

## CONTENTS

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### **ROSATOM NEWS**

[Upgraded Fuel](#)

[Greater Cooperation in Eurasia](#)

### **NEW BUSINESSES**

[Small Power](#)

### **TRENDS**

[Arctic Motion](#)

### **TURKEY**

[Hot Season at Akkuyu](#)

### **MENA**

[Best Products for Future Plant](#)

### **SUB-SAHARAN AFRICA**

[No Go Without Nuclear](#)



## Upgraded Fuel

**In July, three news stories were published about a number of nuclear fuel and fuel cycle upgrades that aim to improve the economics of power generation at Russian-designed nuclear power plants and to close the nuclear fuel cycle.**

### **Fuel with minor actinides**

The main news is that three fuel assemblies with minor actinides added to their

fuel composition were for the first time ever loaded into the BN-800 fast neutron reactor (installed at Unit 4 of the Beloyarsk Nuclear Power Plant). Minor actinides are the most radiotoxic elements contained in irradiated nuclear fuel, emitting most heat and having the longest half-life.

The fuel composition of the three experimental fuel assemblies is based on mixed uranium and plutonium oxide (MOX) fuel. BN-800 has been operating on MOX fuel since September 2022. What makes the new assemblies different is the addition of americium-241 and neptunium-237. They were manufactured in late 2023 at the Mining and Chemical Plant (part

## ROSATOM NEWS

[Back to contents](#)

of Rosatom’s fuel division TVEL) and passed factory acceptance tests. Their pilot operation is divided into three micro campaigns, totaling about a year and a half. The goal is to prove in practice the possibility of burning minor actinides on an industrial scale.

If this possibility is proved, radiation activity and toxicity of spent nuclear fuel will be reduced 2,300 times. “Rosatom’s MOX fuel with minor actinides for commercial fast reactors has no counterparts in the world and demonstrates the fundamental technological possibility of forging a critical, yet missing link for Generation IV nuclear power systems. By itself, uranium and plutonium fuel makes it possible to reprocess spent nuclear fuel into fresh fuel instead of storing it, thus reducing nuclear waste. In turn, burning minor actinides gives an opportunity to significantly reduce radioactivity of such waste. This will enable us in the future to abandon its complicated and expensive isolation in deep geological repositories,” explains Alexander Ugryumov, Senior Vice President for Research and Development at TVEL.

Rosatom is the world’s first company to be working on the links required to close the nu-



clear fuel cycle. This work is conducted under the Proryv (Breakthrough) project aimed at the development of Generation IV power systems, which involve fast neutron reactors and facilities for reprocessing irradiated fuel into fresh fuel. These facilities include a demonstration power production facility with the BREST-OD-300 reactor and a new power unit with the BN-1200M reactor to be built at the Beloyarsk Nuclear Power Plant.

### **Fuel in load-following mode**

Rosatom researchers conducted a successful experiment to study the parameters of nuclear fuel designed for the 18-month operation in VVER-1200 reactors in the intraday load-following mode. Experimental fuel elements, both with and without a burnable absorber integrated into them, were loaded into the MIR research reactor. The test scenario simulated intraday load following: seven hours at 40% power (night hours), four hours at 100% (morning load), another four hours at 40% (daytime decline), and then nine hours at 100% (evening load). In-pile tests lasted 224 effective days, with 218 power ascension and descension cycles completed.

The experiment confirmed that the new fuel maintains its integrity and performance under repeated and rapid power changes. “This is another step towards demonstrating the feasibility of operating Russian-designed high-power reactors in load-following mode. Our research is attracting much interest from the operators of Russian-built nuclear power plants abroad,” says Alexander Ugryumov.

Operating nuclear reactors in load-following mode is important in those power systems that have a high share of nuclear or renew-

## ROSATOM NEWS

[Back to contents](#)

able capacity but have no or a low share of gas-fired or hydro power plants, which are usually used to address load changes in the power system.

### 18 months from day one

TVEL went ahead with delivering on the contract for the supply of nuclear fuel for India’s Kudankulam NPP Units 3 and 4. This fuel is designed for the 18-month-long operation from the first load.

Previously, VVER-1000 reactors, which are installed at Kudankulam, operated in a 12-month refueling cycle. Since 2022, TVEL has been supplying TVS-2M fuel assemblies for the first two units. They have a rigid design, a new-generation anti-debris filter and a higher uranium mass. Due to their higher reliability and uranium content, the reactors were switched to an 18-month operation cycle. This reduced the number of days in downtime, thus increasing output and improving economics.

“Kudankulam Units 3 and 4, which are currently under construction by Rosatom, will be the first ever VVER-1000 units to operate in an 18-month refueling cycle from the start. This is the result of our successful cooperation in recent years. The solutions that have proved effective at similar power units in Russia and China will be implemented at Kudankulam’s reactors. Along with supplying nuclear fuel, Rosatom provides engineering services, improving the reactor economics through new fuel solutions,” says TVEL President Natalia Nikipelova.



## Greater Cooperation in Eurasia

Rosatom was one of the most notable participants of the Innoprom International Forum held in early July in Yekaterinburg. The session titled ‘Partnership for Promotion to the Markets of Greater Eurasia: We Win by Joining Forces’ discussed optimal partnership formats for the markets of this macro-region.

### Through efforts of multiple companies

Kirill Komarov, First Deputy Director General for Corporate Development and International Business at Rosatom, spoke about the cooperation with local businesses in nuclear construction projects.

The average local content (locally sourced goods and services) in Rosatom’s international projects stands at around 30% to 40%.

## ROSATOM NEWS

[Back to contents](#)



he emphasized. “Each nuclear power plant needs about 50 thousand articles of machinery and other products. No single company can produce the entire assortment. Our projects are an opportunity for industrial enterprises to receive huge high-tech, long-lead orders and make their contribution,” he said.

Over the past five years, Rosatom’s procurements from small and medium-sized businesses have doubled to reach an estimated RUB 550 billion this year. Each nuclear construction project creates 3 to 10 thousand jobs in the host country. This adds about USD 20–25 billion to the country’s GDP during both the construction phase and an almost century-long service life of the plant. “We are an engine for Russian technology in foreign markets, and we take care not only of ourselves but give numerous businesses a chance to earn big money. This is also a tremendous opportunity for them to make their production culture meet our strict requirements, to teach their employees, and to create high-tech competitive products. Only having set the bar high, on a par with international competitors, is it possible to be truly successful in our country,” Kirill Komarov expressed his confidence.

### A look into the future

The visitors to Rosatom’s exhibition booth could take a look at the City of the Future art installation presenting nine promising business areas of the Russian nuclear corporation. These are green energy, environmental solutions, health technologies, logistics and transportation, resources and fuel, digital solutions, new technologies and materials, science and innovation, and education. The booth also featured a simulated production line powered with AtomMind, Rosatom’s predictive analytics system.

Evgeny Tugolukov, the founder of Medscan, gave an example of cooperation with Rosatom in the field of medicine. Rosatom acquired a 50% stake in the company in two successive transactions. Evgeny Tugolukov compared the company to a dolphin that follows a whale and also helps it. According to the businessman, following the large company gives Medscan many opportunities and benefits as it can be the first to deploy nuclear medicine solutions developed by the Russian nuclear corporation. This does not mean, however, that one can sit back and do nothing. “There is a lot of hard work we are doing together, and it never ends. New opportunities are opening up, and they need effort,” Evgeny Tugolukov says.

Alexey Gruzdev, Deputy Minister of Industry and Trade of the Russian Federation, noted that globalization was giving way to regionalization (cooperation within regional associations), and Russia would use every opportunity provided by the SCO, EAEU and BRICS to establish mutually beneficial partnerships. For this purpose, the Russian Ministry of

## ROSATOM NEWS

[Back to contents](#)

Industry and Trade is setting up a network of trade missions around the world. There are 59 of them, but additional accreditation allows Russia to be present in 78 countries. Seven trade missions were opened over the last three years, including five last year.

Russia's economic interests extend beyond Greater Eurasia to Africa, Latin America and South East Asia, but trade is not the only thing in the focus of attention. Russia is setting up joint production facilities in favorably located industrial parks that offer special investment conditions. Such projects are currently in progress in Central Asia and the Caucasus. Joint funds are being established by stakeholders to co-finance projects. This practice will be expanded to cover other initiatives.

Russia also proposes to set up BRICS industrial competence centers to serve as best practice exchange and training platforms. The goal is to maximize the integration of supplier companies from the BRICS countries. The initiative is actively supported by the United Nations Industrial Development Organization (UNIDO).

Olzhas Saparbekov, Vice Minister of Industry and Construction of Kazakhstan, and Elnur Aliyev, First Deputy Minister of Economy of

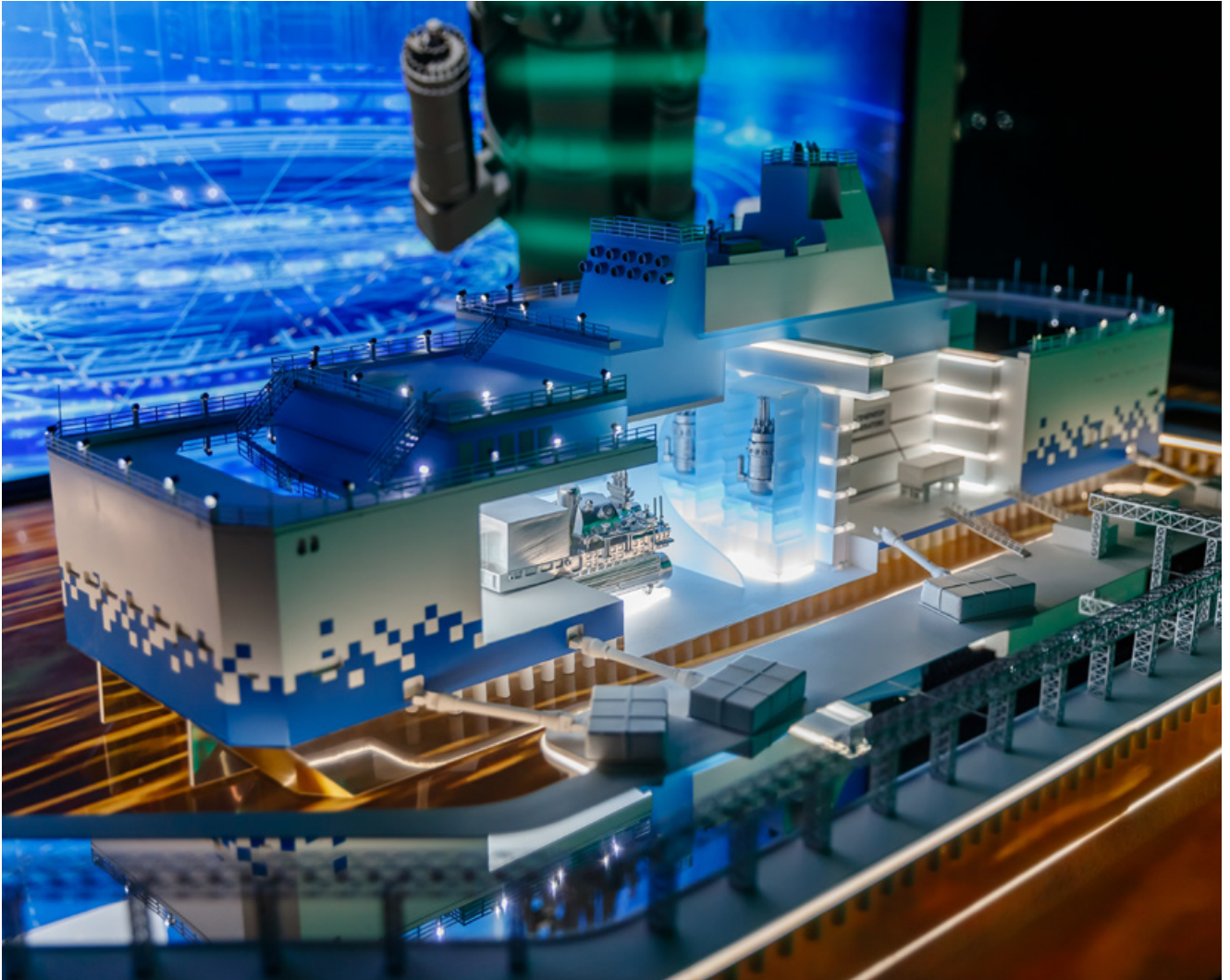
Innoprom has been held annually in Yekaterinburg since 2010. As a partner of Innoprom 2024, the United Arab Emirates sent about 200 people to the forum, including ministers of industry, foreign trade, public education and advanced technologies.

Azerbaijan, presented cross-country facilitation tools for commercial and industrial cooperation, such as special economic zones, industrial parks and investment funds. Ahmet Yozgatlıgil, Deputy Minister of Industry and Technology of Turkey, agreed that the countries of Greater Eurasia needed to improve trade and cooperation and said what opportunities Turkey could use for this purpose, emphasizing the unique geographical location of the country.

Summarizing the discussion at the session, Kirill Komarov noted that, for the partnerships to succeed, it was very important to understand each other's interests and find a balance between them despite possible differences. [NL](#)

[To the beginning of the section](#)

## NEW BUSINESSES

[Back to contents](#)

## Small Power

Small modular reactor nuclear power plants (SNPPs), both offshore and onshore, form a new business segment for Rosatom. The world's first floating nuclear power plant, Akademik Lomonosov, has been successfully operating in Russia's northernmost town of Pevek (Chukotka Peninsula) for four years by now. Russia's first onshore SNPP to be built in Yakutia is preparing for the first concrete pouring. Rosatom is also making agreements with other

countries all over the globe to promote small-scale nuclear generation projects. Here is the latest news from this business segment.

### **Akademik Lomonosov**

The Akademik Lomonosov floating nuclear power plant is equipped with two KLT-40S reactors. The first of them was successfully refueled in late 2023, with the other to be refueled by the end of the current year. In July, Elemash (part of Rosatom's nuclear fuel division) shipped a batch of fresh fuel for this purpose.

## NEW BUSINESSES

[Back to contents](#)

The KLT-40S reactor core consists of fuel assemblies, emergency shutdown rods, and startup neutron sources. It is refueled in a single batch once every few years. Completion of the first refueling marks an important milestone in the operation of the reactor plant, meaning that it was performing nominally throughout the first fuel campaign.

### **Yakutian SNPP**

Preparations are in progress on the site of the Yakutian SNPP as workers are building the second construction camp (temporary accommodations for the on-site staff), roads, and other infrastructure facilities. Rosatom also sponsored the renovation of the runway in the town of Ust-Kuyga.

Earlier in June, Rosatom and the Government of Yakutia signed a power grid construction agreement on the sidelines of the Saint Petersburg International Economic Forum (SPIEF 2024). The document provides that Yakutia will build the necessary power distribution infrastructure, including power lines and substations, in the communities near the Deputatskoye, Tirekhtyakh and Kyuchus deposits. Speaking at the forum, Kirill Bychkov, Chairman of the Yakutian Government, said the parties were discussing the possibility of equipping the Yakutian SNPP with two reactors.

### **New agreements and prospects**

In late May this year, Rosatom and Uzbekistan signed a contract to build a small modular reactor nuclear power plant in the country. This is the world's first export contract for the construction of an SNPP. The plant will have six 55 MW reactor units, each to

be commissioned one by one. The first one is scheduled to be brought to power in late 2029.

In late June, the SNPP construction office held its first meeting, which was attended by representatives of Uzbekistan's Nuclear Energy Development Agency (Uzatom) and Rosatom's engineering division AtomStroyExport supervising the construction project.

“We are entering an active phase with this major project, which will provide the region with clean energy. We know our Uzbekistan partners as efficient and talented managers, and now we are starting joint activities at the construction site. I am confident that together we will meet all of our contractual obligations in a timely and orderly manner,” said AtomStroyExport President Andrey Petrov.

In early July, a delegation from Rosatom visited Mali to hold extensive negotiations on a wide range of nuclear power matters. Particular attention was paid to the possibility of building a Russian-designed small modular reactor in Mali. Following the talks, the parties signed three memorandums.





## NEW BUSINESSES

[Back to contents](#)

Earlier in June, Rosatom’s mechanical engineering division and officials from Guinea met at SPIEF 2024 to sign a memorandum of intent. The parties will study the possibility of deploying offshore power units with RITM 200 reactors to supply electricity to the country’s households.

### Learning technology


In early July, Rosatom’s Technical Academy in Saint Petersburg hosted a training course that addressed solutions to the infrastructure issues arising when small-scale nuclear generation capacity is added to the national energy mix. The course was attended by representatives of 16 countries, including Egypt, Indonesia, Malaysia, Saudi Arabia, Thailand and Egypt.

The course included lectures, seminars, and a virtual technical tour to the Akademik Lomonosov FNPP. The attendees also had an opportunity to see how nuclear-powered vessels are built in Saint Petersburg.

The training course covered construction and operation of offshore and onshore SNPPs, construction licensing, site selection, and establishment of national regulatory bodies. “We were told about the financial and legal issues that may arise when implementing nuclear programs. The knowledge I have gained will help me to more deeply assess the



current state of the nuclear program in my country and offer appropriate recommendations to the management,” said Edwin Ndoli from the Rwanda Atomic Energy Board.

“Rosatom is active in different applications of nuclear energy, which is recognized as ‘green’ by most of the world. We believe that offshore power units will be in great demand both in our country and around the world. This technology causes great interest, so we are negotiating on it,” Andrey Nikipelov, Deputy Director General for Power Engineering and Industrial Solutions at Rosatom, said at SPIEF 2024. 

[To the beginning of the section](#)



## Arctic Motion

**Rosatom is developing international partnerships, Arctic shipbuilding, and infrastructure of the Northern Sea Route (NSR) as the shortest shipping lane between Northern Europe and Asia. These are parts of a broader national strategy for the Arctic expansion.**

### **Promoting freight transport on the Northern Sea Route**

In early July, Rosatom and China's container service operator NewNew Shipping Line

launched a new multimodal route, Express NSR 1. A container train left the Bely Rast logistics center near Moscow and headed for the port of Arkhangelsk. The next step is the loading on a container ship and transportation of cargoes via the NSR to the Chinese ports of Shanghai and Ningbo. And in mid-August, the first ship from China on the route Arctic Express No. 1 was solemnly welcomed at the Arkhangelsk Commercial Seaport. Then the cargo went to Moscow and St. Petersburg.

A total of 12 voyages to be made by the end of the year. The length of the route is about 1,200 kilometers by rail and 6,600 nautical miles by sea. "The start of the Arctic Express

## TRENDS

[Back to contents](#)

is a historical event for the Northern Sea Route project. The route will give new impetus to the development of logistics between the two countries and promote trade cooperation,” Ke Jin from NewNew Shipping Line said at the launching ceremony.

The launch of the route is the first step towards delivering on the agreement signed by Rosatom and NewNew Shipping Line at the Saint Petersburg International Economic Forum in June this year. “We receive maximum support in our cooperation with Rosatom. And more importantly, we buy into the idea that the NSR can reduce delivery time, which is the primary goal of any freight transport company,” Fan Yuxin, Chairman of NewNew Shipping Line, said at the forum.

Other freights are running their course, too. In early July, the nuclear-powered icebreaker Vaygach joined three ships near Cape Zhelaniya to escort them eastwards. The ships are carrying oil products and other cargoes to remote Russian communities.

In late July, another ship, Lady D, set on this year’s first government-financed coastal voyage, which follows the route Arkhangelsk — Nakhodka — Murmansk with calls at Korsakov, Pevek, Magadan and Petropavlovsk-Kamchatsky. Lady D will bring fish products from the Far East to Murmansk. In total, three such voyages will be made this year, as many as last year.

A coaster line with dispatch dates understandable to shippers, operating between the north-west of Russia and the Far East, makes it possible to deliver cargoes to ports on the NSR route from St. Petersburg to Vladivostok. The geography of voyages is expanding, and this year alone the number of ports has grown from 11 to 14.

Thus, Rosatom is expanding its activities, fulfilling a key task on the Northern Sea Route — to ensure safe cargo transportation.

Rosatom is an operator of the Northern Sea Route infrastructure. Its NSR Directorate includes the NSR Administration, which issues navigation permits and provides information and navigation support to the vessels traveling on the NSR; Atomflot, an operator of nuclear icebreakers escorting ship convoys along the NSR; and the Hydrographic Service, which is engaged in the provision of port infrastructure and dredging operations, thus improving navigation safety and creating new opportunities for the Northern Sea Route traffic.

Rosatom is also developing its own mining projects and small-scale nuclear generation, both onshore and offshore, in the Arctic.

### **In the international context**

Russia is the largest investor in the Arctic. As noted in the Arctic Zone of the Russian Federation: Risks and Development Pros-



## TRENDS

[Back to contents](#)

pects report by Yakov & Partners consulting firm, Russia’s Arctic Development and National Security Strategy 2035 provides for USD 187 billion to be invested in the region. The key goals and objectives set out in the Strategy envisage the Arctic as a territory of comprehensive social and economic development driven by research, technology and extended infrastructure. They will be achieved through the build-out of the Northern Sea Route, intensification of extraction activities at the oil, gas and metal deposits, and construction of LNG plants.

As a comparison, Norway plans to invest USD 97 billion in the Arctic pursuant to its national strategy, with USD 96 billion to be spent by Sweden, USD 73 billion by Canada, and USD 33 billion by the US. Cumulative investments by Finland, Denmark and Iceland total USD 35 billion, the report says.

China is also interested in expanding its footprint in the Arctic. “Combining investment and commercial activities, research and humanitarian projects, contributions to local communities and Arctic governance initiatives, China is systemically strengthening its geopolitical position in the region without confronting the Arctic states,” the report says.



### **Economic significance of the region**

Life in Russia’s Arctic is to a great extent dependent on the development of hydrocarbon and mineral deposits, including iron ore, nickel, diamonds, coal, copper, gold and others. In 2022, the Russian government approved a development plan for the NSR until 2035 with funding of almost 1.8 trillion rubles (USD 19.5 million). The main goals are to ensure reliable and safe transportation of cargoes for residents of the Far North, as well as to create conditions for the implementation of investment projects in the Arctic zone of Russia, according to a comment on the government portal.

The mere possibility of building mineral extraction and processing facilities and exporting their products is inherent in the availability of a developed transportation system. Thus, the efforts made to improve navigation on the Northern Sea Route and partnerships with friendly countries are strategically important for the economic, technological and political sovereignty of the Russian Federation, and also for the development of international trade through the creation and improvement of routes for the delivery of cargoes with shorter deadlines and no security risks. Cargo traffic along the Northern Sea Route is expected to grow to 220 million tons by 2035.

### **Shipbuilding in the spotlight**

Construction of Arctic-class ships is key to the Arctic development. This topic has been repeatedly raised at all major economic conferences, including the Eastern Economic Forum, Saint Petersburg International Economic Forum, Neva Forum, and others. 15 rescue vessels, including tugs and multi-purpose ships, are under construction to

## TRENDS

[Back to contents](#)



ensure safe navigation on the Northern Sea Route. Contracts for the construction of another 30 same-purpose vessels are expected to be signed in the next six years.

The Zvezda Shipyard in the Russian Far East has already delivered five Aframax oil tankers to customers, with contracts signed to build another 26 tankers of different capacities. The company also plans to build 92 ice-class vessels of various purposes (container carriers, dry bulk carriers, tankers, etc.) by 2037.

It is expected that the government will make a decision by the end of the year to construct a new shipyard (Russia's North West and Far East are being considered as its optional locations). Much work is also being done to set up production of key vessel systems, with Rosatom playing an important role in this effort.

New partnerships are being formed with international market players. For example, the agreement between Rosatom and NewNew Shipping Line also provides for the establishment of a joint venture to build high-ice-class container ships and manage a container line.

High-ice-class vessels are one of the necessary conditions for the development of the

Arctic, faced by both Russia and any other country engaged or planning to engage in the Arctic. Powerful icebreakers are indispensable for safe and reliable navigation in the Arctic Ocean.

With nuclear-powered icebreakers in its fleet, Russia, unlike other countries, boasts a huge advantage. There are seven of them, including three most advanced nuclear icebreakers of the Project 22220 series. These are Arktika, Sibir, and Ural. Another three — Yakutia, Chukotka and Leningrad — are under construction, with the first two in the final stages. Nuclear fuel has already been manufactured for the two reactors of the Yakutia icebreaker, which is expected to be commissioned by the end of 2024. Another icebreaker of the same series, Stalingrad, is planned to be laid down in 2025.

Also under construction is Rossiya, an icebreaker of the Project 10510 (Leader) series, which has an unparalleled ice-breaking capability of over four meters. This is enough to ensure year-round navigation on the Northern Sea Route. Rossiya is expected to be put in operation by the end of 2030.

In general, the combined efforts of those interested in the NSR navigation will ensure progress of the Russian mining projects in the Arctic, improve life in the Arctic communities, provide Russian companies and projects with Russian-made vessels, and turn the Northern Sea Route into a customary freight lane and an obvious choice for international trade.

### Careful attitude to the Arctic

One of the most important tasks for Rosatom is to preserve the unique ecosystem of the Arctic region. Rosatom, together with

## TRENDS

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[Back to contents](#)

the Marine Research Center of Moscow State University, has been conducting environmental monitoring of the NSR water area since 2021. The goal is to monitor the environmental safety of the route and prevent negative environmental impacts. Field research is being conducted in the main port waters of the NSR.

In general, the Northern Sea Route is being transformed into a familiar and understandable international route that ensures the stability of cargo transportation and the stability of the global logistics chain. Along this route, companies from all over the world will be able to transport cargoes quickly, conveniently and safely. [NL](#)

[To the beginning of the section](#)

## TURKEY

[Back to contents](#)

## Hot Season at Akkuyu

The last few weeks were busy for the construction team working at the Akkuyu Nuclear Power Plant as builders finished some critical construction operations. Rosatom top managers and Turkish officials held a number of meetings to discuss current issues.

### News from the construction site

In late July, concreting of a foundation slab for the pumping station was completed at

Akkuyu Unit 3. The foundation slab was divided into eight blocks, each requiring four to ten stages of concreting, depending on complexity. Workers laid almost 20,000 cubic meters of concrete and placed about 2,000 tonnes of steel rebar. “Each concreting stage was preceded by specific on-site preparations. The concreting was done using high-strength concrete. These operations involved 350 Russian and Turkish workers,” said Sergey Butskikh, CEO at Akkuyu Nuclear. The pumping stations of the Akkuyu NPP are designed to supply sea water for the primary operation processes at the nuclear power plant and to remove heat from the auxiliary equipment of the turbine island. Each power unit will be served by one such station.

## TURKEY

[Back to contents](#)

In July, the first stage of installation of the reactor instrumentation and control (I&C) system started at Unit 1. “This is the most critical set of hardware and software components designed to collect and process data from the sensors located, among others, in the reactor core. The resulting data stream is fed into upper-level automation systems,” said Dmitry Dimashov, Head of Technology at the I&C Division of Rusatom Automated Control Systems (RASU). Power plant operators use this information to monitor all the necessary parameters of the reactor operation.

In early July, installation of the containment prestressing system was completed at Akkuyu Unit 1. Prestressed steel ropes add more strength to the concrete structures of the containment. The prestressing system is designed to withstand extreme loads, such as internal pressure of 5 kg/cm<sup>2</sup> or a crash of a large airliner. “The containment prestressing system increases safety and engineering stability of the reactor building and the entire station. Its installation is a particularly complex and responsible task,” Sergey Butskikh said.

### Meetings

In late July, Rosatom Director General Alexey Likhachev and Turkey’s Minister of Energy and Natural Resources Alparslan Bayraktar had a working meeting in Istanbul.

“We discussed the progress of work at the Akkuyu NPP site and a roadmap for the commissioning of the plant’s first unit. We are working intensively to commission the first unit as soon as possible. Meanwhile, construction of the other three power units is continuing at pace. When all the reactors of the Akkuyu NPP are put into operation, the plant will provide 10 percent of Turkey’s electricity

needs,” Energy Minister Alparslan Bayraktar pointed out.

The parties also discussed the possibility of building Turkey’s second nuclear station at Sinop. The project might be delivered by Rosatom. The solutions to be chosen for the project will factor in the intent of the Turkish authorities to maximize the effect of the project for the national economy.

A monthly working meeting was held at the plant construction site in late July with the participation of Yusuf Ceylan, Director General for Nuclear Energy and International Projects at the Turkish Ministry of Energy and Natural Resources. The parties discussed the progress of construction and installation works, equipment delivery, a preoperational testing program for Unit 1, involvement of Turkish suppliers in the project, and the training of qualified personnel for the power plant.

Another meeting held in July dealt with the exchange of experience in the training of licensed personnel and the establishment of education and training centers (ETCs) for the





## TURKEY

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[Back to contents](#)

nuclear stations under construction in Russia and other countries. The parties paid special attention to equipping ETCs with full-scale simulators and simulators that reproduce operating conditions of a nuclear power plant as closely as possible. This will allow operators and engineers to obtain practical skills in the closest to real conditions.

Besides, the experts studied the staff training and certification experience and discussed the development of teaching materials and training programs. About 1,300 Turkish specialists need to be trained to work at the first and second power units of the Akkuyu NPP.

Also in late July, Akkuyu passed a pre-accreditation audit by the Turkish Standards

Institution to prove compliance with the international ISO standards. “This is an initial step in the certification process. The pre-accreditation audit helps assess compliance with the accreditation requirements, and demonstrates the company’s openness and commitment to the improvement of its internal processes. ISO certification will officially confirm the compliance of the company’s standards with international requirements,” Sergey Butskikh said.

The auditors praised the high level of staff competence and quality of technical equipment. <sup>NL</sup>

[To the beginning of the section](#)



## Best Products for Future Plant

**Production of key components for a nuclear power plant is a long and technologically complex process. In July this year, Russian steel-makers shipped a large batch of billets to be processed into the equipment for Unit 1 of Egypt's El Dabaa Nuclear Power Plant.**

AEM SpetsStal (a steel-making facility of Rosatom's mechanical engineering division) manufactured 24 large-size billets weighing over 650 tonnes. The billets were shipped to three of Rosatom's production sites in Vol-

godonsk, Petrozavodsk and Saint Petersburg. They will be used to make primary circuit components, the reactor pressure vessel, pressurizer, and primary coolant pipes.

Production of a VVER-1200 reactor vessel takes around 840 days from design to delivery. At every stage of the manufacturing process, priority is given to product quality and safety during subsequent operation. The general quality assurance plan contains more than 300 control points.

The pressurizer is a critical piece of the nuclear station's equipment. It is designed to maintain pressure in the primary circuit in nominal operation modes and level off pressure changes in transient and emergency modes.

## MIDDLE EAST & NORTHERN AFRICA

[Back to contents](#)

By now, AEM SpetsStal has manufactured 75% of the steel billets that will be used to make equipment for the first unit of the Egyptian nuclear station. The remaining billets are planned to be produced by the end of 2024. They are made of special grade steels designed for the operation in specific conditions. The billets go through several levels of control, with their steel properties being carefully analyzed for compliance with the pre-designed parameters.

Another production facility of Rosatom's mechanical engineering division, Petrozavodsk-Mash, proceeded to manufacture pipes for the reactor island of El Dabaa Unit 1. Workers began cladding the pipes intended for the primary coolant circuit. The total weight of the set of pipes will amount to 276 tonnes.

Primary coolant pipes connect all the systems and equipment of the primary coolant circuit. They are arranged in four loops, each being connected to the reactor and comprising a primary coolant pump and a steam generator. When the reactor is in operation, coolant



with a temperature of 320 °C is circulated through the primary coolant circuit.

Production of key components for a nuclear power plant is a complex multistage process. To get an idea how long it is, consider that the ceremonial start to the production of the reactor pressure vessel for El Dabaa Unit 1 was given two years ago, in June 2022. <sup>NL</sup>

[To the beginning of the section](#)

SUB-SAHARAN AFRICA

[Back to contents](#)



## No Go Without Nuclear

As estimated by international experts, the population of the African continent will double by 2060: over 25% of the global population, or more than 2.8 billion people, will live in Africa. Energy development is one of the toughest challenges the continent is facing. Rosatom offers its African partners reliable high-tech solutions to this challenge.

With a number of far-reaching documents signed, bilateral talks held and visits made, the Russian nuclear corporation continues to expand and strengthen its cooperation with African countries in 2024. Here is our recollection of the key events from the current and previous years.

### Mali

2024: in early July, a delegation from Rosatom visited Mali and held a meeting with Assimi Goïta, the head of Mali’s transitional government. Negotiations were also held

## SUB-SAHARAN AFRICA

[Back to contents](#)

with a ministerial delegation led by the country's Minister of Economy and Finance Alousséni Sanou. The parties discussed, among other things, solar generation and geological exploration projects, and strategic plans to build a Russian-designed SMR nuclear power plant in Mali.

Following the talks, Rosatom signed two memorandums of cooperation in developing nuclear infrastructure and building positive awareness of nuclear energy with Malian Energy and Water Resources Minister Bintou Camara, and another memorandum of cooperation in personnel training with Minister of Higher Education and Scientific Research Bouréma Kansaye.

In April, Rosatom Director General Alexey Likhachev and Energy Minister Bintou Camara met at the Atomexpo 2024 international forum to sign a roadmap for establishing a dialog in peaceful uses of nuclear energy. After the parties set up a legal framework for the cooperation in this field, they will consider the possibility of implementing nuclear power projects and using radiation technologies in agriculture and medicine in Mali.

### Burkina Faso

2024: in June, Alexey Likhachev and Burkina Faso Minister of Energy, Mines and Quarries Yacouba Zabré Gouba signed three memorandums on the sidelines of the Saint Petersburg International Economic Forum (SPIEF 2024). The first of them pertains to the training of staff for the nuclear power sector. The parties will develop ties between specialized educational institutions, organize short-term training courses and upskilling programs for teachers, publish educational and academic literature, and exchange students. The purpose of these



arrangements is to train personnel for the yet-to-emerge nuclear industry in Burkina Faso.

The second memorandum aims to assess and develop nuclear infrastructure in the country. This is planned to be done in compliance with the IAEA guidelines and Rosatom's best practices. The third document is intended to promote a positive public attitude to nuclear power and raise public awareness among the people of Burkina Faso on the advantages of nuclear technology, including non-power nuclear solutions.

In April, at Atomexpo 2024, Alexey Likhachev and Yacouba Zabré Gouba signed a roadmap for establishing a dialog in peaceful uses of nuclear energy.

2023: the parties signed a framework memorandum of understanding and cooperation in civil nuclear power technology.

### Rwanda

2024: in April, the Tomsk Polytechnic University (TPU, one of Rosatom's backbone univer-

## SUB-SAHARAN AFRICA

[Back to contents](#)



sities) and the Rwanda Atomic Energy Board signed a memorandum of understanding at the Atomexpo 2024 international forum. The parties agreed to develop cooperation in education, training and research in nuclear physics and other areas. Their efforts will be primarily concentrated on joint educational programs, offering the students from Rwandan universities undergraduate, graduate and postgraduate programs at TPU, and organizing internships for them.

2019: Rosatom and Rwanda signed an agreement to build a nuclear science and technology center, a memorandum of understanding on the training of human resources, and a memorandum of understanding on public acceptability.

2018: the parties signed a framework memorandum of understanding and an intergovernmental agreement on cooperation in peaceful uses of nuclear energy.

### Congo

2024: in mid-July, Nikolai Spassky, Deputy Director General for International Relations

at Rosatom, held talks with Emile Ousso, Minister of Energy and Water Resources, during his visit to the Republic of Congo. The talks resulted in the signing of memorandums of cooperation in peaceful uses of nuclear energy and in hydro power.

Nikolai Spassky also met with Prime Minister Anatole Collinet Makosso to discuss the prospects for consistent expansion of the Russian-Congolese partnership in the energy sector.

2020: Rosatom and Congo signed two memorandums of cooperation in training human resources for Congo's nuclear power industry and in building positive awareness of nuclear energy in the country.

2019: an intergovernmental agreement on cooperation in peaceful uses of nuclear energy was signed during an official visit of Congolese President Denis Sassou Nguesso to Moscow.

2018: a memorandum of understanding and cooperation in peaceful uses of nuclear power was signed.



## SUB-SAHARAN AFRICA

[Back to contents](#)

### Guinea

2024: in June, Rosatom's power engineering division and its partners from the Republic of Guinea signed on the sidelines of SPIEF 2024 a memorandum of intent to build floating power units to supply electricity to the country. The parties will consider the possibility of using offshore generation facilities with field-proven and efficient RITM-200 reactors, and set out the terms and conditions of the project.

Other African countries are also among Rosatom's partners. For example, intergovernmental agreements on cooperation in peaceful uses of nuclear energy were signed with Zimbabwe and Burundi in 2023. Rosatom also maintains contacts with Ghana, Nigeria, Zambia, Angola, Namibia, South Africa, Tanzania, Kenya, Ethiopia, Uganda, and Zambia. [NL](#)

[To the beginning of the section](#)

### Sergey Rozhenko, Power & Utilities team lead at Kept

Electrification and industrialization of Eastern and Southern Africa is a truly massive task, commensurate in scope with the construction of five Russia-size power systems in just 30–40 years. Such a task can be accomplished only with a combination of all types of energy resources, including fossil fuels, renewable and nuclear. According to Kept's estimates, nuclear generation can play an outstanding role in the development of the regional energy sector and economy. By 2060, nuclear might account for a fifth of the energy mix of Eastern and Southern Africa, with installed nuclear capacity standing at above 125 GW. This can be achieved by the construction of 80 large nuclear reactors and more than 300 small and medium reactors. In addition, nuclear power plants are well positioned to become a one-of-the-kind intersection point for local supply chains and high value-added manufacturing economies.