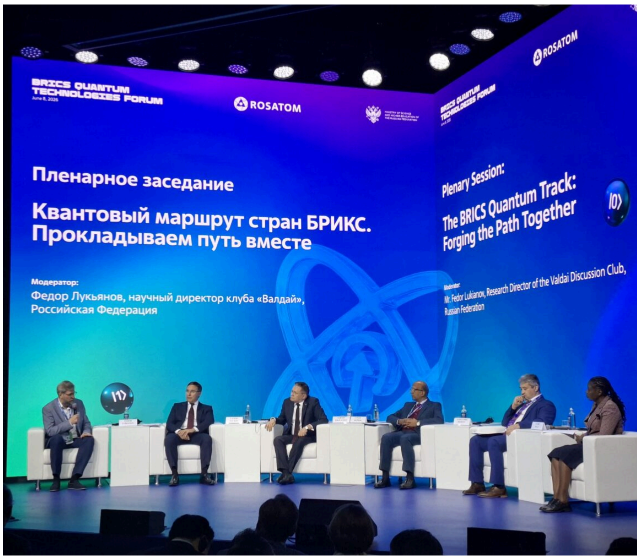
ROSATOM [360]

01.

STORIES

Nuclear Power Backs Quantum Technologies
The Era of Energevity
A Fusion Boost for Gyrotrons



02.

TRENDS

Exporting Russian Nuclear Education

Nuclear Power Backs Quantum Technologies

In June, Moscow hosted the 1st BRICS Quantum Forum. Speaking at the event, Rosatom Director General Alexey Likhachev announced the start of discussions on a 10-year quantum technology development strategy. Researchers, government officials, and business representatives from various countries proposed pathways for international cooperation.

Alexey Likhachev started the event with a welcoming address from Russian Prime Minister Mikhail Mishustin: “The Russian Federation is open to international cooperation in quantum research. In recent years, our country has achieved a stream of world-class results. And we are ready to share our experience and best practices in this field.”

Alexey Likhachev reaffirmed that Russia is open to cooperation in quantum technologies: “Seven quantum computers and dozens of algorithms in quantum computing, quantum sensing, and quantum communications — this is the wealth of assets we enthusiastically and unconditionally bring to the table for joint cooperation. I am confident that other countries will do the same, because we are stronger together,” the Rosatom chief continued.

Forms of cooperation

The plenary session titled “BRICS Quantum Route: Paving the Way Together” and involving physicists, representatives of international NGOs, government officials, and business leaders from various countries explored national achievements in quantum engineering and proposed ways to structure cooperation.

Russian Minister of Science and Higher Education Valery Falkov noted that Russian research teams have made significant strides in creating prototype quantum processors, scaling up from two qubits at the start of their work in 2020 to 70 qubits by the end of 2025. These computers are already solving test problems and will be highly sought after in the real economy.

Russia is active in developing its research infrastructure. For instance, a national research computer network has been established; it hosts an inter-university quantum key distribution network for testing new information security technologies.

Forty-seven Russian universities and academic centers offer training programs in quantum technologies to undergraduate and graduate students of various disciplines. Quantum R&D centers have been established at the National Research Nuclear University MEPhI and the Moscow Institute of Physics and Technology.

According to Valery Falkov, the points of mutual interest for BRICS countries include academic exchange programs, joint research, and the development of common standards or their mutual recognition. Another focal point is the shared use of research infrastructure. “When addressing fundamental challenges under conditions of high uncertainty, we will reach our goals much faster if we move together,” the minister concluded.

Vinay Kumar, Ambassador Extraordinary and Plenipotentiary of India to the Russian Federation, supported the enhancement of academic mobility and the involvement of students in exchange programs. He also pointed out that quantum technologies require billions in investment. In his opinion, China could become an industrial partner in quantum cooperation, which would give the collaboration a new impetus.

Alexander Shoytov, Russian Deputy Minister of Digital Development, Communications and Mass Media, said that academic collaborations are expected to yield quantum computers with a large number of qubits, the development of quantum memory, increased data transfer speeds, and extended distances in quantum communications. The emergence of hybrid computers powered by artificial intelligence is also anticipated. “We are doing all of this in Russia, but a breakthrough requires the consolidation of a broader community,” Alexander Shoytov noted. He believes that efforts should be united in fundamental and applied research, with a focus on developing algorithms and software. Another area of mutual interest is linking the quantum communication networks of partner countries, incorporating data re-encryption at the borders.

Nikolay Kolachevsky, Scientific Director of the Quantum Computing Roadmap and a member of the Russian Academy of Sciences, spoke about the capabilities of other BRICS member states in the quantum field: “India has a very strong mathematical school, encompassing algorithm developers and programmers. Joint quantum projects in space hold great promise with China. We can also talk about the mutual exchange of hardware components for quantum computing.” The starting point, however, must be mutual visits by scientists and students, joint projects, and grants, Nikolay Kolachevsky emphasized.

Looking to the future

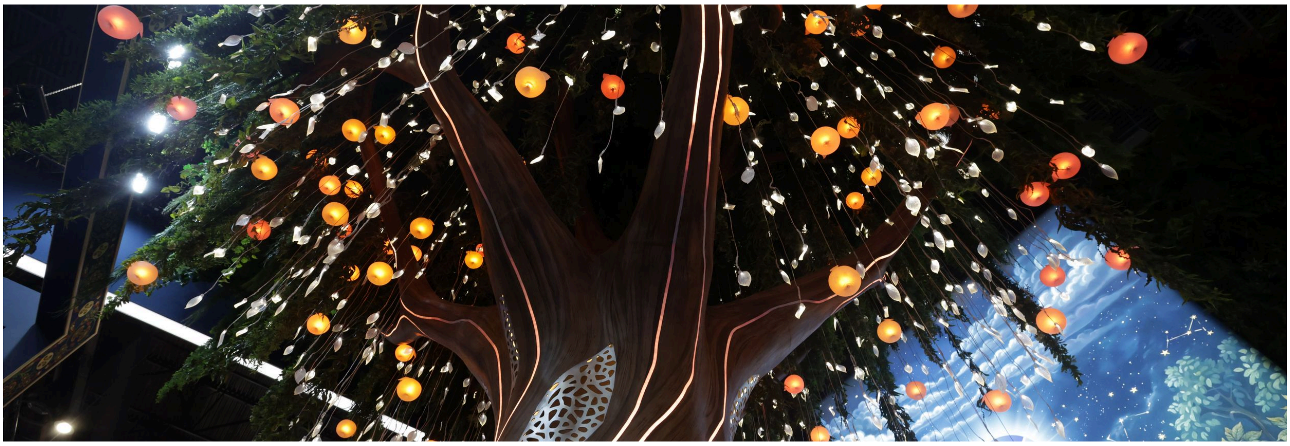
Elsie Pule, Chief Coordinator of the BRICS Nuclear Energy Platform, signed a joint statement made by its participants. “We recognize the strong potential of quantum computing in peaceful uses of nuclear energy to solve a wide range of modeling and engineering tasks, optimize production and logistics processes, and develop new materials and technologies,” the document says. “We must universally integrate quantum technologies into the nuclear energy sector,” Elsie Pule commented. Following the forum, the delegations adopted a statement reaffirming their intention to maintain contacts in the field of quantum technologies.

“Over the past 30 years, BRICS has evolved into a highly influential international entity with a far-reaching, profound agenda. Introducing quantum topics into it is a great historical mission. And I am confident that we will succeed together,” Alexey Likhachev concluded.

Photo by: Rosatom Quantum Technologies

The Era of Energevity

Rosatom has introduced a new concept of “energevity” to the global lexicon. In short, energevity means a long life full of energy and accomplishments, and a sharp mind. This concept was discussed at the Saint Petersburg International Economic Forum (SPIEF) 2026.



A fairy tale come true

This year, Rosatom’s booth at SPIEF looked literally magical, designed in the style of classic Russian fairy tales. The outside multimedia panels showed the Firebird shimmering in all shades of red, the Little Humpbacked Horse galloping, and the Sleeping Beauty awakening. Inside, a magic tree with rejuvenating apples glowed. The Sleeping Beauty represented early medical diagnostics using nuclear technologies, which are developed by Rosatom’s Science Division and applied by the Medscan Group (also part of the nuclear corporation). The Firebird symbolized the achievements of nuclear medicine in the fight against cancer. And the Little Humpbacked Horse — the protagonist of Pyotr Yershov’s famous fairy tale — introduced another character, Ivanushka, to revitalizing spa technologies.

“When designing the booth, we sought to reflect a simple yet important idea: thanks to Rosatom, what seemed like science fiction yesterday is becoming an integral part of everyday life today and an accessible technology,” explained Andrey Timonov, Director of Communications at Rosatom.

The booth embodied the philosophy of energevity. It bridges advanced medical technologies and active longevity. Rosatom is confident that existing technologies, coupled with a proactive attitude toward personal health from a young age, will enable people to live energetically and work productively for many decades. Visitors could take care of their health right at the booth by undergoing rapid diagnostics from Medscan experts and attending presentations on a comprehensive approach to extending an active life.

Part of the Russian nuclear DNA

Born at Rosatom, the concept of energevity implies the ability to maintain energy, mental clarity, decision-making speed, and psychological resilience, regardless of chronological age. “Energy is the most valuable asset Rosatom has. And energy is the most valuable thing in every person, regardless of age. Without it, it is impossible to work fruitfully, implement projects, achieve national goals, love, or raise children. With this in mind, we combined two words: ‘energy’ and ‘longevity.’ That is how the term ‘energevity’ was born. This is an approach to preserving and developing human potential. Along with extending life, it implies improving its quality,” Kirill Komarov, First Deputy Director General for Corporate Development and International Business at Rosatom, told the Strana Rosatom industry newspaper.

Rosatom’s operations are aimed at improving people’s quality of life. The Russian nuclear corporation builds and operates nuclear power plants, contributing to the growth of low-carbon generation in Russia and around the world — this is a crucial contribution to energevity. For instance, Rosatom plans to build 38 nuclear power units in Russia by 2042, which is more than the number currently in operation (34 reactors at large and small nuclear power plants). Rosatom is also building 26 large power units and two small modular reactor (SMR) units across nine countries. “This is our contribution to the clean energy future of our entire planet,” Kirill Komarov emphasized.

Nuclear medicine is another of Rosatom's business lines directly aimed at improving quality of life. Every year, 2.5 million patients worldwide receive diagnostics and treatment using isotopes produced by the Russian nuclear corporation. A radiopharmaceutical factory is currently under construction in Obninsk. The corporation is also building medical infrastructure facilities in Russia and establishing a chain of radionuclide therapy centers that will ensure broad access to high-tech medical care.

The third area of Rosatom's activities focuses on improving the living environment. "Our expertise in managing radioactive waste enables us to tackle the remediation of various categories of hazardous facilities," said Kirill Komarov. Rosatom is remediating legacy waste sites not only in Russia but also in Central Asian countries and Belarus.

"The concept of energevity is rooted in our historical identity. Over the next 10 to 15 years, this topic could become a substantial vector for applying our technologies and competencies. We are referring not only to medicine as an industry but also to the creation of a new culture of managing human health throughout one's entire life," said Kirill Komarov.

The concept of energevity provides a unified purpose for many of Rosatom's high-tech products. The Russian nuclear corporation sees immense potential in combining medical data, artificial intelligence, diagnostic technologies, personalized medicine, and modern approaches to disease prevention. Integrating these elements will enable a transition from a treatment-based economy to an economy focused on preserving and maximizing human potential.

Photo by: The newspaper "Strana Rosatom"

A Fusion Boost for Gyrotrons

Russia has increased its contribution to the construction of the International Thermonuclear Experimental Reactor (ITER). In June, the Russian team installed the first three gyrotron systems at the site of the world's first fusion reactor designed to produce net energy. Previously, Russia secured an order for 20 more such devices. Cooperation is also expanding across other areas.

The goal of the ITER project is to demonstrate the scientific and technological feasibility of using fusion energy on a commercial scale and to validate the necessary technologies. As an initiator and one of the key contributors to the project, Russia designs, manufactures, and supplies 25 ITER systems (including all central divertor assemblies, 40% of the first-wall panels, switching equipment, diagnostic systems, blanket module connectors, and more).

Pietro Barabaschi's visit

The Director General of the ITER Organization spoke at the Saint Petersburg International Economic Forum (SPIEF) and discussed training and secondment opportunities for Russian engineers at the ITER project with Tatiana Terentyeva, Rosatom's Deputy Director General for Human Resources. The parties agreed to explore various options for representatives of Russian educational and research institutions. "It is a great pleasure to visit Russia again and participate in a landmark event like SPIEF. I am very glad that Russia continues its active participation in the ITER project. The project is currently in a swift implementation phase, and only through the closest possible cooperation will we be able to achieve success," Pietro Barabaschi said at SPIEF.

More gyrotrons

In June, technical specialists from the Institute of Applied Physics of the Russian Academy of Sciences (IAP RAS), the GYCOM research and production enterprise, and Rosatom's ITER Project Center installed three Russian-made gyrotron systems at the ITER construction site. The assembly and installation process took six weeks.

"The plasma temperature in ITER will reach 300 million degrees Celsius, which is 20 times hotter than the core of the Sun. Heating plasma to such temperatures requires systems of immense complexity. This has never been done before. Russian systems with record-breaking technical specifications will help achieve this," emphasized Anatoly Krasilnikov, Director of the ITER Project Center.

Gyrotrons are needed to heat deuterium-tritium plasma using electron cyclotron resonance heating (ECRH), one of three heating methods utilized in ITER. Invented in the USSR in the 1960s, a gyrotron is capable of generating electromagnetic radiation with an output of several megawatts. With a wavelength of approximately 1 mm, the radiation can be focused on a small target to heat it to extreme temperatures.

Initially, the ITER design provided for 24 gyrotrons. Europe was to manufacture six of them, India two, and Japan and Russia eight each. "Eight Russian gyrotrons have been manufactured, four have been delivered to France, and three have been installed. Japan has manufactured and delivered eight gyrotrons. Two have been assembled, and one is undergoing tests. ITER has not yet accepted the European-made gyrotron. India plans to supply Russian-designed gyrotrons by simply purchasing them from us," Andrey Fokin, Laboratory Head at IAP RAS, told the Strana Rosatom newspaper.

Two years ago, due to difficulties in securing approval from the French regulator, the ITER management decided to abandon beryllium as the first-wall material and replace it with tungsten. Consequently, the importance of gyrotrons for ITER grew significantly: a decision was made to increase their total capacity from 20 MW to 80 MW. In 2025, ITER signed contracts with Russia and Japan to manufacture and supply an additional 40 gyrotrons, 20 from each country. "It is possible that we and the Japanese will receive an order for four more systems if other project members fail to meet their targets," Andrey Fokin added.

Ahead of schedule

In late June, the ITER Organization headquarters hosted the 38th meeting of the ITER Council. It was noted that the project is proceeding well ahead of schedule, reflecting the well-coordinated efforts of the international project team. "The pace of construction for this unparalleled facility has increased sharply. To maintain this momentum going forward, it is essential to strictly fulfill all commitments undertaken by each party, and those commitments have grown significantly. I hope that all high-tech components can be delivered here from Russia strictly on schedule, despite the well-known restrictions," commented Victor Ilgisonis, Rosatom's Director for Technology Research and Development and Russia's representative on the ITER Council.

In the autumn of 2026, the Russian ITER Project Center plans to ship control racks for the gyrotron systems to the site. This will be the largest delivery related to these devices in 2026. Several other major shipments are also scheduled for this year.

Photo by: ITER, The newspaper "Strana Rosatom"

Exporting Russian Nuclear Education

Rosatom's primary academic partner — the National Research Nuclear University MEPhI — has two overseas branches, in Tashkent (Uzbekistan) and in Almaty (Kazakhstan). MEPhI Rector Vladimir Shevchenko spoke in an exclusive interview with our publication about the operations of the overseas branches, what and how they teach, the success of their graduates, and the university's plans to promote Russian nuclear education abroad.

— Mr. Shevchenko, how is the work progressing at MEPhI's overseas branches?

— As of May 2026, 146 students were studying in undergraduate and graduate programs at the Almaty branch of MEPhI. Since the branch opened its doors, student enrollment has been growing: while 94 people were admitted in 2022, the number rose to 107 in 2025, mostly supported by government educational grants. Students are enrolled in programs such as Operation of Nuclear Power Plants, Electronics and Automation of Cyber-Physical Systems and Facilities, Elementary Particle Physics and Cosmophysics, and Secure High-Performance Computing Systems. There is also a master's program in Secure High-Performance Computing Systems and Technologies. We graduated our first master's students in Computer Science and Engineering in 2025.

As for the Tashkent branch, the annual intake is 100 bachelor's students majoring in nuclear physics and power engineering, thermal power engineering, and electrical power engineering. I should note that last December, with the support of Rosatom and Uzatom, we opened an Advanced Engineering School (AES), and we selected the branch's top 20 students for it.

— The nuclear new build projects in Kazakhstan and Uzbekistan are in their early stages. Where do the graduates of these branches find employment?

— The Almaty branch of MEPhI trains professionals who are highly sought after in the R&D sector and high-tech industries. For example, master's graduates who studied Computer Science and Engineering under the Secure High-Performance Computing Systems and Technologies program are employed by Kazakh banks and IT companies. In addition, some graduates have continued their education in doctoral programs at leading Kazakh universities.

In 2026, we will graduate our first bachelor's students in the fields related to nuclear physics and technologies. Some of them have already decided on their further educational and professional trajectories. For instance, Artyom Tishkov has received a job offer from Kazakhstan's Institute of Nuclear Physics (INP) and plans to continue his studies in a master's program at the Almaty branch of MEPhI. Alexandra Gurova will apply for a master's program at MEPhI in Moscow. Several students from the Elementary Particle Physics and Cosmophysics program are also considering employment at INP, where they will be able to participate in international scientific research and megascience projects in cooperation with the Joint Institute for Nuclear Research in Dubna, Russia.

We expect that graduates of our bachelor's programs will be in demand at INP, the National Nuclear Center, the Atomic Energy Agency of Kazakhstan, and other research organizations and high-tech companies in the country. Many graduates are considering further studies in a master's program at the Almaty branch. Thus, the branch in Kazakhstan is already involved in personnel training for the country's high-tech development and national projects in nuclear technology and science.

Graduates of the Tashkent branch will not be left without work upon completing their studies either. Young professionals are assigned to the Uzatom agency (which is the primary customer), as well as the Nuclear Power Plant Construction Directorate, enterprises under the Ministry of Energy, institutes of the Academy of Sciences, and other organizations. Some graduates continue their studies in master's programs at MEPhI and other universities.

— How are the programs and the list of majors determined at MEPhI's overseas branches?

— They are structured based on the national priorities and the needs of the national economies of Kazakhstan and Uzbekistan. For instance, in 2021, Kazakh President Kassym-Jomart Tokayev instructed the government and the Samruk-Kazyna sovereign wealth fund to comprehensively study the possibility of developing safe nuclear energy in the country. In January 2022, an initiative was put forward to open branches of leading foreign universities in Kazakhstan, and by February of that year, following a meeting between the presidents of Kazakhstan and Russia, a decision was made to open a MEPhI branch. It was officially established in August 2022.

In October 2024, a majority of Kazakh citizens supported the construction of a nuclear power plant in a referendum, and in August 2025, the implementation of the first NPP project officially began near the village of Ulken on the shores of Lake Balkhash. In October of that year, I had a meeting with Kassym-Jomart Tokayev and took that opportunity to discuss the further development of the branch, the construction of its own campus, and the establishment of a consortium of universities offering nuclear education.

The Tashkent branch is intended to support the development of nuclear power in Uzbekistan and train personnel for the nuclear power plant under construction, so its most in-demand graduates are those in MEPhI's core disciplines: Nuclear Power and Thermal Physics, Nuclear Physics and Technology, Thermal Engineering and Technology, Electrical Engineering and Technology, and several others.

The programs at MEPhI's overseas branches differ because each country shapes its own demand for personnel training. The university tailors its educational offering to the national priorities and needs of a specific economy. I must emphasize, however, that the curricula at the main campus and the branches differ minimally, and such differences are tied to the need to comply with the legislation of the host country. For example, the branch programs must include courses in the national language and the history of the host country.

— Does Rosatom support the branches?

— Certainly, it does. The Russian nuclear corporation provided assistance when the branches were opened, and today their operation would be impossible without Rosatom's consistent support.

— What is the role of Russian professors in teaching the branch students?

— The role is key. Russian professors regularly travel to Almaty and Tashkent. At the Almaty branch, about half of the faculty consists of professors from the main campus. The education process follows a 3+1 model: students study for three years in Kazakhstan and one year at the MEPhI campus in Moscow. First to third year students are taught by professors from both the branch and the main MEPhI campus. Specialized last-year courses, which form professional competencies of future specialists, are primarily taught by professors from the Moscow campus. Some subjects are taught using our modern digital educational technologies and resources. This comprehensive approach ensures unified educational standards, continuity of training, and the full integration of branch students into the MEPhI academic environment.

At the Tashkent branch, Moscow-based professors teaching basic natural science disciplines participate in examination sessions and conduct classes in specialized subjects. In the academic year that just concluded, about 30 professors from the main campus taught more than 40 disciplines and supervised term projects and final qualification papers.

— Is there training provided for Kazakh and Uzbek professors?

— All professors at the Tashkent branch regularly take continuing education courses, including at the main campus.

A continuing professional education program is currently being developed for professors based at the Almaty branch. This March, the meeting of the education and science subcommittee of the intergovernmental Kazakh-Russian cooperation commission recommended that the Kazakh Ministry of Science and Higher Education assist in granting the Almaty branch the right to teach supplementary and continuing professional education programs for children and adults starting from the 2026/27 academic year. It is planned that, upon receiving this right, the branch will provide advanced training and professional retraining for educators and employees of nuclear companies and research organizations in Kazakhstan, involving MEPhI experts and professors for this purpose.

— How do students do internships?

— During their practical training and pre-graduation internships, students of the Tashkent branch visit specialized organizations in Uzbekistan related to their major (Uzatom, thermal power plants, the Ministry of Energy, the Institute of Nuclear Physics, and medical centers). Students also visit industrial sites during their studies to consolidate their knowledge in practice.

— What are the plans for the upcoming academic year?

— In the 2026/27 academic year, we plan to launch master's programs in nuclear physics at the Tashkent branch and joint programs with Uzbek universities. In particular, we will partner with the Jizzakh Polytechnic Institute, which is expanding its list of majors following an instruction from the country's President, Shavkat Mirziyoyev, regarding the comprehensive training of personnel for the nuclear power plant currently under construction.

— Can students from other countries enroll in the Almaty or Tashkent branches?

— Yes, both of our branches are open to international students on a tuition-paying basis. The student body mostly consists of host-country nationals, but there are exceptions. For example, this year we will have our first female graduate who is a Kazakhstan national; she transferred to the Tashkent branch two years ago. As for the Almaty branch, there are citizens of Russia and Bulgaria studying, in addition to Kazakhs. Such integration promotes the development of the branches and strengthens educational and scientific cooperation between different countries.

— What are MEPhI's plans for opening branches in other countries?

— They are closely tied to Rosatom's international strategy. Several countries are currently under consideration, and one of them is Egypt. But I must emphasize that opening a branch is typically the final step of a lengthy process. It is preceded by the implementation of joint educational programs with foreign partner universities, the opening of a MEPhI representative office in the country, and other steps. A branch is a costly endeavor, so the host country must be confident that the national personnel trained there will work to develop its nuclear industry.

For reference: *Rosatom State Corporation annually provides comprehensive support to the development of branches of the National Research Nuclear University MEPhI abroad in cooperation with partners representing organizations of the nuclear industry of Kazakhstan and Uzbekistan.*

Photo by: Tashkent branch of MEPhI, Rosatom State Corporation