



CONTENTS

[Back to contents](#)

ROSATOM NEWS

[Uranium One Enters Lithium Project](#)

[Clean and Safe](#)

TRENDS

[Atom Two in One: Sustainability and Cost-Effectiveness](#)

ROSATOM GEOGRAPHY

[Made in Russia](#)



Uranium One Enters Lithium Project

Uranium One Holding N.V. (part of Rosatom) and Alpha Lithium Corporation (Canada) made a joint venture agreement to develop a lithium project Tolillar in Argentina. If the project reaches the production stage, Rosatom will benefit from having a stake in the ‘green’ economy as lithium is a critical element for energy storage systems.

This is the first deal made by Uranium One to acquire a share in a company holding lithium exploration and production rights.

The agreement provides for Uranium One to buy a 15% stake in the newly formed Alpha One Lithium B.V. for USD 30 million. Alpha Lithium Corporation will hold 85% of shares in the new company, which is the sole shareholder of Alpha Argentina S. A. that owns exploration and production rights for the Tolillar lithium deposit. The license covers 10 blocks with a total area of 27,500 ha in the salt area called Salar Tolillar in the Northern Argentinean province of Salta.

This is one of the most promising deposits as it is located inside two ‘lithium triangles’. One of them is formed by the Argentinean provinces of Jujuy, Salta and Catamarca and is a part of a larger triangle of Argentina, Bolivia and Chile. According to the latest estimates by the US Geological Survey, the three countries account for nearly 50 million tons of lithium out of 86 million tons of global resources.



ROSATOM NEWS

[Back to contents](#)

Another advantage of the project is its relative proximity to the power and transport infrastructure, which is a very important factor affecting the amount of investment in the project.

The project is at an early stage of development. According to initial exploration results published by the company in October 2019, geological data and analytics are limited yet. The plans for the next two and a half years provide for more geological surveys, construction of a pilot production facility, and validation of production parameters. The company will also prepare a feasibility study for a large-scale plant that will produce lithium carbonate.

The share of Uranium One in the project is not large yet. However, it may be increased after the feasibility study is completed. If the project proves to be economically feasible, Uranium One may increase its share to 50% pursuant to the joint venture agreement at the price of USD 185 million. If the option is exercised, Uranium One will have the right to purchase up to 100% of the product.

The agreement also contains certain conditions precedent to be fulfilled before the parties can exercise their rights and meet obligations in full.

“We are glad to partner with Uranium One. Its ability to deliver large-scale industrial projects and extensive expertise in operating mining and processing facilities worldwide are invaluable for effective development and operation of the Tolillar deposit,” said Brad Nichol, President and Chief Executive Officer at Alpha Lithium.

“Lithium is an essential material for the provision of resources for the green



economy of the future. The development of this line of business is strategically important for Rosatom. The project in Argentina will be implemented in accordance with the principles of sustainable development. We plan to develop the deposit, taking into account the interests of local communities, using innovative technologies that have minimal impact on the environment, and supporting scientific and technical cooperation programs,” said Andrey Shutov, President of Uranium One Group (the parent company of Uranium One Holding N.V.). He also stressed that the company was evaluating other rare and important metal deposits.

As you may remember, Rosatom invests heavily in the development of energy storage systems based on lithium-ion batteries. RENERA (part of Rosatom’s TVEL Fuel Company) owns production assets in Russia and South Korea, manufacturing energy storage products along the entire value chain, from individual battery cells to ready-to-operate energy storage systems. This September, RENERA announced that it would build a ‘Russian Gigafactory’ to manufacture lithium-ion cells and energy storage systems at the site of the Kaliningrad (Baltic) Nuclear Power Plant. The factory is expected to be



ROSATOM NEWS

[Back to contents](#)

TVEL is Rosatom's fuel division and one of the world's largest suppliers of nuclear fuel. TVEL is a monopoly supplier of nuclear fuel to all power, marine and research reactors in Russia. The company fuels nuclear power plants in 15 countries, or every sixth power reactor in the world.

Uranium One is an international group of companies owned by TENEX (part of Rosatom) and one of the world's largest uranium producers with a diverse portfolio of assets worldwide, including in Kazakhstan, Tanzania, Namibia, and the United States.

put into operation as soon as 2026. Its annual capacity will be at least 3 GWh.

Lithium carbonate is a key input material for this segment, so the growing interest towards lithium deposits is driven by the surging demand for lithium-ion batteries.

According to the IEA estimates, demand for lithium will grow from 74,000 tons in 2020 to 242,000 tons in 2030 under the base case scenario and to 461,000 tons under the sustainable development scenario. By 2046, these figures will reach 373,000 tons and 1.16 million tons, respectively. The key consumer will be manufacturers of electric vehicles and also the growing segment of energy storage systems for the power industry. Such systems are needed by both large power plants and distributed generation to compensate for unstable electricity supply from renewable energy sources.



ROSATOM NEWS

[Back to contents](#)

Clean and Safe

Rosatom expands its presence in the nuclear decommissioning market. In early December, Rosatom's integrator for decommissioning services TVEL signed several new deals. TVEL's subsidiary NUKEM Technologies announced it had completed the dismantling of the reactor pressure vessel of Barsebäck-1 NPP (Sweden).

Shaking hands to dispose waste

Rosatom's TVEL Fuel Company signed several partnership agreements for nuclear decommissioning and nuclear materials management at the World Nuclear Exhibition 2021.

One of them was signed with the French D&S Groupe. Established in 2004, the group comprises seven companies providing nuclear risk management services. The parties agreed to work jointly on the development of relevant technologies.

Another agreement was signed between TVEL and ROBATEL Industries, also from

France. It is a large group of mechanical engineering companies founded in 1830. At present, its core activities comprise design and manufacturing of radioactive waste containers and other special equipment for the nuclear industry. The agreement between TVEL and ROBATEL provides for joint participation in international projects and different service options for potential customers.

“TVEL Fuel Company partners with European companies to better establish itself in the international market,” Vadim Sukhikh, Chairman of NUKEM Supervisory Board and Director for Decommissioning at TVEL, explains.

Lords of reactor rings

The consortium of NUKEM Technologies (TVEL's engineering subsidiary in Germany) and Fortum's Uniper Anlagenservice completed the dismantling and removal of the reactor pressure vessel from the reactor pit at Barsebäck-1 NPP in Sweden.

In 2019, the two companies acting in a consortium won a contract to dismantle two RPVs at Barsebäck and two more at the Oskarshamn nuclear power plants. The work on the first reactor unit helped refine and improve the technology and operations to make them as cost efficient and safe as possible. The experience gained at Barsebäck will be employed at the second power unit of the same plant and at the Oskarshamn NPP.

The first RPV was dismantled by using the so-called thermal cutting technique, which had been used at German nuclear stations. The vessel was first segmented



ROSATOM NEWS

[Back to contents](#)

in 13 rings between 0.9 and 1.8 meters high and a bottom. Then the rings and the bottom were removed from the reactor pit to the post-segmentation area to be cut into smaller pieces that would fit better into packaging containers. In total, 430 tons of equipment was dismantled. The operation took 13 months.


All the four reactors are expected to be dismantled by 2024.

“The RPV dismantling operations in Sweden were our first and, more importantly, successful case of decommissioning commercial boiling water reactors. We are looking forward to proceeding with other reactors. Our case demonstrates to the global community that decommissioning stops being a problem and turns into a routine, cost-efficient process,” Vadim Sukhikh pointed out.

“Decommissioning refers to the administrative and technical actions taken to remove all or some of the regulatory controls from an authorized facility so the facility and its site can be reused. Decommissioning includes activities such as planning, physical and radiological characterization, facility and site decontamination, dismantling, and

TVEL became Rosatom’s integrator for nuclear and radioactive decommissioning and radioactive waste management services in 2019. By 2021, TVEL delivered 39 large projects in the field of nuclear decommissioning, construction of radioactive waste repositories and site rehabilitation.

NUKEM Technologies (based in Alzenau, Germany) provides radioactive waste and spent nuclear fuel management, nuclear decommissioning, engineering and consulting services. Since 2021, NUKEM Technologies is a part of TVEL.

materials management. Decommissioning is a normal part of a nuclear facility’s lifetime and needs to be considered at the earliest stages of its development,” the IAEA website says. 

[To the beginning of the section](#)





Made in Russia

Throughout 2021, we were writing about the countries in which Rosatom operates, launches social initiatives and interacts with local communities. We would like to close the year with a story about Russia. This is where Rosatom develops and tests new technologies and then offers them to customers from all over the world.

VVER-TOI reactors

VVER-TOI stands for “Water-Cooled Water-Moderated Energy Reactor — Universal Optimized Digital” in Russian. Two power units with VVER-TOI reactors is being built at Kursk II NPP.

VVER-TOI takes over from the AES-2006 design that was used to build reactors at Leningrad II and Novovoronezh II nuclear power plants. Each unit will have a power capacity of 1,300 MW. VVER-TOI is characterized by improved earthquake resistance, better load following, and an ability to withstand heavy hits, such as a 400-ton airplane crash. It is capable of maintaining operation in the absence of external power and water supply. Besides, VVER-TOI can run on MOX fuel.

In late November this year, AtomEnergomash (Rosatom’s power engineering division) manufactured the first steam generator for Kursk II Unit 2. A month before, the first steam generator for Unit 1 had been delivered to the construction site. It is planned that the steam generator for Unit 2 will arrive at the site by the end of the current year.



ROSATOM GEOGRAPHY

[Back to contents](#)

Steam generators for VVER-1300 reactors feature a specific design — they do not have a header, which was previously placed at the upper part of the steam generator. Steam comes out of a single nozzle that is directly connected with the steam pipe. These design solutions improve the overall reliability as they decrease the number of welded seams in the steam generator. A higher steam generating capacity (1,652 tons/hour vs. 1,200–1,602 tons/hour in VVER) secures a higher power capacity of the reactor unit.

This September, a reactor pressure vessel (RPV) for Unit 1 was delivered to the Kursk II NPP construction site. The number of welded seams in the pressure vessel of VVER-TOI reactors is also smaller if compared with VVER-1200 (four vs six). Since there are no welded seams in the core, the RPV service life can be extended for another 40 years after the initial 60-year period is over.

RITM-200 SMRs

Russia is the first country in the world to have built a small modular reactor (SMR) in the 21st century. It is Akademik Lomonosov, the world's only floating nuclear power plant.



This year, Rosatom has intensified its R&D efforts in SMRs. In particular, a decision was made that Baimsky GOK (a mining and processing plant that will develop one of Russia's largest gold deposits Peschanka) will be supplied with power from four (three basic and one backup) upgraded floating power units (abbreviated as “MPEB” in Russian for “modernized floating energy unit”). Their key difference from Akademik Lomonosov is another reactor, RITM-200S, to be used instead of KLT-40. The upgraded units will have two RITM-200S reactors with a power capacity of 55 MW each. The power of the turbine, which is designed specifically for MPEBs, will be increased from 50 to 58 MW. The upgraded power units for Baimsky GOK will not be used to produce heat as it will not be needed. Engineering design for MPEB will be completed in the first quarter of 2022.

Later, it will be improved to create an optimized floating power unit (abbreviated as “OPEB” in Russian for “optimized floating energy unit”) that will differ from MPEB in smaller dimensions and a new setup. OPEB will also use RITM-200S reactors but can be equipped with a more powerful 200 MWe RITM-400 reactor. It is developed at OKBM Afrikantov (part of Rosatom) for the Leader icebreaker. Construction of a combined SMR for the production of electric power and heat is discussed with the government of Kamchatka in Russia's Far East, while its tropical version is negotiated with some island countries.

Besides, Rosatom and the government of Sakha (Yakutia) are working on the project to build an onshore SMR with a RITM-200 reactor in the town of Ust-Kuyga. Its major power consumer will be a nearby gold mine, Kyuchus. Consumption of at least 35 MW of electric power was a condition of the tender for the development of Kyuchus gold deposit.



ROSATOM GEOGRAPHY

[Back to contents](#)

MBIR

MBIR is a multi-purpose fast breeder reactor under construction in Dimitrovgrad (Ulyanovsk Region, Russia). For now, the reactor has been concreted to Level +13, and a slab installed for the foundation of the reactor pit. MBIR will be used to conduct research, and Russian scientists already know what it will be. The scope of research will cover development of new reactor concepts, closing of the nuclear fuel cycle, fundamental studies on cold and ultracold neutrons, and tests on materials and components for the reactor core of new reactors.

MBIR is intended to be an international research collaboration. According to Director General of Rosatom, Alexey Likhachev, negotiations are underway with China and France as potential collaborators. He also invited Serbia to take part in the project. An international consortium for MBIR-based research was established to give everyone a chance to participate in research programs.

Breakthrough


Perhaps, this is one of Rosatom's most ambitious current projects. Proryv (Russian for "breakthrough") is a project aiming to close the nuclear fuel cycle. No one has yet

AtomEnergMash (AEM) is Rosatom's power engineering division and one of Russia's largest power machinery producers providing comprehensive solutions in design, manufacture and supply of machinery and equipment for nuclear, thermal, petroleum, shipbuilding and steel-making industries. Its production facilities are located in Russia, the Czech Republic, Hungary and other countries.

attempted to develop a lead-cooled fast neutron reactor that can use mixed uranium plutonium nitride (MUPN) fuel.

The entire facility will consist of a BREST-OD-300 (the acronym stands for the Russian 'Naturally Safe Lead-Cooled Fast Reactor — Test Demonstration'), a fuel fabrication and refabrication unit, and a fuel reprocessing unit.

In late November, concrete pouring for the basemat of BREST-OD-300 was completed in Seversk (Tomsk Region). Work is currently underway to build external walls of the containment building.

Rosatom is also working on other advanced reactor technologies, such as microreactors, space nuclear propulsion systems, high-temperature gas-cooled reactors, and others. We have mentioned only those that have approached their physical implementation. The principle that the Russian state nuclear corporation follows is to study and master the latest technology at home and offer a clear and tested solution to the customers abroad later. We hope we will have no fewer reasons to write about Rosatom's projects abroad next year. 

[To the beginning of the section](#)



Atom Two in One: Sustainability and Cost-Effectiveness

Can one say that 2021 was lucky for nuclear energy? It was surely not simple, but the return of nuclear to big politics seems to be a central thing that has happened this year. The global community has recognized that nuclear is a source of electricity that has two major advantages — it is carbon-free and sustainable. And it also serves key goals of fighting climate change and developing the economy.

Climate change and reduction of carbon dioxide emissions have dominated the energy agenda for the last five years. Cold waves in Texas and Europe and the cold October of

2021 showed, however, that the sources of energy should be reliable and affordable, not just clean. An energy crisis, the largest in the last 50 years, broke out in October this year, right before the UN Climate Change Conference held in Glasgow from October 31 — November 12.

Following a ban on Australian coal and a downfall in domestic coal production, China increased gas imports, causing shortage of gas supplies in the rest of the world, particularly in Europe. As a result, the price of natural gas skyrocketed. The monthly average gas price in October reached USD 31.05 per MMBTU, according to the World Bank. This is roughly an equivalent of USD 885.5 per 1,000 cu m. To compare, the price of gas in May 2020 fell as low as USD 1.575 per MMBTU (less than USD 45 per 1,000 cu m). Wind was weak in the autumn, so wind farms could not provide a sufficient supply of electricity. No wonder that panic



TRENDS

[Back to contents](#)

statements from energy companies and politicians and alarmist publications in the media became a background for COP26.

Nuclear energy looked promising in this context. Opinion leaders of the energy industry spoke in support of atom as an indispensable part of the future energy mix. **“The world is going through difficult times in terms of energy volatility. One of the unintended positive consequences of this market volatility is that some people have re-appreciated the value of nuclear power. This is something we all need to take note of,”** said Fatih Birol, Executive Director of the International Energy Agency (IEA). Birol referred to the IEA’s Net Zero by 2050: A Roadmap for the Global Energy Sector report and stressed that the recommendations in it were well accepted and being widely followed. **“One of the facts in that report is in my view very pertinent. In order to reach energy and climate goals nuclear generation needs to double compared to today... Nuclear power has an integral role to play if we are serious about the climate challenge,”** he said.

Preventing emissions

Reflecting on the summit at the Low-Carbon Development Pathways: The Role and Approaches of Russia side event, Rosatom’s Director General Alexey Likhachev said, **“From now on, the history of the global nuclear power industry is divided into pre-COP26 and post-COP26 as a positive conclusion was finally reached in the discussion. The answer to the question of whether nuclear should be present in the global low-carbon energy mix was made clear at COP26: yes, it should.”**

All the materials published by nuclear industry organizations for the summit highlighted the point that nuclear stations prevent emissions. **“New analysis in this edition shows that since 1970 nuclear reactors have avoided the emission of 72 billion tons of carbon dioxide, compared to the emissions that would have arisen had coal-fired generation been used instead,”** reads the preface to the WNA report. Right before COP26, UNECE published a study showing that the nuclear power industry produces the lowest amount of emissions throughout the life cycle, even less than wind energy does. **“Nuclear energy was seen and heard at COP26. Not just representatives of the Russian nuclear industry, but also our colleagues from international organizations spoke about nuclear energy as an important tool to achieve the goal of global carbon neutrality,”** Polina Lion, Chief Sustainability Officer at Rosatom, pointed out.

Those who refuse nuclear energy its green status find themselves in curious situations. Indeed, the summit organizers turned down applications from nuclear companies to participate in the Green Zone exhibition open to the general public. Ironically, nuclear power plants generated 70% of clean electricity for Glasgow during the summit. This is evidenced by carbon intensity data published by the National Grid Electricity System Operator.

Stability of supply

Nuclear energy also seems advantageous amidst volatile prices at energy markets. The price of electric power can be predicted for decades ahead as the price of fuel — natural uranium — accounts for as little as few percents. **“China, India, Bangladesh and**



TRENDS

[Back to contents](#)

Pakistan have long added nuclear energy to their national electricity programs and work intensely to build nuclear capacity. They are not very much concerned about whether the European Union will include nuclear energy in its Sustainable Taxonomy — they cannot imagine their national energy systems without nuclear power plants. They discuss where, when and what capacity to build because they understand that nuclear plants have a service life of 60 to 100 years and the price of uranium make only 2–3% of electricity costs. That means consumers would hardly notice even a fivefold increase in uranium prices, unlike the price of coal or gas,” Alexey Likhachev commented on the COP26 results at the Global Impact Conference.

Young nuclear professionals who came to COP26 from all over the world demonstrated explicitly how little fuel a nuclear station needs and how much energy it contains. During two weeks, they organized events in support of peaceful atom. A cherry on top of these pro-nuclear activities was a gummy bear. The young people walked around with a can of gummy bears, handed them out and explained the fundamentals of nuclear plant operation. They showed that a nuclear fuel

pellet the size of a gummy bear is equivalent in energy density to 1 ton of coal. **“Simple comparisons like this have a powerful effect on skeptics and people having an anti-nuclear stance, and make them give it a thought. Of course, there are a lot of discussions ahead, and we still have to find an optimal energy mix, but the fact that acceptance of nuclear energy grows among younger people is a sure thing now,”** said a representative of Rosatom Central Europe, Oleg Spoyalov.

Shift of focus

If we take a look at the attitude towards nuclear power in different countries, we will see an interesting picture. Very few countries are active opponents of nuclear energy. There are five of them — Germany, Austria, Luxembourg, Denmark and Portugal. Environment ministers of these countries signed and published a declaration on the COP26 sidelines. New Zealand also stands among nuclear opponents. Australia used to be one, too. However, after it broke a contract with France for diesel submarines and opted for nuclear vessels to be produced in the USA, Australia can hardly be called an anti-nuclear nation.

There are countries like Spain that rely exclusively on renewable sources in combination with energy storage systems and phase out their existing nuclear capacity. There are also those countries that approved a similar strategy first and now attempt to reconsider the decision. The Swiss People’s Party (SVP) filed a petition about the energy future of the country. **“Hydro and nuclear energy should remain secure pillars of power supply in Switzerland because no other source of energy is close to being**





TRENDS

[Back to contents](#)

competitive in terms of capacity, cost and reliability of supply,” the document says. The party demands that the Swiss government should extend the service life of the existing nuclear stations and build new capacity.

Other countries and regions use and develop nuclear technology for power generation or other purposes, and produce uranium, although some of them make only the first steps in this direction. Ten European countries (France, Romania, Finland, Slovakia, Croatia, Slovenia, Bulgaria, Poland, Hungary, and the Czech Republic) even published an open letter in support of nuclear energy.

The European community expects that the EU government will finally decide on the place of nuclear power in the Taxonomy, a list of desirable green industries and projects. This Taxonomy is a guideline for investors, and the inclusion of nuclear in it will signal its sustainability and green light the flow of capital into the industry. It is hardly surprising that one of the arguments against nuclear energy is that money will not be enough for other industries. But if we take a look at other countries, we will see that money is already allocated to nuclear projects (see the inset). It will be logical and reasonable for the European Union, which fosters ESG values, to include nuclear in its Taxonomy because it fully fits in with them. ^{NL}

[To the beginning of the section](#)

Most ambitious nuclear projects announced in the last few months

- China announced a program to build 150 power reactors in the next 15 years.
- The USA will invest USD 6 billion to prevent early decommissioning of nuclear power units. Another USD 2.5 billion is earmarked to finance an advanced reactor demonstration program. In addition, USD 8 billion will be invested in hydrogen production. Since ‘green’ hydrogen can be obtained by electrolysis at nuclear stations, it is not unlikely that nuclear operators will receive some of these funds.
- France announced a program to construct new power reactors. EUR 1 billion will be invested in small modular reactors, and another EUR 8 billion in the construction of hydrogen electrolysis facilities.
- Russia plans to build new reactors to increase the share of nuclear power from the current 20% to 25%. According to preliminary estimates, 24 new power reactors will be needed to meet these plans.