. Participants answered 20 questions about the history of the nuclear industry, scientific discoveries, and advanced technologies.

Seven events were organized as part of Obninsk Tech, a joint initiative of Rosatom and Russia's top technical universities. For instance, the *Study in Russia* session featured university rectors and international students sharing insights on studying and living in Russia, seasonal schools, internships, on-site training, technical tours, and networked educational programs. In the interactive zone, festival participants had a chance to earn points and exchange them for souvenirs. Five winners received vouchers for summer and winter schools of science and technology in Obninsk.



Tastes of host communities

In the Welcoming Lounge, winners of the *Atoms of Taste: Culinary Heritage of Rosatom Communities* competition offered festival attendees a tasting of lemonades and wafer rolls made from family recipes from Obninsk, culinary souvenirs from Glazov, and coffee from Sarov (all three being host communities for nuclear facilities — *Ed.*). The Tours of Opportunities offered a chance to explore the nature, history, and culture of host communities. The festival also featured performances by Rosatom's children's symphony orchestra and the *Nuclear Kids* theater with their *Who Are You?* musical show.

"For me, the festival is about the energy that young people bring. This is the future that you can feel everywhere here. It is about the tremendous opportunities our country is showcasing to the world. And, of course, this is a source of pride for Russia and for Rosatom. I know no other country that is so open and provides young people with such incredible opportunities," said Tatiana Terentyeva, Deputy Director General for Human Resources at Rosatom.

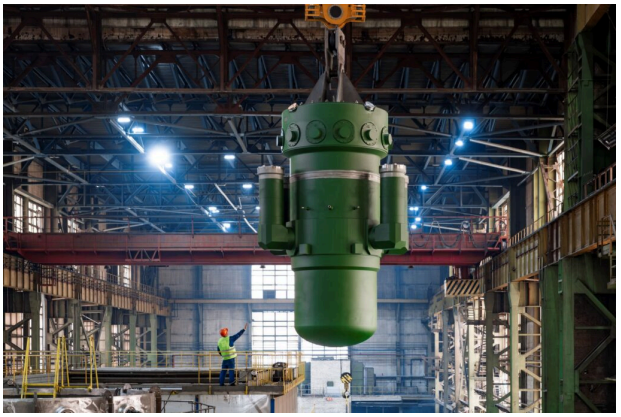
Photo by: Rusatom International Network; Rosatom Corporate Academy

Advanced Reactor News

Russia, a global leader in next-generation reactor technologies, has completed the manufacturing of a full set of reactors for a floating power unit, and passed key construction milestones for the BREST-OD-300 and MBIR fast-neutron reactors. A molten salt reactor (MSR) project has moved a step closer to implementation. Here are the third-quarter updates on advanced reactor construction programs.



The MBIR reactor will be used for cutting-edge research in reactor technologies and materials science on both national and global scales. It will host an international research center, which is structured as a consortium, granting its members priority access to experiments for their national nuclear programs.



In July, a 12-tonne, 5.5-meter-tall air-cooled heat exchanger was installed for the second loop of the emergency heat removal system (EHRS). It will facilitate heat transfer from the EHRS sodium circuit to the ultimate heat sink (the ambient air). A 70-tonne power transformer was installed in its design position at the power evacuation substation. In the turbine building, a 16-tonne transition duct was mounted onto the upper nozzle of the condenser, connecting the exhaust section of the turbine casing to the condenser itself. Furthermore, the installation of key overhead crane components, including bridge girders and a hoist trolley, has been completed. A 750-tonne crawler crane was deployed to carry out these highly complex lifting operations.

BREST-OD-300

The BREST-OD-300 reactor, currently under construction at the site of the Pilot Demonstration Energy Complex (abbreviated ODEK in Russian), is a core component of Rosatom's strategic Proryv (Breakthrough) Project. The operation of the reactor, alongside ODEK's fuel reprocessing and fabrication/refabrication modules, is designed to demonstrate the feasibility of closing the nuclear fuel cycle using a fast neutron reactor and multi-recycled nuclear fuel.

In September, the first phase of concrete pouring for the inner cavity of the reactor vessel was completed at the site. The use of concrete is a distinctive feature of the BREST-OD-300 design. The reactor consists of steel cavities that will house the core and primary circuit equipment. The space between these cavities is filled with concrete, which serves as a load-bearing structural element, as well as thermal and radiation shielding. This design ensures the safe and reliable operation of the world's first lead-cooled fast reactor.

Meanwhile, reactor components are being installed. For instance, the installation of the piping system connecting the central and four peripheral cavities of the reactor vessel has been completed, effectively closing the primary circuit loop.

In October, two moisture separator reheaters, each

16 meters tall and weighing 95 tonnes, were installed in their design positions on the turbine island. The turbine foundation is scheduled for completion by the end of 2026, to be followed by the installation of the power unit's turbine.

Molten salt reactor

The program to build a molten salt reactor (MSR) is also progressing. Like the Proryv project, it contributes to closing the nuclear fuel cycle. The MSR will be used for the industrial-scale transmutation (or "burning") of minor actinides — highly radioactive, long-lived isotopes. Without these isotopes, radioactive waste becomes significantly less hazardous, making storage requirements drastically simpler and storage periods significantly shorter.



A new laboratory dedicated to the MSR is being built at the Radium Institute (part of Rosatom's Science Division). By the end of 2026, the laboratory is scheduled to be ready for conducting the first research activities.

The laboratory will test technologies for handling and reprocessing spent nuclear fuel from the MSR. The first testing phase will involve synthesizing a model fuel composition based on lithium and beryllium fluorides, which will also include simulants of fission products and plutonium. Subsequently, the technologies will be tested on a mock-up.

"The main stage of the technological process is the mixing of two molten phases under active hydrodynamic conditions, the fuel salt and lithium bismuthide. In this process, lithium transfers into the fuel salt, while neutron poisons extracted from the salt transfer into bismuth. Our equipment has no counterparts worldwide," commented Ilya Skrigan, Head of the Laboratory for Radioactive Waste Solidification Technology and Processes at the Radium Institute.

RITM-200

In September, ZiO-Podolsk (part of Rosatom's Mechanical Engineering Division) manufactured the second RITM-200S reactor for the FPU-106 floating power unit. The first one was completed in May of this year. That means the complete two-reactor set is now ready for installation.

"This is an important step in the development of small-scale nuclear generation worldwide. Our plant has set a record this year: four RITM-family reactors have been manufactured in less than a year, and five more are in production," said Anton Lebedev, CEO of ZiO-Podolsk.

The FPU-106 will become the world's first example of powering a large industrial facility using floating nuclear power units. Russia is the only country with such operational experience: since 2020, the *Akademik Lomonosov* FPU has been operating in the northern region of Chukotka, having generated nearly 1.4 billion kWh of electricity.

To date, a total of 16 RITM reactors have been manufactured, eight of which are currently operating on the *Arktika*, *Sibir*, *Ural*, and *Yakutia* nuclear icebreakers.

Photo by: SSC RIAR JSC; SCC JSC; ZiO-Podolsk JSC

Nuclear Fleet: Guidance for Expansion

In early September, the World Nuclear Association (WNA) released its report on the prospects for nuclear power development. The report is divided into two major sections. The first covers the 2025 results in new construction. The second offers recommendations aimed at rapidly translating plans for fleet expansion into actual kilowatts.



2025 in review

In 2025, the global nuclear fleet generated a record 2,702 TWh, which is 35 TWh more than in 2024. However, the share of nuclear power in the total global electricity generation continues to shrink, having declined from a record high of 17.44% in 1996 to 8.84% in 2025. The reason is clear: electricity generation from other sources, primarily renewables, has surged.

Asia is now the main driver of nuclear generation rise. Between 2012 and 2025, output in the region increased roughly two-and-a-half-fold, from 330.55 TWh to 842.48 TWh. This growth was driven by the rapid expansion of nuclear power in China and the launch of new reactors in India, Pakistan, and the United Arab Emirates.

2,702 TWh

Global nuclear generation in 2025

Since 2012, nuclear generation in North America, South America, and Africa has remained largely flat. In Eastern Europe and Russia, output gradually increased between 2012 and 2025, rising from 251.18 TWh to 271.64 TWh. In Western and Central Europe, however, it declined as Germany shut down all its reactors, and the oldest units were retired in Belgium, Sweden, Switzerland, and the UK.

Total installed nuclear capacity at the end of 2025 stood at 400 GW, just 2 GW more than at the end of 2024. Overall, three units with a combined capacity of 2,956 MW were connected to the grid in 2025. Zhangzhou 2 in China was built in 62 months, Kursk II Unit 1 in Russia in 92 months, and Rajasthan 7 in India in 163 months.

Notably, the construction timeline for Kursk II Unit 1 was impacted by military threats. “The operation of the existing Kursk Nuclear Power Plant and the construction of new units continued amid constant provocations and direct attacks by the Ukrainian armed forces. This makes it all the more significant that, at the end of the year, the first unit of Kursk II was connected to the national grid for the first time. The nuclear professionals at Kursk deserve congratulations and gratitude for this remarkable New Year’s gift,” Rosatom Director General Alexey Likhachev commented on January 1, 2026, following the unit’s first grid connection.

In 2025, seven units were permanently shut down: three in Belgium, one in Taiwan, and three units at Bilibino in Russia. “The Bilibino reactors had reached the end of operations, however, whereas the other four reactors were closed as a result of political decisions,” the WNA report notes. With these seven units, 2,823 MW of capacity was removed from the global nuclear power sector.

In 2025, construction began on nine units in China and two in Russia. Rosatom poured first concrete for Leningrad II Unit 4 on March 20 and for Kursk II Unit 3 on December 20. Those 11 first concrete pours match the number recorded in 2024. “Over the last 40 years, this number of new construction starts has been exceeded only in 2009 and 2010,” the report says. Despite the high number of new builds, WNA experts note that tripling global nuclear capacity by 2050 will require six times as many construction starts per year by the mid-2030s as we see today.

400 GW

Total installed nuclear capacity in 2025

Long-term operation programs continue to sustain nuclear generation volumes. As of August 2026, the average age of operating nuclear reactors worldwide was 33 years. Forty-six reactors are over 50 years old, accounting for about 10% of the operating fleet. The average age at which reactors are retired is gradually increasing: it was 47.3 years in 2024 and 48.7 years in 2025. The report specifically notes that a reactor’s age does not necessarily affect its capacity factor.

Forecasting a shortfall

According to the report, of the 423 GW (gross) of nuclear capacity currently operating, 401 GW will remain in operation in 2050. Through 2030, the growth in global nuclear capacity will be driven primarily by reactors currently under construction. The total capacity of such reactors has increased from 76 GW to 82 GW compared to last year’s forecast. By 2030, they will add 54 GW to the global fleet. An additional 28 GW of capacity under construction is scheduled for commissioning by 2035.

According to WNA projections, “planned” units — those typically commissioned within 15 years — will add 106 GW to the global fleet, and another 8 GW by 2050. Compared to last year’s forecast, capacity in this category has grown from 107 GW to 114 GW. By 2050, “proposed” units are expected to add 289 GW, which is 5 GW lower than last year’s projection. More than half of this capacity will be commissioned between 2041 and 2050. Another 13 GW falls into the “potential” category, where total capacity has decreased from 24 GW.

An additional 559 GW is required to meet the target. “If national targets and identified projects are achieved and the existing fleet continues operating, capacity would reach 1,457 GWe in 2050,” the report says.

Action needed

A significant portion of the WNA report is dedicated to recommendations for countries developing or intending to develop nuclear generation. WNA Director General Sama Bilbao y León advises governments and industrial enterprises to develop programs, select sites, and establish regulatory frameworks and financing mechanisms for nuclear power reactors well before an acute need arises. “This matters because nuclear expansion will take place alongside rapidly increasing electricity demand from electrification, data centers, cooling, desalination, hydrogen and industrial decarbonization. New nuclear capacity will be needed both to replace unabated fossil generation and to help meet growth in total low-carbon electricity demand. It can also provide reliable heat for sectors that are difficult to decarbonize through electricity alone,” the report says.

It is crucial to maximize the potential of existing capacity. This requires ensuring long-term operation, safely uprating capacity, and assessing the feasibility of restarting previously shut-down units. Rosatom possesses unique expertise in this area, having restarted and subsequently extended the operational life of the Armenian NPP.



When selecting new projects, Sama Bilbao y León advises opting for proven solutions. “Their contribution will be greatest where we move away from isolated projects and establish repeat-build programs that capture experience from one unit to the next,” she emphasizes. Rosatom operates precisely on this logic, first testing reactor technologies in Russia before offering them to international customers.

The WNA Director General acknowledged that financing models for new nuclear builds will vary depending on how energy markets are structured. In any case, however, risks must be allocated among various stakeholders.

She also advised newcomer countries to turn to experienced equipment suppliers to accelerate initial construction, rather than attempting to localize manufacturing immediately. Another piece of advice is to train nuclear professionals well in advance, paying special attention to regulators, operators, project managers, and skilled workers: “Countries restarting nuclear construction after long gaps should not assume that an existing operating fleet automatically provides the skills needed for major new-build programs.” Rosatom is a proven and reliable partner in these areas. Companies within its perimeter have well-established production capabilities for primary circuit equipment, control systems, and other critical unit components, as well as nuclear fuel. Rosatom is a long-standing partner of the IAEA in nuclear education. The Russian nuclear corporation supports branches of the National Research Nuclear University MEPhI in Kazakhstan and Uzbekistan and offers international students educational programs in Russia.

On the regulatory front, Sama Bilbao y León called for enhanced international cooperation to accelerate decision-making: “Greater use of previous regulatory assessments, while retaining national responsibility for safety decisions, can reduce unnecessary duplication and help successful designs move more efficiently between markets.”

She also noted that long-term programs are superior to one-off projects: “Stable programs allow experience to accumulate. They support investment in people and manufacturing. They make it possible to repeat designs, retain delivery organizations and give governments, regulators, investors and suppliers confidence that capability developed for one project will be needed again.” Rosatom is a premier partner for implementing such programs. For instance, Rosatom is building power units in India and China, as well as four-unit nuclear power plants in Türkiye and Egypt.



Nuclear security

For nuclear generation to expand, however, it is essential to maintain the physical security of power units, nuclear fuel production facilities, and waste storage sites. As noted above, breaches of physical security have extended the construction timeline for Kursk II Unit 1 and slowed the construction of Bushehr 2 in Iran. They also hinder efforts to maintain all units at the Zaporozhye NPP in a safe condition. The importance of the physical protection of nuclear power plants was highlighted by Alexey Likhachev during his address at the IAEA General Conference in September of this year: “On the one hand, we see a genuine increase in interest in nuclear energy and are making plans to expand nuclear capacity. We can state that the vast majority of countries have recognized that nuclear power is indispensable and in high demand. On the other hand, we now live in a world where nuclear facilities are attacked almost daily, creating risks to their security. What was once unthinkable has become a reality.”

Photo by: Kursk NPP; Armenian NPP; Akkuyu Nuclear JSC; Strana Rosatom newspaper