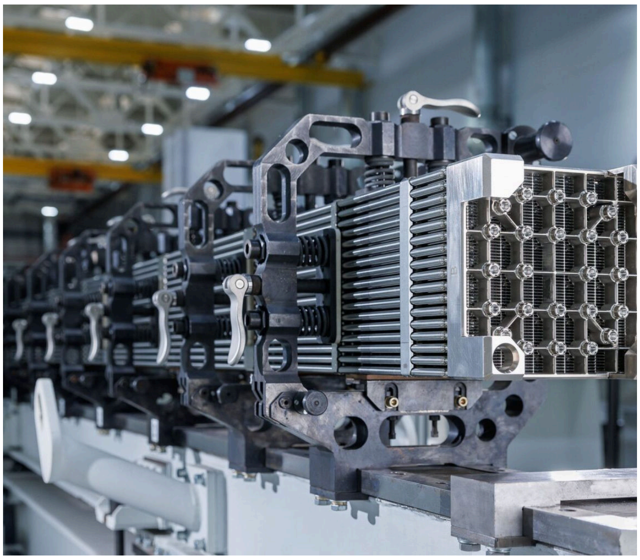
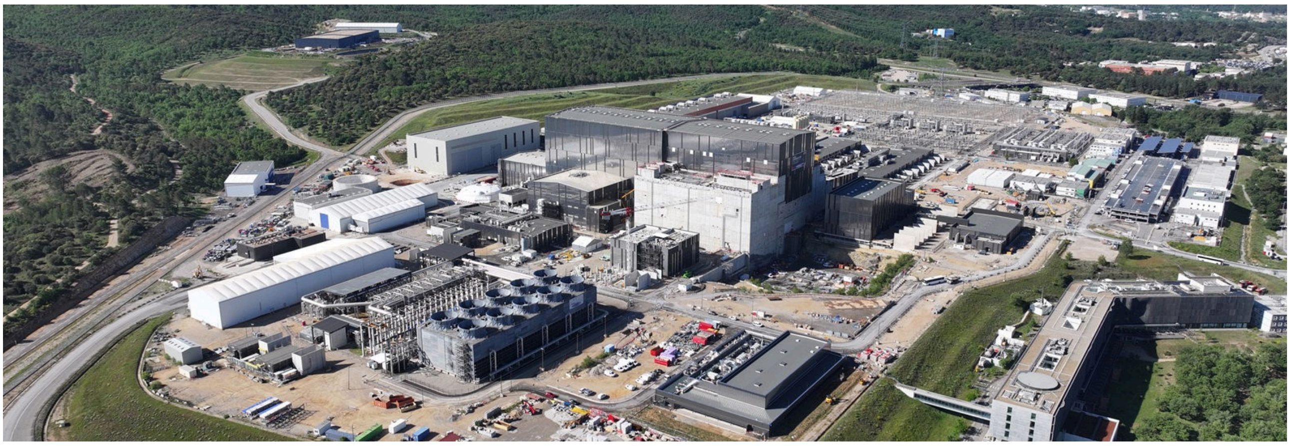
ROSATOM NEWSLETTER



Getting Ready for Tests at ITER

On November 17, the first of four test facilities arrived from Russia at the construction site of the International Thermonuclear Experimental Reactor (ITER). These will be used to test port plugs—special devices housing diagnostic and technical systems—in near-real conditions.



The port plug test facility is a 40-cubic-meter steel vacuum chamber weighing nearly 30 metric tons and equipped with vacuum, heating, control and monitoring systems. According to an agreement signed in 2011, Russia undertook to manufacture and supply four such facilities. The manufacturing company is the Mechanical Engineering and Instrumentation Group (GKMP). GKMP produces equipment for nuclear fusion, cryogenics, and thermal vacuum testing, and conducts complex equipment trials.

"This test facility is one of the most complex and technologically advanced systems within our scope of responsibility for the project. To engineer and manufacture it, our key suppliers had to develop and deploy advanced innovative solutions. Russia has been entrusted with the production of all the units, which is a result of our experience and technological leadership," Anatoly Krasilnikov, Director of the Russian ITER Project Center (a Rosatom subsidiary), said at the ceremony marking the arrival of the test facilities.

Testing is essential

The vacuum chambers will be used to test all 46 port plugs produced by the ITER member countries. Deep vacuum and high temperature will be created inside them to carry out vacuum, thermal, and functional tests. Specifically, there will be three testing cycles with temperatures ranging from 20°C to 240°C. A helium leak test will be conducted at each stage to confirm the system is airtight.

Russian engineers will participate in commissioning the test facility at the ITER site. "We are responsible for supervising the assembly of the test facility and each of its subsystems, and for comprehensive integral testing," Olesya Solovyeva, Director of the ITER Project Office at GKMP, told the Strana Rosatom newspaper. Earlier this year, GKMP began producing the second test facility. It is expected to be completed by the autumn of 2026. Following factory acceptance tests, it will be shipped to France in early winter. The third and fourth facilities will be delivered by the end of 2029, the deadline set by the ITER Organization.

Russian contribution

ITER Construction Project Lead Sergio Orlandi praised the Russian contribution: “As the construction project manager, I am very pleased that the first port plug test facility has been delivered from the Russian ITER Center. This test facility is a vivid example of Russia’s advanced manufacturing capabilities, ensuring that all deliveries for the project are on time, on budget, and with the quality required. I want to express my special gratitude to the Russian experts who supervised every stage of design, procurement, and assembly of the facility.”

Previously, Russian nuclear companies delivered superconductors, a poloidal field coil, and four gyrotrons to the ITER construction site. Production of other components is underway. All Russian-made equipment is delivered in full compliance with the reactor construction timeline. In total, Russian R&D institutes and companies are tasked with manufacturing and supplying 25 high-tech systems for the under-construction ITER fusion facility.

ITER is a project to build the world’s first new-generation international thermonuclear experimental reactor. The construction site is located near Marseille, France. The project’s mission is to demonstrate the feasibility and viability of using fusion energy for peaceful purposes, and to refine the related processes. Mastering fusion will secure energy for humanity for millennia to come.

Russia is an ITER Member Country alongside the EU, China, India, Japan, South Korea, and the USA. Rosatom’s subsidiary ITER Project Center functions as the Russian national ITER agency responsible for ensuring Russia’s in-kind contribution to the project.

Photo by: ITER, “ITER Project Center” in Russia

Icebreaker with Heroic Name

The keel of Stalingrad, the seventh nuclear-powered icebreaker being built to the Project 22220 design, has been laid at the Baltic Shipyard. Once commissioned, it will become the ninth vessel of the Russian nuclear fleet. The icebreakers of the Project 22220 series feature unprecedented performance, being capable of breaking through the ice up to 3 meters thick.

The icebreaker is named after the city of Stalingrad (now Volgograd). The Battle of Stalingrad, one of the major decisive battles of World War II between the Soviet Red Army and the German Wehrmacht, was fought in the city and its vicinity from July 17, 1942 to February 2, 1943, ending in a Red Army victory.

The keel-laying ceremony was timed to coincide with the start of Operation Uranus: on November 19, 1942, the Soviet Red Army launched its counteroffensive in Stalingrad.

“I am confident that the new icebreaker, Stalingrad, will wear this proud name with dignity. Working in the harsh Arctic conditions, breaking a path through the ice, it will become another symbol of our people’s talent, strength, and creative energy, and their ability to set and fulfill the most daring plans and withstand the hardest times,” Russian President Vladimir Putin said via video link at the ceremony.

“You have set for us a new goal of establishing the Trans-Arctic Transport Corridor to incorporate the Northern Sea Route. This is a task of immense, planetary scale. Solving it will strengthen Russia’s leadership, ensure the implementation of national projects in the high latitudes, and lay the foundations for the logistics sovereignty of the Russian Federation,” said Rosatom Director General Alexey Likhachev, addressing the President.

During the ceremony, Battle of Stalingrad veteran Pavel Vinokurov, who turned 103 in November, handed Alexey Likhachev a capsule containing soil from Volgograd. It will be kept on board the icebreaker.

Red and white

The design of the Stalingrad icebreaker features red and white tones. The sides of the superstructure are white, while the front features a mural with the white star of the Hero City on a red background, superimposed with a red silhouette of The Motherland Calls sculpture.

The red-and-white color scheme of the Stalingrad superstructure also serves a functional purpose: it allows the ship to be distinguished from a distance from the Leningrad, another icebreaker of the same series currently under construction at the Baltic Shipyard, which features a blue and white superstructure.

“It is a great joy to define the look of a nuclear icebreaker. And the fact that the Stalingrad icebreaker is being laid down in the year of the 80th anniversary of the Victory and the nuclear industry adds extra significance to my task," said Vladimir Ruzhnikov, the design author and Head of the Art and Design Department at Rosatom's Communications Center.

More icebreakers to follow

At the time of keel-laying, the Stalingrad was 4% complete, with the first three sections assembled. The icebreaker differs slightly from its predecessors, as improvements are made to each subsequent vessel based on the previous experience. However, the main features of Project 22220 vessels remain unchanged. These include a dual-draft design, two RITM-200 reactors, and an alternating current electric propulsion system with asynchronous motors. Such icebreakers are capable of breaking through the ice up to 3 meters thick.

Two other Project 22220 nuclear icebreakers — the Chukotka and the Leningrad — are currently under construction at the Baltic Shipyard.

The Chukotka is already being prepared for mooring trials. In November, Elemash (part of Rosatom) completed the manufacturing of reactor cores for the ship's both reactors ahead of schedule. In October, a large superstructure block consisting of ten sections weighing over 200 metric tons was installed on the Chukotka; it will house the pits for the icebreaker's auxiliary power unit. In the same month, a pre-outfitted accommodation block weighing about 300 metric tons was installed. Following the assembly of the hull structures, the Baltic Shipyard workers will proceed with fitting out the interior spaces: cabins, the mess hall, the dining room, recreation zones, and other areas.

In November, a backup diesel generator weighing 38.5 tonnes with a capacity of 2,000 kW was installed on the port side of the Leningrad. The starboard backup generator will be installed next. The vessel is estimated to be 20% complete.

Construction times for nuclear icebreakers are decreasing thanks to the shift to the prefab construction technology. While the lead ship of the series took seven years to build, the next one, Yakutia, took less than five. The plan is to build the Chukotka in five years, and the Leningrad and Stalingrad in four and a half years.

Additionally, the Zvezda Shipyard continues construction of the Rossiya (Project 10510) super-icebreaker, which is scheduled for commissioning in 2029.

Nuclear icebreakers ensure safe vessel escorts through ice along the Arctic routes of the Trans-Arctic Transport Corridor, stretching from St. Petersburg to Vladivostok.

The Russian nuclear fleet currently comprises eight icebreakers, four of which are of the latest Project 22220 design: Arktika (commissioned in 2020), Sibir (2021), Ural (2022), and Yakutia (2024).

Photo by: United Shipbuilding Corporation, kremlin.ru

Born on the Same Day

In 2025, two companies of Rosatom's Mechanical Engineering Division—OKBM Afrikantov (OKBM, based in Nizhny Novgorod) and the Central Design Bureau for Mechanical Engineering (CKBM, based in St. Petersburg)—celebrate their 80th anniversary on the same day, December 27. OKBM engineers, manufactures, and tests marine reactors, onshore and offshore small modular reactors (SMRs), and fast neutron reactors. CKBM specializes in primary coolant pumps.

OKBM Afrikantov

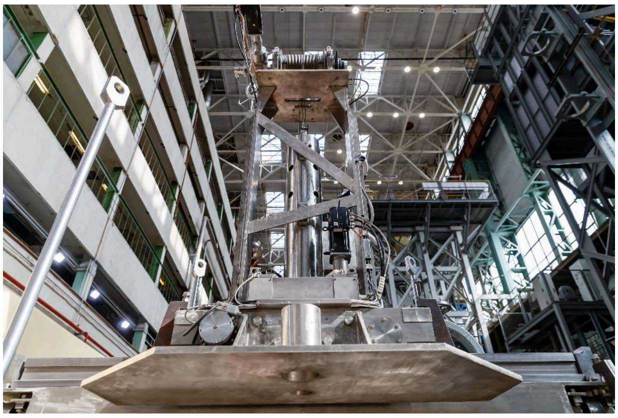
In 1945, a design bureau was established at Plant No. 92 to engineer special machinery and equipment for the Soviet atomic project.
In its early years, the bureau focused on obtaining nuclear materials and researching technologies for handling them. Since 1945, it had been involved in the development of gaseous diffusion machines for uranium enrichment.

Another critical area of the bureau's R&D activities is marine reactor plants. Its first order, which was received in 1953, was to develop a nuclear steam generator for the Lenin icebreaker. It was completed in 1955. Between 1975 and 2006, OKBM engineers developed and produced three reactor modifications — OK-900A, KLT-40, and KLT-40M — for nine nuclear icebreakers.

Today, OKBM is the chief designer and supplier of reactor plants for Project 22220 and Project 10510 icebreakers. For the former, OKBM supplies RITM-200 reactors; for the Project 10510 Rossiya icebreaker, it supplies the RITM-400, which boasts double the capacity.

The marine designs proved so successful that they were adapted for small-scale power generation. OKBM produced two KLT-40S reactor plants for the world's first floating nuclear power plant, Akademik Lomonosov. For the new floating power units slated for operation in Chukotka, OKBM developed steam turbines that, unlike the KLT-40S, will generate electricity only. The electric power generated by the floating power unit will be 1.5 times higher compared to the Akademik Lomonosov, rising from 77 to 116 MW. OKBM has developed the RITM-200M reactor with an extended refueling interval for the international market. Floating power units equipped with such reactors can operate in countries with minimal nuclear infrastructure. Another upgraded design is the more powerful RITM-400M reactor.

The pilot onshore small nuclear power plant will feature RITM-200N reactors. Two such reactors will be installed at the station near the town of Ust-Kuyga in Yakutia.



Since 1960, OKBM has been developing fast neutron reactors, including the world's first commercial reactor BN-350, as well as the BN-600 and BN-800 power reactors. The next project in the pipeline is the BN-1200M reactor for Unit 5 of the Beloyarsk NPP.

Its construction is part of the program to close the nuclear fuel cycle.

OKBM Afrikantov is also the chief designer of high-temperature gas-cooled reactors for industrial power generation facilities and hydrogen production.

By the end of 2025, OKBM Afrikantov plans to manufacture and ship RITM-200 units for the Leningrad nuclear icebreaker, deliver the RITM-400 for the Rossiya icebreaker to the customer, and supply RITM-200S units for a new floating power unit. This is far from a complete list of the company's scheduled shipments and activities.

CKBM

The story of CKBM also started with the production of primary equipment for gaseous diffusion enrichment. Today, it is a key manufacturer of pumping equipment for nuclear power plants.

Primary coolant pumps manufactured by CKBM are installed at more than 20 plants in Russia and abroad.

A recent example is the production of coolant pumps for Unit 1 of the Kursk II NPP. These are new-generation pumping units featuring a single-shaft layout and utilizing water instead of oil for lubrication and cooling of the pump and motor components. This improves performance and enhances fire safety of the power plant.

An unprecedented pump intended to circulate liquid lead was developed and manufactured for the BREST-OD-300 lead-cooled reactor, currently under construction in Seversk, Tomsk Region, as part of Rosatom's Proryv (Breakthrough) project. Also, as part of the same project, CKBM has produced equipment for the fuel fabrication/refabrication module.

Previously, the company manufactured equipment for the production of MOX containing fuel rods and fuel assemblies.

Additionally, CKBM develops and manufactures remote handling equipment for radioactive materials and waste, which is used at various types of nuclear power plants in Russia and abroad.

CKBM operates its own testing center. It is the only facility in Russia capable of full-scale testing of pumping equipment under the conditions that simulate all reactor operation parameters (pressure, temperature, coolant type, etc.). Tests are conducted in various modes, allowing engineers to immediately detect deviations in operating parameters and troubleshoot faults.

The company actively deploys new technologies, including robotic welding of pump components, machine vision, and virtual reality technologies.

Earlier this year, CKBM shipped key components primary coolant pumps for China's Tianwan Unit 8 and Xudabao Unit 3. Pumping and handling equipment was also shipped to other nuclear power plants.

Photo by: Strana Rosatom newspaper

Nuclear Growing, But Share Stagnates

In November, the International Energy Agency (IEA) released its World Energy Outlook presenting an overview of the past and present state of affairs across energy sectors, forecasting the future, and outlining key challenges and risks. The nuclear industry is growing, but not as fast as other energy sectors.

The IEA report posits that instability is the defining factor of the current global reality, and energy security is the primary concern.

The main risks highlighted by the IEA include geopolitical turbulence and conflicts, restrained supply amid rising demand in the oil market, constraints on the supply of critical minerals, cyber threats, and industrial and climate risks. "Decisions taken by energy policy makers will be crucial to address these risks, but they do so against a complex backdrop," the report notes.

The world continues to face an energy shortage. Energy remains — as it often has in the past — at the heart of modern geopolitical tensions. Under these conditions, countries strive to ensure energy security and the availability of energy resources, but they pursue this goal through different means: "Some, including many fuel-importing countries, lean towards renewables and efficiency as solutions. Others focus more on ensuring ample supplies of traditional fuels," the authors believe.

Every type of energy generation is on the rise: "Renewables set new records for deployment in 2024 for the 23rd consecutive year. Oil, natural gas and coal consumption, and nuclear output, all reached record highs as well," the report states.

Another important trend noted by IEA analysts is the declining intensity of efforts to reduce emissions at both national and international levels. Since 2019, coal demand — driven largely by China — has grown 50% faster than demand for natural gas, the next fastest-growing fossil fuel. This is a key reason for the continued rise in energy-related emissions.

Current state of affairs

Since 2010, global energy demand has increased by more than 20%. In 2024, it continued to climb, rising by 2% to over 650 exajoules (EJ). This is much higher than the average growth rate of 1.4% recorded between 2010 and 2023. Fossil fuels satisfied nearly 80% of total energy demand in 2024. Wind and solar generation show steady growth (nearly 700 TWh). Nuclear power output, having dipped in the early 2010s, has since risen due to new units being brought online and the restart of previously halted reactors. The report calls this a 'strong increase,' yet compared to other energy sources, the volume of electricity from nuclear generation remains low (surpassing only biomass).

The increase in global installed nuclear capacity also looks extremely modest, averaging only 8 GW per year over the last decade. By comparison, global installed solar capacity grew tenfold over the same period, reaching 540 GW in 2024.

Energy investment in 2024 rose to USD 3.2 trillion, significantly higher than the USD 2.6 trillion average of the previous decade. The chart presented by the

IEA reveals that nuclear energy is underinvested not only compared to popular and fast-growing segments like energy efficiency, renewables, and battery storage, but also compared to sectors like oil, gas, and even coal. A 70% increase in investment over the last five years sounds positive, but when compared to the doubling of investment in solar panels over the same period, it is clear that the growth rate (especially given the lower base) is, unfortunately, small.

Europe and the US have ceased to be leaders in the nuclear industry. “Nuclear power experienced significant delays and cost overruns in recent years for large-scale reactors in Europe and the United States, which on average have been completed eight years later than planned and cost 2.5-times as much as originally estimated,” the report says. The report mentions modestly, though, that some nuclear projects in Russia, China, and Korea were completed closer to their original schedules and budgets.

Energy forecasts

Traditionally, the IEA presents several energy development scenarios in its World Energy Outlook. The Current Policies Scenario (CPS) provides a snapshot of existing policies and regulations, offering a cautious assessment of the speed at which new energy technologies are deployed and integrated into the grid. The Stated Policies Scenario (STEPS) includes officially proposed but not yet enacted policies, as well as other strategic documents indicating the direction of energy development. This scenario assumes that barriers to technology adoption are lower than in the CPS. These two scenarios appear to be assessed as the most probable. The report also presents the Net Zero Emissions by 2050 (NZE) scenario, charting a path to reducing global energy-related CO2 emissions to zero by 2050, and the Accelerating Clean Cooking and Electricity Services Scenario (ACCESS).

Current Policies Scenario

Under this scenario, electricity demand grows everywhere. India and Indonesia show the highest growth. Solar and wind power are expected to become competitive in many regions, but their deployment will face challenges that slow growth. Consequently, annual solar capacity additions average 540 GW by 2035, which is, by the way, comparable to the capacity installed in 2024 alone. Coal remains the largest source of global electricity generation until 2035. Construction of new nuclear power plants accelerates in the 2030s: “More than 40 countries have policies in place to expand the use of nuclear power, investment has doubled since 2015, and there is a growing pipeline of projects under development: as a result, global nuclear capacity in the CPS expands by one-third by 2035.” By 2050, growth exceeds 80%. IEA analysts cite reactor restarts in Japan and new builds in the US, Japan, Korea, and France as sources of this growth.

To set the record straight, growth will be driven primarily by power units in Russia and China, as well as those power reactors in Europe, Asia, and Africa that Rosatom is currently building or preparing to build. In accordance with Russia’s national Power Plant Location Master Plan 2042, the country will commission 38 nuclear power units with a total capacity of 29.3 GW. The share of nuclear in the Russian energy mix will rise from 18.9% in 2023 to 24% in 2042. Rosatom’s project pipeline includes 41 large and small power units in 11 countries around the world.

“China accounts for close to half of all nuclear capacity under construction today, and is on track to become the world’s largest nuclear power operator around 2030,” the report admits.

Despite nuclear energy growing at roughly the same rate as other energy sources (e.g., coal) over the next decade in the CPS, installed nuclear capacity in 2035 remains at the lowest level in absolute terms compared to other sources—due to the low base.

Stated Policies Scenario

This scenario is designed to reflect the prevailing direction of the energy sector development even if national rules and regulations are not yet legally codified.

According to this scenario, renewable energy generation will be able to meet all additional global energy demand from the 2030s onwards. The share of renewables in electricity generation will rise from one-third today to more than half by 2035 and two-thirds by 2050, primarily driven by solar and wind combined with battery storage. Nuclear power generation grows by 40% by 2035, maintaining its share of total electricity production at around 9%. The IEA has revised its forecast for nuclear demand in this scenario, projecting it to be 4% higher by 2035 than predicted a year earlier. From 2035 to 2050, if the STEPS scenario materializes, nuclear energy will grow by an additional 40% but will still remain at around 9%.

Under both scenarios, investment in nuclear energy increases by 2035 as several countries make final investment decisions on large new reactors. Investment rises by 40% from current levels to over USD 100 billion per year in the STEPS and by roughly 30% to over USD 90 billion per year in the CPS. Looking at investments in other energy segments, it becomes obvious that nuclear investment figures are quite small. For instance, global investment in power grids rises to around USD 715 billion in 2035 in the CPS and USD 730 billion in the STEPS.

Some takeaways

The state of affairs and the most probable scenarios presented in the IEA report show that nuclear generation — a high-tech industry that meets demands for environmental sustainability, low carbon emissions, and stable output — has the smallest share among all other types of electricity generation.

Given the overall growth in the consumption of electricity and, in general, energy resources worldwide, the nuclear industry will have to 'run very fast' just to maintain its current share (about 9%) in the global energy mix.

To achieve better results, it will have to 'run even faster.' This requires appropriate policy decisions, technologies, investment, and personnel.

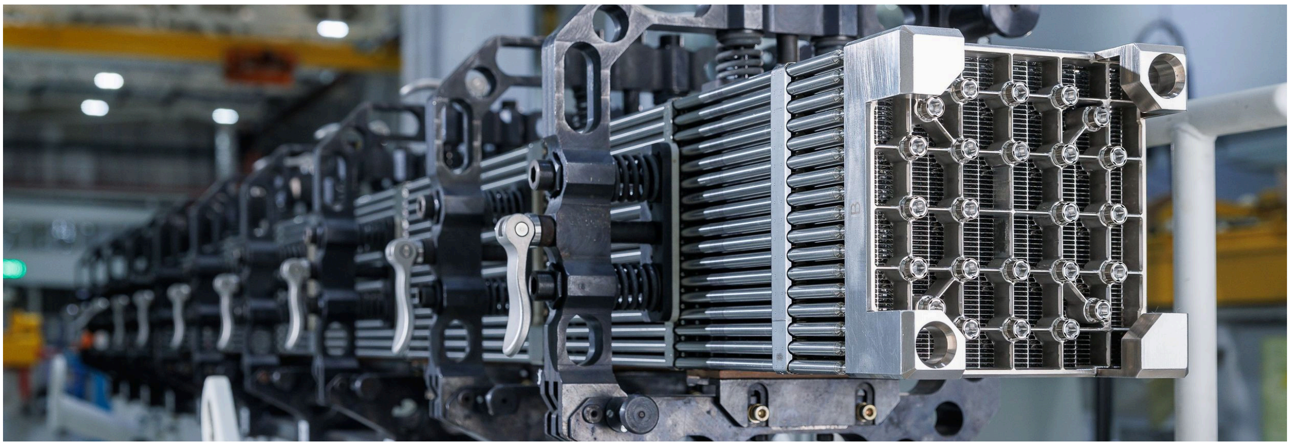
Fortunately, the investment climate is gradually changing for the better. In late November, the Asian Development Bank (ADB) amended its policies to allow investment in nuclear energy projects. The ADB also signed a cooperation agreement with the IAEA to support countries in the Asia-Pacific region exploring the use of nuclear energy within their energy and development strategies. A similar decision was previously made by the World Bank.

One can hope that these decisions and agreements will be followed by others. Such investments will enable the construction of new large and small reactors around the world, providing countries with sustainable electricity, people with interesting high-paying jobs, and fostering the development of science and technology.

Photo by: Leningrad NPP, Rosatom Renewable Energy JSC, Unsplash

Fuel of Any Configuration

Rosatom showcased its achievements in the development of TVS-K fuel at the International Nuclear Energy Industry Innovation Expo held in China. Read our overview of the nuclear fuels for conventional and innovative reactors being developed and manufactured by the Russian nuclear corporation.



The 4th International Nuclear Energy Industry Innovation Expo took place in China's Shenzhen in mid-November. The event brought together the academic community and over 100 major organizations from the nuclear industry. The centerpiece of Rosatom's exhibition booth was an interactive column displaying the Russian-designed TVS-K nuclear fuel intended for Western-designed pressurized water reactors (PWRs). Another section of the exhibition was dedicated to 75 years of Russian-Chinese cooperation in nuclear energy, nuclear medicine, and logistics. The corporation's booth was visited by a delegation of exhibition organizers led by Shi Yubo, Chairman of the Board at the China Energy Research Society.

It was no coincidence that the fuel assembly model was chosen as the key exhibit. Rosatom is a global leader in uranium enrichment and nuclear fuel production. TVEL Fuel Company is Rosatom's subsidiary responsible for these activities, including enrichment of uranium products, fabrication of fuel assemblies and their components, and provision of services related to the development, engineering, licensing, and operational support for nuclear fuel.

For PWRs and beyond

TVEL produces nuclear fuel for every type of Russian-designed power reactors, including VVER-440, VVER-1000, Gen III+ VVER-1200, RBMK, EGP-6, as well as the BN-600 and BN-800 fast neutron reactors, meeting all the needs of nuclear power plants in Russia and supplying reactors with fuel in a number of other countries. Rosatom's fuel company holds a 17% share of the global nuclear fuel market.

Notably, TVEL manufactures fuel for VVER-1200, the flagship reactor of the Russian nuclear power industry. This fuel features fuel rods with increased uranium content, enabling reactors to operate in flexible, variable-duration refueling intervals and load-following mode and improving the reactor economy.

TVS-K is a line of fuel assemblies with a square cross-section designed for PWR reactors, with the capability to adapt to other fuel assembly dimensions. The design employs two families of Russian zirconium alloys, E110 for the spacer grids and fuel rod cladding, and E635 for the guide thimbles. The combination of these materials ensures prolonged reactor operation regardless of the chemical properties of coolant water, offering high reliability and corrosion resistance with minimal formation of oxide films.

The TVS-K design integrates the best solutions successfully proven in VVER reactor fuel assemblies.

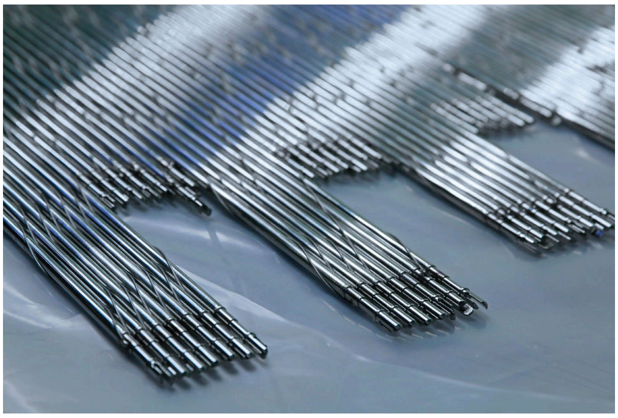
TVS-K is a proprietary design, free from third-party intellectual property rights.

Fuel innovations

TVEL is also developing innovative types of nuclear fuel, such as accident-tolerant fuel (ATF) for example. Belonging to a new generation of safety, this fuel is resistant to overheating should the supply of cooling water to the reactor core cease. This is primarily achieved through eliminating the steam-zirconium reaction that occurs when the temperature of zirconium cladding rises, leading to its degradation. TVEL is developing accident-tolerant fuel for both VVER reactors and Western-designed reactors.

Last year, the reactor of Rostov Unit 2 was loaded with ATF rods for the third consecutive time. That means the fuel assemblies containing the experimental fuel rods will complete the third 18-month operation cycle, which is a standard nuclear fuel cycle for Russian VVER-1000 reactors.

Another innovation developed by TVEL is REMIX fuel for VVER reactors. It is produced from a non-separated mixture of regenerated uranium and plutonium obtained from reprocessing spent nuclear fuel (SNF), with a small amount of enriched uranium added to it later. This allows for reusing the plutonium contained in the irradiated fuel and also the unburned uranium-235. REMIX fuel will reduce the consumption of natural uranium in the fuel cycle. Late last year, REMIX fuel assemblies started their third 18-month pilot operation cycle at Unit 1 of the Balakovo NPP.



Mixed oxide (MOX) fuel is another type of nuclear fuel produced from SNF, but it is based on plutonium oxide generated in power reactors and depleted uranium oxide. With these innovations, the nuclear power industry is heading towards closing the nuclear fuel cycle, reducing nuclear waste, and having a new source of feedstock for the fabrication of fresh fuel through the multiple recycling of spent nuclear fuel.

MOX fuel is already mass-produced and is intended primarily for fast neutron reactors. It has been three years now since the BN-800 fast reactor at Beloyarsk Unit 4 was fully converted to MOX fuel. However, this fuel can potentially be used in new-generation pressurized water reactors as well. In March of this year, Rosatom began researching the neutronic performance of a VVER-S reactor utilizing MOX fuel.

Additionally, TVEL manufactures nuclear fuel for all research reactors in Russia and some other countries. TVEL also supplies nuclear fuel for the Russian icebreaker fleet and the world's first floating nuclear power plant, Akademik Lomonosov.

Playing the long game

Rosatom researchers are also working on the development of nuclear fuel for fundamentally new reactor types. One such design is the high-temperature gas-cooled reactor (HTGR). HTGRs will be key facilities at nuclear power stations designed to provide high-grade heat to industrial sites, particularly those producing ammonia or hydrogen via steam methane reforming process. Recently, a pilot production line for HTGR fuel was established at one of Rosatom's facilities. This fuel consists of coated fuel particles and fuel compacts capable of operating under extremely high temperatures.

Photo by: TVEL JSC, FSUE Mining and Chemical Combine, Balakovo NPP

The 'Heart' of Unit 4 Arrives at Site

The reactor pressure vessel (RPV) for Unit 4 has been delivered to the Akkuyu NPP construction site. This is the last of the four reactors for the Turkish power plant, with the other three already installed. Staff training is continuing alongside construction as a new group of Turkish students have begun studying for nuclear professions at Russian universities.

In addition to the reactor pressure vessel, a containment airlock for Unit 3 and a pressurizer for Unit 4 were delivered to the site. The equipment was shipped using various modes of transport. The RPV was delivered to the pier from the manufacturing plant on a self-propelled platform, after which the vessel traveled over 3,000 kilometers by sea to arrive at the Vostochny (Eastern) cargo terminal of the Akkuyu NPP site.

"The reactor pressure vessel is a key component of a nuclear power unit. This is where the controlled chain reaction occurs during plant operation. The reactor is also called the heart of the nuclear power plant. To date, the same pieces of equipment have already been installed at Units 1, 2, and 3. The arrival of the RPV for Unit 4 means that we have completed the delivery of reactors for all four units of the Akkuyu NPP," said Sergey Butskikh, CEO of Akkuyu Nuclear JSC.

Made of high-strength heat-resistant alloy steel, each reactor pressure vessel is about 13 meters long and 4.5 meters in diameter, and weighs 320 metric tons. The service life of the reactor is 60 years, extendable to 80 years.

The Unit 4 RPV will be mounted using the Open Top technology, which involves lowering heavy equipment into the containment area through the open top of the reactor building's cylindrical section. This technology optimizes construction and installation operations at the power unit.

Nuclear knowledge for everyone

In late November, a new group of 56 students began their master's studies at four Russian universities. The students were selected from bachelor's graduates of relevant Turkish universities based on academic performance and the relevance of their prior education. All candidates passed entrance exams, including interviews with professors from the participating universities. These master's studies are part of a broader staff training program for the Akkuyu NPP.

During the first year, students will study the Russian language to the level necessary to master specialized disciplines, after which they will continue training in their respective specialties, such as nuclear physics, thermal engineering, power engineering, and electrical engineering.

“Each student cohort is a step forward in preparing the team that will operate the first nuclear power plant in Türkiye. The new group of students has already started their course. Broad prospects for professional development in nuclear energy are opening up for them. Our future colleagues will receive fundamental knowledge at the best Russian technical universities and, when working at the Akkuyu NPP, will be able to apply it in practice. We will support students at every stage, from adaptation in Russia to assignment to Akkuyu Nuclear departments,” noted Sergey Butskikh.

Along with training industry personnel, Rosatom is engaged in promoting public awareness of the nuclear industry. In November, the Russian nuclear corporation held its Global Atomic Quiz for the sixth time. This year, about 46,000 people from 106 countries took part in the international educational quiz. In Türkiye, the in-person part of the quiz was organized at Hacettepe University: over a hundred students from different departments gathered to take the test simultaneously. This year’s quiz was dedicated to the 80th anniversary of the Russian nuclear industry and covered the past, present, and future of nuclear technologies. Topics included the history of the industry, latest innovations, and development prospects. Contestants learned through questions and explanations how nuclear technologies are applied in many different areas.

“Global Atomic Quiz questions spark interest in nuclear science and provide new knowledge. Even students without a specialized background tried to answer them using logic. Among the questions were those showing that nuclear technology is not about electricity production only but is applied in very different fields for the benefit of humanity. I especially liked the question about fast neutron reactors. Such reactors operate in Russia, and, in my opinion, they are what will make nuclear energy clean and virtually inexhaustible,” noted Professor Şule Ergün, Head of the Nuclear Engineering Department at Hacettepe University.

Photo by: Akkuyu Nuclear JSC

Reactor Installed at El Dabaa

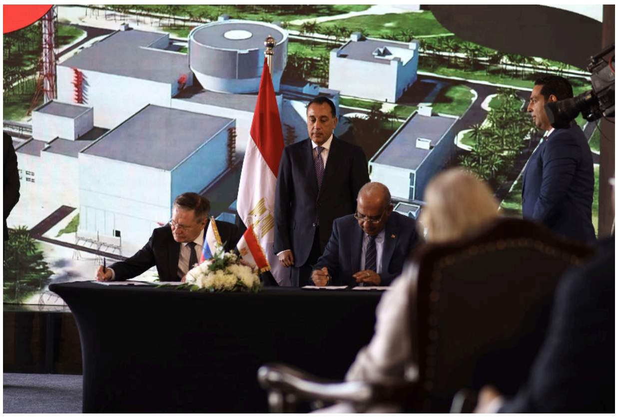
This year's key milestone was passed at the El Dabaa NPP construction site as the reactor pressure vessel for Unit 1 was placed in its design position. The Presidents of Egypt and Russia congratulated the project team on this achievement. With a comprehensive cooperation program signed in November, the two countries are expanding their close cooperation in the nuclear field.

The 340-tonne reactor pressure vessel (RPV) for the power plant's first unit was delivered to Egypt in late October. It passed the incoming inspection before workers proceeded with installation. First, the RPV was lifted from a horizontal to vertical position. Then, workers began lowering it into the reactor pit. All those operations were carried out using a heavy-duty crawler crane with a lifting capacity of 2,200 tonnes.

Finally, an official ceremony took place in late November to mark the installation of the reactor in its design position. Presidents Abdel Fattah el-Sisi of Egypt and Vladimir Putin of Russia congratulated the project team via video link on completing this crucial phase in the construction of El Dabaa Unit 1. International Atomic Energy Agency (IAEA) Director General Rafael Grossi also sent a video message to the event participants.

Rosatom Director General Alexey Likhachev noted that placing the Unit 1 RPV in its designated position was the year's major milestone for the El Dabaa NPP project. "I am truly happy that we can celebrate Egypt's Nuclear Energy Day with such a significant achievement, marking one of the key stages in the construction of the first Generation III+ unit on the African continent. Construction work at each of the four power units is in full swing, with more than 30,000 people involved," Likhachev pointed out.

The reactor pressure vessel is a key component of the reactor unit, housing the core in which the controlled chain reaction occurs. It is leak-tight, withstands high pressure and temperature, and guarantees the safety and reliability of the power unit.



Cooperation continues

Rosatom and the Egyptian Ministry of Electricity signed a comprehensive cooperation program. The document establishes framework cooperation procedures and opens up new areas of joint effort. The program focuses on strengthening the strategic partnership between the countries, and provides for the development of economic collaboration and the expansion of cooperation between specialized organizations of the two states. Particular attention is paid to the exchange of experience and scientific and technical collaboration, laying a sustainable platform for a long-term partnership. The initiative aims to create conditions for launching promising projects and the comprehensive development of key sectors of the Egyptian economy.

“Russia and Egypt are consistently strengthening economic ties and creating infrastructure for the exchange of technological competencies and for local sourcing, which will promote investment growth, job creation, and higher competitiveness,” Alexey Likhachev said.

Cooperation between Egypt and Rosatom is closely linked to key aspects of Egypt’s Sustainable Development Strategy: Vision 2030. The El Dabaa NPP project is the primary, but not the only, field of joint work. Specifically, Rosatom supplies low-enriched nuclear fuel components for Egypt’s second research reactor, ETRR-2.

Business ties

Rosatom is expanding cooperation with Egypt at every level, including by way of strengthening business ties. In November, the Russian nuclear corporation participated in the Smart Transport, Infrastructure, Logistics and Traffic Expo and Conference (TransMEA 2025), Egypt’s leading regional platform for discussing innovation, technology transformation, industrial development, and sustainable mobility.

Rosatom presented a diversified portfolio of its technological solutions extending far beyond nuclear energy. This includes, for instance, a comprehensive additive manufacturing ecosystem that comprises development of new materials, engineering software, advanced 3D printers, and industrial applications, as well as energy storage solutions, including lithium-ion batteries and modular systems.

“Egypt is a strategic partner, and our cooperation spans several decades and is embodied in the El Dabaa NPP project. Building on this solid foundation, we continue to develop our partnership in advanced technologies that complement the achievement of Egypt’s national goals, from additive manufacturing that increases production efficiency and accelerates production processes to energy storage systems that enhance the reliability and efficiency of power supply,” said Murad Aslanov, Director of Rosatom’s office in Egypt.

Photo by: ASE JSC, Rosatom State Corporation