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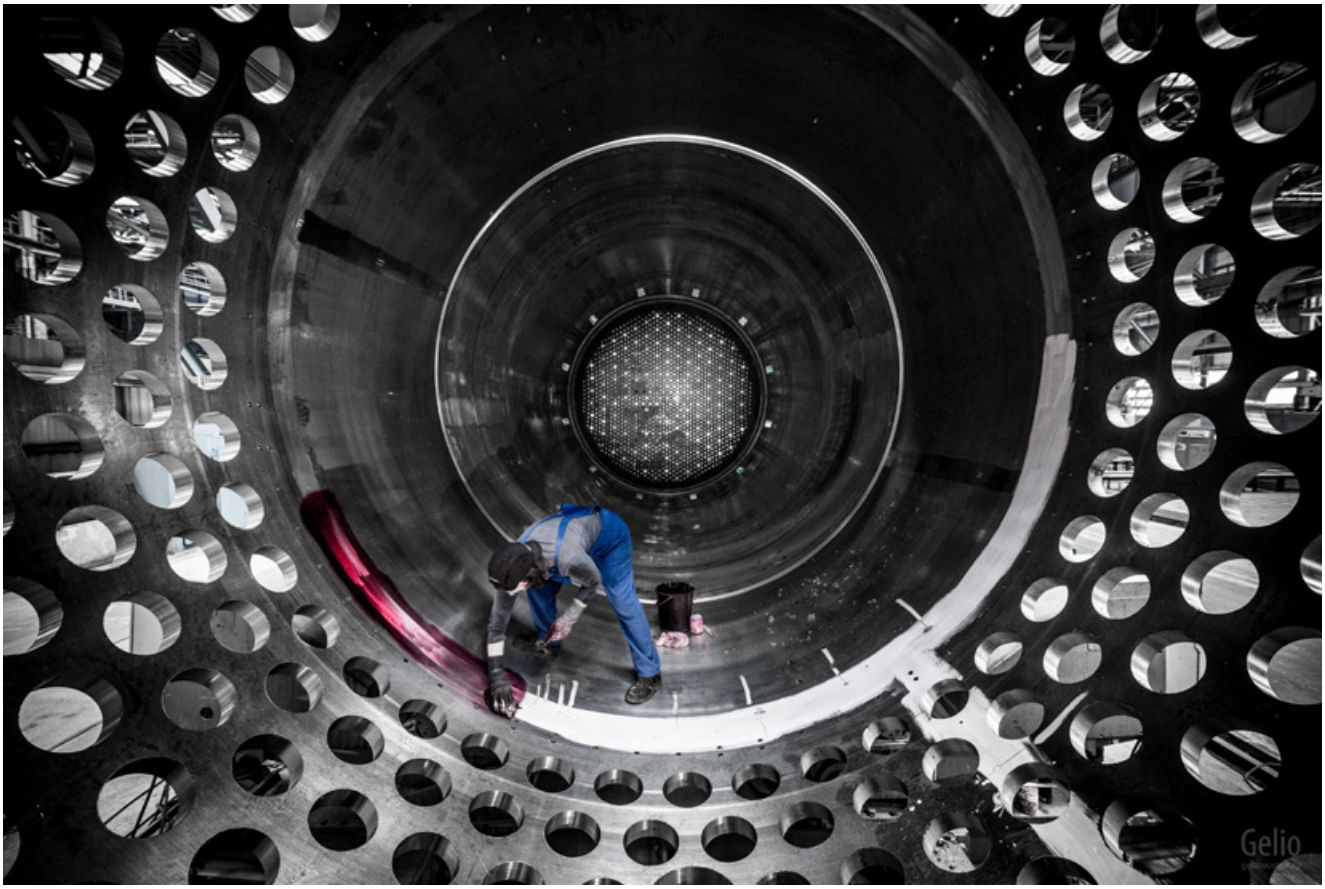

Power Engineering at Fifteen

In late March 2021, AtomEnergoMash (AEM), Rosatom power engineering division celebrated its fifteenth birthday. This article will tell you more about one of Rosatom's most important divisions — its companies, R&D institutions, latest achievements, and plans for the future.

"If you need anything big and made of steel, we are always there," says AEM CEO Andrei Nikipelov. The company specializes in manufacturing heavy industrial equipment, such as reactor pressure vessels — each of them weighs 320 metric tons, which is twice as much as a Boeing 747 aircraft.

Two halves of the RPV should match each other with a tolerance of less than 1 mm. Welding them together takes 10 days. The reactor itself consists of a hundred of different-size components and requires 768 process operations and about two years to be manufactured. For example, the reactor for Rooppur Unit 2 in Bangladesh was made in 650 days, but AEM keeps optimizing its processes to reduce the production time.

The division brings together major power engineering companies, including production facilities and R&D centers. Located in Russia, the Czech Republic, Hungary and other countries, AEM production facilities put into practice what has been developed by the scientists and researchers studying properties, applications and processing technology of different materials.

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Rosatom's power engineering division is capable of the end-to-end supply of machinery and equipment for the nuclear and turbine islands of nuclear power plants. AEM takes part in the construction of all new Russian-designed nuclear power plants across the globe. The division has produced equipment for the Kudankulam (India), Rooppur (Bangladesh), Akkuyu (Turkey) and Kursk II (Russia) plants. It is now in the process of making machinery for two Chinese nuclear generating stations (Tianwan and Xudabao). The work is underway to manufacture equipment for turbine islands based on the Arabelle half-speed turbine technology. AEM companies also take part in upgrading power reactors in operation.

In 2020, AtomEnergoMash set a historical record, having produced three RPVs and 18 steam generators. With new nuclear power plants planned to be constructed, the company will increase its output in the future.

AEM also operates in shipbuilding and supplies core equipment for Rosatom's icebreakers. Its subsidiaries manufacture reactors, heat exchangers, pumps and other equipment for Project 22220 nuclear icebreakers, including Arktika (already commissioned), Sibir, Ural, Yakutia and Chukotka (under construction). They will also produce RITM-400 reactors, steam turbines and all associated systems for Lider (Leader) icebreakers. The division is also involved in Rosatom's stand-alone generation projects (floating nuclear power plants and small modular reactors).

Foreign companies are interested in partnerships with AtomEnergoMash in shipbuilding. Late April, AEM signed a memorandum of intent with the Swiss

company ABB, a large global supplier of marine electrical equipment, including Azipod steerable propulsion systems. The parties agreed to join their efforts in setting up production of marine propellers at the facilities of Rosatom's power engineering division.

"We plan to supply complete marine propulsion systems, from engine to propeller. These are the most demanding parts and components, so they are usually made of special steel grades that meet the most stringent requirements. Not many companies in the world have the competencies needed for that," Andrei Nikipelov shared plans for the future.

Non-nuclear businesses are also of interest for AEM. In 2020, the division completed pilot tests of the first Russian-designed and produced pump for liquefied natural gas. The pump passed the tests and was put into operation. Pumps of this kind are used at commercial LNG production facilities. The company continues to build Europe's first test facility for the equipment of medium and large-sized LNG plants. The test facility is being installed at Rosatom's Efremov Research Institute and will be finished later this year.

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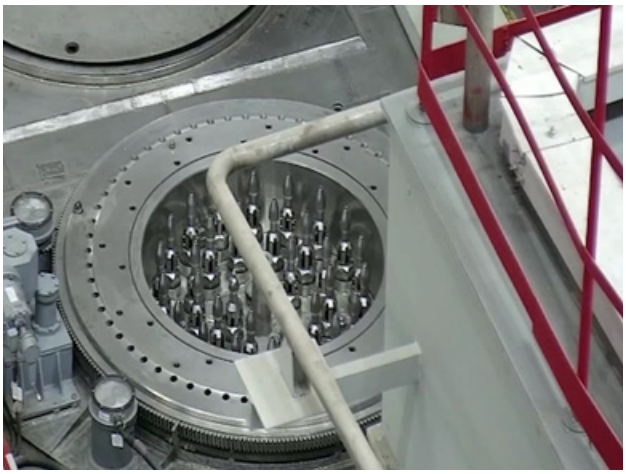
As part of the Clean Country Russian federal program, AtomEnergoMash has partnered with the Swiss-Japanese company Hitachi Zosen Inova to build waste incineration plants in Russia and supply equipment for similar plants abroad. In 2020, the division shipped several superheaters for steam boilers of the Riverside waste-to-energy plant in the UK.

What you have read above is far from being a complete list of competencies the power engineering division possesses.

"We are entering a phase of rapid growth. Next year, we plan to make around RUB 113–115 billion in total revenue and bring it up to RUB 150–156 billion in 2023–2024. We expect our work load to peak every year, but the sharpest rises should happen in 2023–2025 — this is when we will have to solve the most difficult tasks," Andrei Nikipelov sets out plans for the company.

AtomEnergoMash companies

1. Central Research Institute for Machine Building Technology (CNIITMASH)
2. OKB Gidropress
3. OKBM Afrikantov
4. AEM Technologies
5. Central Design Bureau of Machine Building
6. Sverdlovsk Chemical Engineering Research Institute (SCERI or SverdNIIKhimMash)
7. ZiO Podolsk
8. Atommash (Volgodonsk branch of AEM Technologies)
9. Petrozavodsk branch of AEM Technologies
10. Turbine Technology AAEM
11. ATM
12. ARACO (Czech Republic)
13. Ganz EEM (Hungary)



Circle of Fuel

Rosatom accumulates resources to close the nuclear fuel cycle. By defluorinating depleted uranium hexafluoride, the Russian nuclear corporation obtains uranium oxide to be used in the closed nuclear fuel cycle. The fuel cycle closing will make nuclear generation almost waste-free. Thanks to repeated recycling of one and the same amount of uranium, nuclear will become a renewable source of energy.

Working in pair

"The major issue facing the global nuclear sector now is closing the fuel cycle and thus solving the back-end challenge. If we succeed, it would turn nuclear in a type of renewable energy as basically there will be virtually no waste. Or at least no more waste than left after the end life of solar panels. It is what the next, 4th generation of reactors is expected to deliver — they would be able to burn used uranium extracted from spent fuel," Andrei Rozhdestvin, head of Rosatom Western Europe, explains.

One of Rosatom's strategic goals is to close the nuclear fuel cycle with a two-component approach that provides for thermal neutron and fast neutron reactors working in a combination. Thermal neutron reactors run on a fuel containing a little less than 5% of uranium-235. It is enriched because natural uranium contains only 0.7% of uranium-235. The rest is uranium-238. Fast neutron reactors can run on MOX fuel, a mixture of depleted uranium (see below) and radioactive elements obtained from conventional nuclear fuel irradiated in power reactors.

Rosatom has long been working to bring the two-component approach to energy generation to life. In January 2020, the first 18 assemblies with MOX fuel were loaded into the BN-800 reactor. With another 160 fuel assemblies loaded into the reactor this January, MOX fuel makes a third of its total load. In 2022, conventional nuclear fuel in the BN-800 reactor will be fully replaced with MOX fuel.

According to experts, recycling spent nuclear fuel and using a uranium-plutonium mixture in new assemblies will increase the total amount of energy extracted from natural uranium by about 100 times.

Valuable DUHF

DUHF stands for depleted uranium hexafluoride. It consists almost entirely of uranium-238 left over after the separation of uranium-235 during the enrichment process. Since it is 'leftover', it is considered to be a 'waste' and treated negatively, which is wrong. However, DUHF is not a waste, but a resource.

First, technology is progressing fast: DUHF can be re-enriched to obtain more

uranium-235. It used to be expensive or technically impossible, but not anymore. Rosatom provides depleted uranium re-enrichment services, including to foreign companies.

Second, DUHF is segregated into depleted uranium oxide and hydrofluoric acid. Depleted uranium oxide is used to produce MOX fuel for fast neutron reactors, while hydrofluoric acid is returned into the natural uranium enrichment cycle or reprocessed into anhydrous hydrogen fluoride and sold to chemical companies. Defluorination has one more advantage: uranium oxide is much easier and safer to store and handle. In fact, defluorinated DUHF is very much like uranium octoxide but does not contain uranium-235.

Depleted uranium is defluorinated in the UK, USA and France (see Uranium Deconversion Plants). Rosatom has been engaged in depleted uranium processing since 2009 when a DUHF processing unit with a capacity of 10,000 tons per annum was put in operation at Rosatom's Electrochemical Plant in Zelenogorsk (Krasnoyarsk Krai). Its capacity is sufficient to reprocess almost the entire amount of DUHF left over after the uranium enrichment. The deconversion unit was produced by French Orano (then Cogema). For 10 years in operation, it reprocessed over 100,000 tons of DUHF.

TVEL has initiated two more projects. Two defluorination units with an annual capacity of 10,000 tons of DUHF each are planned to be installed at the Ural Electrochemical Plant in Novouralsk (Sverdlovsk Region). Engineering surveys and a feasibility study for the project began in August 2020.

The Electrochemical Plant in Zelenogorsk is constructing a building and infrastructure for its second unit with a capacity of 10,000 tons per annum. It will also be supplied by Orano and is planned to be launched in 2023.

Rosatom Group companies have accumulated nearly 1.2 million tons of DUHF by now. The new deconversion units at the two plants will help dispose of the DUHF stock, presumably by 2057.

"When the closed nuclear fuel cycle becomes a reality, it will solve a number of very important tasks. "First, we will have a much larger resource base for the nuclear energy industry. Second, we will be able to recycle spent nuclear fuel instead of storing it. Third, we will dispose of accumulated DUHF stocks by using them in nuclear fuel fabrication. What is more, development

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

of recycling technologies in the nuclear industry is fully in line with Responsible Production, one of the UN Sustainable Development Goals," noted Alexander Ugryumov, Vice President for R&D and Quality at TVEL. NL

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Uranium Deconversion Plants
(World Nuclear Association as of September 2020)

Operator	Location	Capacity, tU/year
Areva	Tricastin, France	20,000
	Richland, Washington, USA	small
Urenco ChemPlants	Capenhurst, UK	15,000
Mid America Conversion Services	Portsmouth, Ohio, USA	13,500
	Paducah, Kentucky, USA	18,000
INIS Fluorine Products	Hobbs, New Mexico, USA	6,500 (construction on hold)
Rosatom	Zelenogorsk, Russian Federation	10,000

Contracts with French Accent

This May marks the 50th anniversary of the first contract between TENEX (now part of Rosatom) and the French Atomic Energy and Alternative Energies Commission. This was the first international contract made by TENEX for uranium enrichment services. In commemoration of this event, our today's story is about the French nuclear industry and cooperation between Rosatom and French organizations — a cooperation that reaches far beyond supplies of enriched uranium.

Accounting for about 70% of the national energy mix, the nuclear power industry plays a major role in supplying France with electricity. In 2020, this share decreased to 67.1%, though. There are two reasons for that. First, the coronavirus pandemic reduced the total electricity consumption in the country by about 5%. Second, Fessenheim nuclear power plant Units 1 & 2 were permanently shut down in February and June 2020. As a result, the installed capacity of the French nuclear generating stations decreased from 63.1 GW to 61.4 GW. In 2020, they generated 335.4 TWh of electricity. At present, France has 56 power units in operation.

Supplies of nuclear fuel products

Fifty years ago, in early 1971, the country had seven operating power units. In order to supply the French nuclear capacity with fissile materials, the French Atomic Energy and Alternative Energies Commission (CEA)

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and TENEX signed a contract for uranium enrichment services. The contract became a doorway for Russian uranium products to the global market and a starting point for the multi-year reliable partnership in the supplies of nuclear fuel products.

In 1974, TENEX signed a contract for the supply of enriched uranium with the French company Cogema (now Orano). The first contract with EDF was made in the early 2000s. Russian nuclear companies have supplied their French customers with nuclear fuel products for half a century, and the cooperation is up and running: long-term contracts for the supply of uranium products and uranium conversion services are still in force.

Another joint project in the nuclear fuel segment is enrichment of reprocessed uranium from French reactors and return of the obtained fissile material to France, and maintenance of EDF casks used to transport reprocessed uranium. The total price of the long-term contract is nearly USD 1 billion, which makes it one of the largest contracts in the entire history of cooperation between Russian and France.

The French party regularly audits Russian companies. The audits confirm high quality of Rosatom's products and services.

Strategic framework

Cooperation between Russian and French nuclear companies has long reached far beyond the nuclear fuel segment. Strategic agreements are made at the highest level. In 2018, Director General of Rosatom Alexey Likhachev and General Administrator of CEA François Jacq signed a strategic document on the Russian-French cooperation in peaceful uses of nuclear energy. The presidents of the both countries attended the signing ceremony. The parties plan to strengthen cooperation in fast neutron reactors, engineering and supplies of equipment for nuclear power plants, supplies of nuclear fuel for commercial and research reactors, reprocessing of spent nuclear fuel and re-use of recovered materials, and joint projects in third countries.

In July 2019, CEA and Rosatom signed a similar strategic document on cooperation in the construction and operation of nuclear power plants, renewable energy sources, digitalization, radioactive waste and spent nuclear fuel management.

All the agreements find their way into practice.

Richer in knowledge

"When it comes to R&D in nuclear, we're actively involved in the work on International Centre based on Research Reactors (ICERRs) scheme under the IAEA framework. Three of the centers that are

part of this framework are in Europe — in France, Belgium and Russia. The MBIR project — a research facility that will be enabled with a multipurpose sodium-cooled fast-neutron reactor — also provides a unique opportunity for international R&D cooperation," Andrei Rozhdestvin, Director of Rosatom Western Europe, noted.

In late 2020, RosEnergoAtom (Rosatom's electric power division) renewed an agreement with EDF to extend its full membership in the Materials Aging Institute (MAI) for 2021–2024. MAI is the largest international organization specializing in the study of aging processes in different materials. Rosatom engineers and researchers study the aging of alloy, structural and polymer materials, the influence of organic compound destruction on corrosion resistance of structural materials in the primary coolant circuit of VVER and PWR reactors, etc.

Reliable equipment

In 2005, Orano (then Areva) signed a contract with Rosatom to supply depleted uranium defluorination equipment to the Electrochemical Plant (part of Rosatom) in Zelenogorsk. Another contract to the same effect was signed in 2019. This April, construction of the second DUHF defluorination unit started at the plant. For more details on uranium defluorination projects see this issue's article Circle of Fuel.

Rosatom has also signed a number of large contracts and agreements for the supply of French I&C systems to Russian nuclear power plants.

For example, Areva NP signed a contract to supply TELEPERM XS, a digital reactor protection system, to Novovoronezh II Unit 1 (Russia). In 2019, Assystem signed an agreement to provide Rosatom with consulting and engineering services during the design and commissioning of nuclear power plants.

In June 2020, Rosatom signed a memorandum of understanding with

TechSnabExport (TENEX) is a Rosatom company supplying nuclear fuel cycle goods and services. Its key activities are uranium production, international supplies of Russian uranium products, nuclear fuel cycle back-end services, and logistics. TENEX is also engaged in lithium mining and biofuel production.

RosEnergoAtom is Rosatom's electric power division. The company is an operator of nuclear power plants in Russia, operating 11 generating facilities with a total capacity of 30.5 GW. Its other divisions include an R&D center for emergency response at nuclear power plants, a design and engineering department, and a technology department.

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Framatome SAS (France) and GE Steam Power to participate in the selection of a strategic investor for the Belene NPP in Bulgaria. If Rosatom becomes a strategic investor of the Belene project, Framatome SAS will be a key supplier of I&C systems for the Bulgarian station.

In January 2021, Framatome and Rosatom signed a contract to provide technical support in designing and integrating an I&C system for the Hanhikivi nuclear power plant planned to be constructed in Finland.

"We are open to cooperation with our partners across a wide spectrum of technologies that ensure and promote sustainable development — for example, in small modular reactors, in closing the nuclear fuel cycle, in hydrogen, in wind, in new materials, in storage solutions," Andrei Rozhdestvin concluded.

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EU Taxonomy Lacks Nuclear

The European Commission is to decide whether nuclear energy will be included in the EU Taxonomy of sustainable activities. If it is included, nuclear will be an activity recommended to investors. Despite the conclusion made by the Joint Research Center that atom does no more harm than other energy sources, the decision was postponed until the summer of 2021.

March and April of 2021 saw another round of struggle for the inclusion of nuclear energy into the EU Taxonomy and, consequently, for the favor of financial institutions.

The EU Taxonomy is a regulatory document determining whether an economic activity can be considered as contributing substantially to environmental objectives. These criteria help establish appropriate definitions for companies, investors and financial market participants on which economic activities can be considered environmentally sustainable.

Nuclear is not more harmful than other energies

The goal of the European Commission is to assess the degree of sustainability of nuclear energy and decide on its inclusion in the EU Taxonomy. In order to ensure that the sustainability assessment is objective, the Joint Research Center (the European Commission's pool of experts with vast knowledge in many fields, including nuclear) carried out a technical assessment of nuclear energy in accordance with the 'do no significant harm' (DNSH) principle postulated in the EU Taxonomy.

Published in March 2021, the assessment report consists of two sections. The first section is a review of the environmental impacts corresponding to the various life cycle phases of nuclear energy and comparison with the environmental impacts of other electricity generation technologies, such as coal, oil, gas and renewables (including hydropower). The second section focuses on the state-of-the-art and «do no significant harm» (DNSH) aspects of radioactive waste management, focusing on the final disposal of high-level radioactive waste and spent nuclear fuel.

The key takeaways demonstrate that nuclear is as safe as other sources of energy:

The analyses did not reveal any science-based evidence that nuclear energy does more harm to human health or to the environment than other electricity production technologies already included in the Taxonomy as activities supporting climate change mitigation.

The comparison of impacts of various electricity generation technologies (e. g. oil, gas, renewables and nuclear energy) on human health and the environment, based on recent Life Cycle Analyses (LCA)… shows that the impacts of nuclear energy are mostly comparable with hydropower and the renewables, with regard to non-radiological effects.

Related analyses demonstrate that appropriate measures to prevent the occurrence of the potentially harmful impacts or mitigate their consequences can be implemented using existing technology at reasonable costs.

Similarly, carbon capture and sequestration (CCS) technology is based on the long-term disposal of waste in geological facilities and it has been included in the taxonomy and received a positive assessment. The Taxonomy Expert Group therefore considers that the challenges of safe long-term disposal of CO2 in geological facilities, which are similar to the challenges facing disposal of high-level radioactive waste, can be adequately managed. There is already an advanced regulatory framework in place in the communities for both carbon dioxide storage and radioactive waste management (see Annex 1). In terms of practical implementation, there is currently no operational geological disposal for carbon dioxide or for radioactive waste.

What is more, JRC experts concluded that nuclear energy is comparable to, or even outperforms, renewable energy sources in terms of certain environmentally important parameters:

Nuclear energy has very low NOx (nitrous oxides), SO2 (sulfur dioxide), PM (particulate matter) and NMVOC (non-methane volatile organic compounds) emissions. The values are comparable to or

better than the corresponding emissions from the solar PV and wind energy chains;

With regard to acidification and eutrophication potentials, nuclear energy is also comparable to or better than solar PV and wind;

The same is true for freshwater and marine eco-toxicity; ozone depletion and POCP (photochemical oxidant creation potential);

Land occupation of nuclear energy generation is about the same as for an equivalent capacity gas-fired power plant, but significantly smaller than wind or solar PV.

Action and reaction

The reaction to the conclusions, which are favorable for nuclear energy, wasted little time. Despite all the evidence, diagrams, tables and other objective data presented in the JRC report, Greenpeace stooped so low as to suspect JRC experts of a biased attitude. **"However, the JRC's structural links with the Euratom Treaty, its relations with the nuclear industry and the views expressed publicly by JRC members on nuclear energy call into question the JRC's ability to conduct an objective assessment of the sustainability of nuclear energy. The European Commission should have entrusted this study to an impartial structure and included civil society,"** a statement by the environmental organization read.

Not every NGO shares the viewpoint of Greenpeace, though. In late March, 26 NGOs from different countries (Denmark, France, Poland, Switzerland, etc.) signed a letter to President of the European Commission Ursula von der Leyen. **"Scientific assessments have made clear that nuclear energy is needed to address the related causes and the challenges ahead of these disruptions. Despite this, the limited recognition this low carbon, dispatchable energy source receives from the European Commission is at best paradoxical, and certainly counterproductive,"** the letter read.

"If we fail to appropriately include nuclear energy, we, as members of the European Union, will have to bear responsibility for promoting a strategy that is clearly inadequate to decarbonize our economies and hence preserve climate and populations," the NGOs warned.

The letter mentions **'the irrationality of some decisions being taken by several Member States'**. These states appear to be Germany and Austria, dogmatic opponents of nuclear energy. Indeed, some publications in the German media in the last two weeks of April were negative towards nuclear. Others dealt with Germany's opposition against France, another large Member State but an advocate of nuclear generation.

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France insists on including nuclear in the EU Taxonomy. Politicians, energy companies and even energy industry trade unions voice this idea. **"We want nuclear energy to be included in the EU Taxonomy and will fight for it with great determination,"** Bruno Le Maire, Minister of Economy and Finance of France, said.

"The association of French trade unions FNME-CGT, CFE CGC Énergies, FCE-CFDT and FO Énergie et Mines representing the energy sector of the French utilities and gas industry, sent a petition to the President of the European Commission with a request to include nuclear energy in the EU Taxonomy and not to deprive the European Union of its key assets that will help it achieve carbon neutrality by 2050, the primary goal of the European Green Deal supported by the EC President," a statement published by the trade union association read.

The inclusion of nuclear energy in the EU Taxonomy is important not only for France, which generates almost 70% of its electricity from nuclear energy, but also for Central Europe. It is so important that leaders of seven countries (France, Slovakia, Slovenia, Romania, Poland, Hungary and the Czech Republic) have sent an open letter to the European Commission. They reminded that nuclear energy had social and economic significance: **"As low-emission baseload, it guarantees the continued renewable deployment to much higher penetration levels. Nuclear power seems to be also a very promising source of low-carbon hydrogen at an affordable price and can play an important role in energy sector integration. It also generates a considerable number of stable, quality jobs, which will be important in the post-COVID recession."** Then they expressed concerns that their

right to determine the national energy mix is **'heavily limited by EU policy making, which excludes nuclear power from more and more policies.'**

"Finally, all Member States are making the policy choices in the field of energy fully in line with EU law, including the Euratom Treaty. This is yet another argument of our urgent call to ensure a true level-playing field for nuclear power in the EU without excluding it from EU climate and energy policies and incentives, and bearing in mind that half of EU countries utilize or develop nuclear power providing close to half of EU low-emission generation, in line with the most stringent safety standards as ensured by the Euratom framework," the authors of the letter concluded.

The European Commission has so far postponed its decision on including nuclear energy in the EU Taxonomy. **"The Commission will adopt this complementary Delegated Act as soon as possible after the end of the specific review process expected in summer 2021,"** a statement made by the commission read.

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Sustainable finance for nuclear plants

Since Russia is not a member of the European Union, it does not officially participate in discussions of the EU Taxonomy. Rosatom took part in the open discussion of the draft taxonomy and Delegated Act, which were made available online for expert review and comments in accordance with the established procedure.

While Europe is busy disputing whether nuclear is sustainable enough for 'green' investments, Russia is working on its own taxonomy. Russian state development corporation VEB.RF drafted and discussed it in the Russian Ministry of Economic Development in mid-March. Unlike the EU Taxonomy, the Russian document labels nuclear energy as a sustainable sector from the outset.

What is more, Rosatom has already obtained two sustainability loans. In early March, Sovcombank provided two loans — for USD 200 million and USD 100 million — to Akkuyu Nuclear (part of Rosatom and the owner of the Akkuyu construction project). Both loans are sustainability-linked, which means the interest rate will depend on whether the borrower will meet its sustainable development commitments. In April, Otkritie Bank and Akkuyu Nuclear signed another USD 500 million sustainability loan agreement for seven years.

"The loans made available to Akkuyu Nuclear may well be considered a precedent of international importance because they will be used to finance a project in Turkey," Polina Lion, Chief Sustainability Officer at Rosatom, commented.

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On Cosmic Scale

Preparations for El Dabaa project run as scheduled. All necessary measures are taken to prevent the spread of coronavirus. Rosatom continues informing Egyptians about applications of nuclear technology. Its contribution to space exploration is featured in a photo show opened in April.

Egypt is preparing for the construction of its first nuclear power plant in El Dabaa. The parties keep working together on the documents needed to apply for the construction license, Alexander Voronkov, director of Rosatom Middle East and North Africa, told the media. **"We have joined our efforts in taking all necessary preventive and proactive measures to protect the staff involved in the project,"** Alexander Voronkov stressed.

He reminded that Egypt had embarked on a nuclear program in the middle of the previous century when the first research reactor was put in operation in Inshas. It was built in 1961 with help from Soviet engineers.

"The launch of the nuclear plant construction project is an important milestone for the country. Joining the nuclear club will give a strong impetus towards Egypt's economic and technological development in many areas, including industry, medicine, agriculture and many others," Alexander Voronkov assured.

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Voronkov added that construction of a nuclear power plant made the country more competitive as it stimulated investments, local producers and infrastructural development. After El Dabaa NPP is put in operation, it will generate more than 33 GWh of low-carbon energy per annum. In addition to supplying domestic consumers, Egypt will be able to export electricity to other markets. **"What is more, Egypt will strengthen its position of a regional technology leader as it acquires expertise in nuclear,"** Alexander Voronkov pointed out. He believes that fear and concerns about nuclear energy are usually caused by the lack of sufficient knowledge and resulting myths and prejudice. **"Quite often, people do not know how the latest nuclear reactors work and why they are totally safe for the man and environment,"** the manager thinks.

Rosatom sees dissemination of knowledge about radiation technology and its applications as one of its priority tasks. In April, Rosatom opened a photography exhibition in Egypt to commemorate the 60th anniversary of the first man in space (he was Soviet cosmonaut Yuri Gagarin). Mikhail Kornienko, a Russian cosmonaut and a holder of the Hero of Russia honor title, arrived in Egypt to take part in the opening ceremony. He visited the Egyptian Space Agency and laid flowers at the memorial of Yuri Gagarin. The events were organized by AtomStroyExport (part of Rosatom's engineering division).

"Nuclear companies had been involved in the Soviet space program long before the first man was launched into space. Some of the companies, which now belong to Rosatom Group, took part in the moon program and development of a moon crawler, the first spacecraft and space nuclear power units. We are proud of our achievements in power generation and exploration of space. The visit of Mikhail Kornienko to Cairo, which we organized, shows that space exploration and high technology strike a chord not just with the scientific community, but with the young generation as well. Young people literally did not want to let our cosmonaut go — they bombarded him with questions and showed strong interest," said Grigory Sosnin, Vice President of AtomStroyExport and El Dabaa project director.

The opening ceremony for the photo show took place in the Olympic Center in Maadi.

AtomStroyExport (ASE) belongs to Rosatom's engineering division, which is a global leader constructing most of the nuclear power plants abroad and having the world's largest portfolio of nuclear construction contracts. The division is active in Europe, Middle East, North Africa, and Asia Pacific. ASE's core activities are project management in the construction of thermal and nuclear power plants, construction and design supervision, and related consultancy services.

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Egypt's Minister of Youth and Sports Ashraf Sobhy, Ambassador of Russia to Egypt Georgy Borisenko, and representatives of the Egyptian Space Agency and AtomStroyExport attended the event.

Mikhail Kornienko shared his impressions of the visit, **"This is my first time in Egypt although I have seen the country many times from the orbit. I am very glad and proud of being here right in the anniversary year. I would like to thank the engineering division of Rosatom for this invitation. It is a pleasure for me to see that Egypt continues the legacy of Yuri Gagarin who made the first spaceflight 60 years ago. I am sure that the Russian-Egyptian cooperation in high-tech areas, such as nuclear and space, will be fruitful."**

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