CONTENTS

Back to contents

Turkish Start

On March 15, the Istanbul-based Kuzey Star Shipyard hosted a keel laying ceremony for a floating dock that will service Russian-designed Project 22220 multi-purpose nuclear icebreakers.

Atomflot and Kuzey Star signed a construction contract for the floating dock in June 2021. **"The Turkish shipyard has all the necessary competencies and earned a respectable reputation in the shipbuilding market,"** said Mustafa Kashka, the then CEO of Atomflot. The deal is worth almost RUB 5 billion. According to the contract, the dock will be built and delivered to Murmansk within 29 months after the date of signing. The sea voyage from Istanbul to Atomflot's naval base is estimated to take at least one month.

Atomflot has two floating docks for now. One of them, PD-3, is stationed in the port of Murmansk. It is used to dock the nuclear icebreaker 50 Let Pobedy and third-party vessels. The other dock, PD-0002, is stationed at Atomflot's base and services Yamal, Taymyr and Vaygach nuclear icebreakers.

However, those floating docks are not capable of servicing Project 22220 series icebreakers (Arktika and Sibir are already in operation; the other three — Ural, Yakutia and Chukotka — will join them soon). For instance, the breadth of PD-0002 is 33.5 meters while the breadth of the new icebreakers is 34 meters. Without a floating dock, the new icebreakers are repaired in

Back to contents

the dry dock of the Kronstadt Marine Plant (this is where Arktika was serviced in 2021). All the operations, including transportation, require administrative efforts, entail costs and consume time. This is why the decision was made to build a new floating dock.

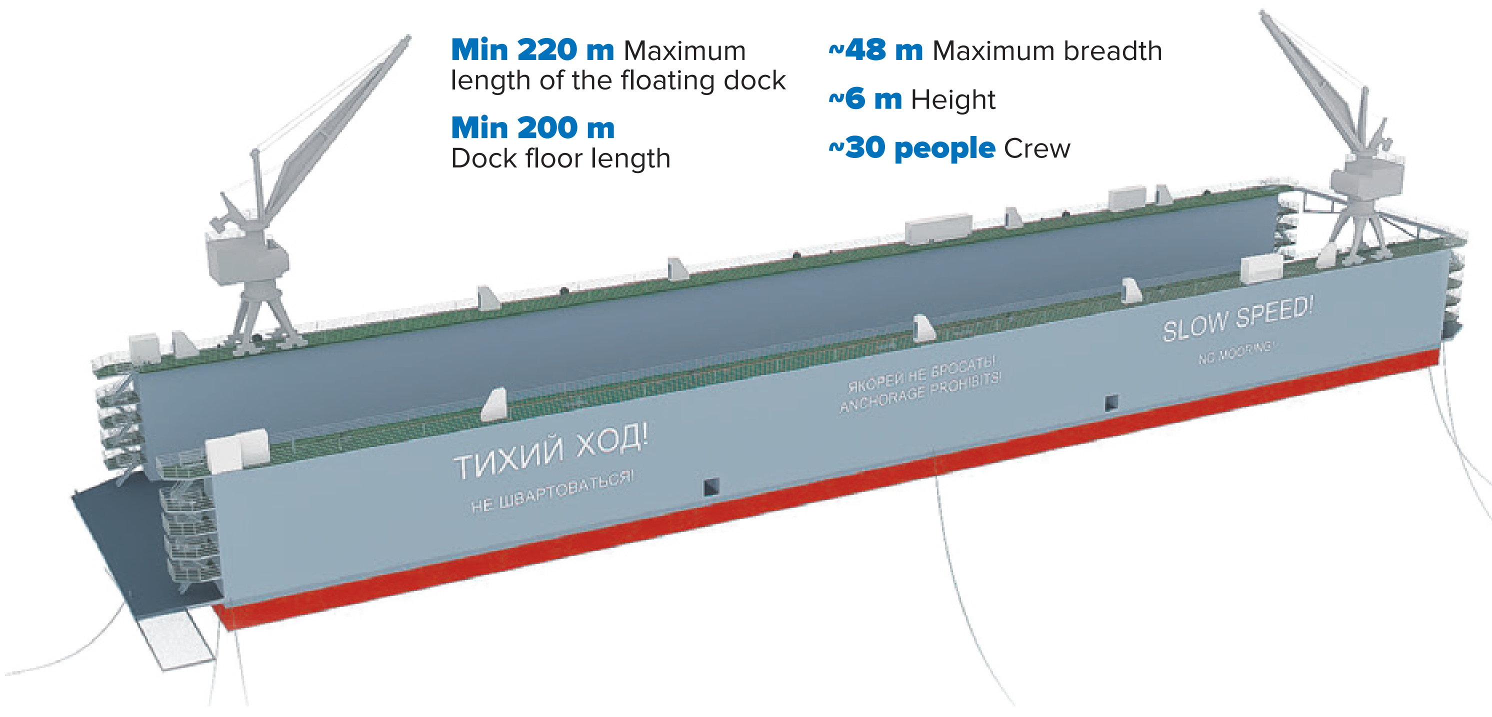
The new floating dock will have a capacity of around 30,000 tons. To compare, PD-0002 has a capacity of about 20,800 tons while the lightship mass of Project 22220 icebreakers is 26,700 tons. The steel floating dock will have two towers and a pontoon system that operates as a single pontoon. The towers are steel boxlike structures attached to the dock pontoons on two sides. They contain key mechanisms and functional systems of the floating dock. When docking, a section of the towers submerges while the rest stays above water, ensuring positive buoyancy.

The new dock is designed to repair underbodies, sea valves, steering and anchoring gear of Atomflot's new icebreakers, clean and paint the hulls, replace hull protection, and carry out other repair and maintenance works. The key advantage of the floating dock over dry docks is its mobility. It can be installed anywhere offshore where the water depth is sufficient. Building a dry dock requires much more time and effort since it needs a large parcel of land to sit on and a large amount of construction works.

The new dock is expected to replace PD-3. It will service not only Project 22220 icebreakers but also other nuclear icebreakers, which are now in operation (50 Let Pobedy, Yamal, Taymyr, and Vaygach).

The construction of the new floating dock is going as scheduled. **"Compliance with construction deadlines is extremely important for us. The floating dock is an essential element of the coastal infrastructure for the maintenance of Project 22220 nuclear icebreakers,"** Mustafa Kashka pointed out.

In the future, Atomflot will need one more floating dock, this time for Rossiya, the first



DIMENSIONS OF ATOMFLOT'S ICEBREAKERS

Vessel	Draft, m	Weight, t	Length, m	Overall breadth, m
50 Let Pobedy	10,1	22 750	159,6	30
Yamal	10.3	21,277	150	30
Taymyr	8,05	18 353	150	29,2
Vaygach	8.05	18,259	150	29.2
Project 22220 Arktika, Sibir, Ural, Yakutia, and Chukotka	9	26 700	173,3	34

Project 10510 icebreaker. Its capacity should be no less than 60,000 tons.

The overarching purpose of Project 22220 and Project 10510 icebreakers is to ensure uninterrupted year-round navigation on the Northern Sea Route (NSR), which is expected to be launched in 2030.

The NSR Directorate is preparing actively for the extension of navigation and traffic growth. Apart from construction of nuclear icebreakers, this covers improvements of the navigation, including digital, infrastructure. In particular, a single digital platform will be created to integrate both new and existing solutions developed by the NSR Directorate, cargo and ship owners, Russian Meteorological Service, and Ministry for Development of Russian Far East. The platform will go online in 2025.

Last year, buoys equipped with automatic identification stations were installed along the NSR. Their operation will be analyzed and improved. The NSR Directorate conducts offshore and bathymetric surveys and studies ice conditions (ice thickness and movement) in the eastern section of the Northern Sea Route, which has never been crossed in winter before. The Directorate also builds onshore facilities for the Utrenniy terminal and in Sabetta, a sea port in the Gulf of Ob.

ITER and Beyond

As the International Thermonuclear Experimental Reactor (ITER) project is advancing, Russia continues to manufacture and supply critical components for the reactor. A major role in the design and production is played by Rosatom companies. Apart from participating in the ITER project, Russia puts much effort into developing its national thermonuclear program.

Shipments to ITER continue

By the end of 2022 Q2, Russia will ship a poloidal field coil PF1 to France, where ITER is constructed. It will be placed outside the ITER toroidal magnet system and generate a poloidal magnetic field to produce plasma, control its position and shape and maintain electric current in it. There will be six poloidal field coils. One of them will be supplied by China; another four are made right on the site — so big they are — the Russian-produced coil is 9 meters in diameter and weighs 200 tons.

Each of 16 coil cables is made of niobium-titanium (NbTi) superconductors manufactured at the production facilities of Rosatom's fuel division and the Russian Research Institute for the Cable Industry. Their superconducting properties manifest themselves at the temperature of about 4°K. The work on the coil started in 2014. Technology and equipment were developed at Rosatom, while manufacturing takes place at Sredne-Nevsky Shipbuilding Plant in Saint Petersburg.

In September, ITER expects to receive gyrotrons — vacuum devices generating high-power, high-frequency radiation that overheat electrons in plasma — made in Russia. More important is that they cause breakdown and plasma initiation. Output power of each gyrotron is 1 MW and radiation frequency is 170 GHz. ITER needs 24 gyrotrons in total, and Russia will supply eight of them. Six devices are ready; five of them have already passed acceptance tests.

The gyrotrons will be placed in a detached building since they are susceptible to external electromagnetic fields that are present in abundance in the tokamak, ITER's core functional component. The engineering process is supervised by the Institute of Applied Physics of the Russian Academy of Sciences; manufacturing takes place at Gycom in Nizhny Novgorod.

Shipment of pedestals for blanket module connectors is scheduled for November–December 2022. The pedestals will be mounted by welding on the reactor's vacuum chamber. They are designed to hold electrical connectors that complete a path for currents induced in the blanket modules at the time of plasma disruption. The connectors were manufactured at the

Research and Development Institute of Power Engineering (NIKIET, part of Rosatom). The manufacturing process took about three years and a half. The pedestals are made of two materials, a chromium zirconium copper alloy and stainless steel.

By the end of 2022, Russian companies will produce port plugs and test stands for them. Port plugs are modules that enable the installation of plasma diagnostic systems inside the reactor. They protect the systems against neutron flux and mitigate the effects of ionizing radiation in the areas accessible by personnel. There will be a total of 40 port plugs installed along the perimeter of the tokamak vacuum chamber, and four of them will be made in Russia. It will also supply four stands for pre-operational vacuum, thermal and functional testing of the port plugs. The test stands will be pre-assembled at the factory and then assembled on the site in a LEGO-like manner. Each port plug will be tested for about five months, this is why several stands are needed. If there were a single test stand, it would take more than 16 years to test all the devices. The first shipment of the stands is scheduled for next year. The last stand will be delivered in 2026.

The port plugs will be manufactured at the Institute of Nuclear Physics of the Siberian Branch of the Russian Academy of Science, and test stands at GKMP Research and Production Company in Bryansk.

ITER maintains neutrality

Russia takes part in the development and production of 25 diagnostic, vacuum, electromagnetic and other systems. Some of them are indispensable for launching the reactor. **"Russia will continue to fulfill all of its obligations. We have already shipped some of the critical systems and components. Other essential shipments are scheduled for later this year, and we keep working on the systems we have undertaken to produce,"** said Alexander Petrov, the press secretary of ITER Center (Russian office of the ITER project).

ITER firmly maintains neutrality and, despite political and economic headwinds, does not refuse to cooperate with Russia. **"There are no changes in the team's attitude. ITER has long been positioning itself as a fundamentally neutral project. In early March, we received a confirmation of this principle and assurances that any signs of disrespect in the team, particularly those related to the crisis, would be addressed immediately. The objectives of ITER cannot be achieved without Russia's contribution, and everyone understands it. According to the information I have, Director-General of the ITER Organization Bernard Bigot has repeatedly assured that he will do his best to tackle any problems with contracts, customs clearance, bank payments, etc.,"** Vitaly Krasilnikov, a supervisor of Neutron Diagnostics at the ITER Organization (France), shares his opinion.

Back to contents

Russian fusion

Russia carries out independent research in thermonuclear fusion technology as part of its national thermonuclear research program.

In 2021, the multi-faceted program Nuclear Energy Technology and Research Development in the Russian Federation Through to 2024 was supplemented with a state project for research in controlled thermonuclear fusion and innovative plasma technologies. Among other things, the project aims to develop a tokamak that will leverage reactor technology (code-named TRT). Planned to be built at TRINITI (part of Rosatom) by 2030, the new-generation tokamak will incorporate technologies that Russia has developed as a party to the international project, and also a number of alternative solutions, such as liquid lithium first wall, electron cyclotron heating and others. **"TRT will be a test venue for new ideas that will bring closer the prospects of thermonuclear fusion, including those like blanket technology and direct conversion of high-energy plasma flux,"** says Rosatom's Director for Technology Research and Development Viktor Ilgisonis.

The program also provides for upgrades of the existing infrastructure. For example, the tokamak T-15MD commissioned in 2021 at Kurchatov Institute will be equipped with additional heating, diagnostics, data collection, current generation and other systems.

Other objectives of the program include prototyping of high-propulsion plasma engines, laser-induced thermonuclear fusion, etc.

To the beginning of the section

Back to contents

Equipment as Modus Vivendi

Talking about Rosatom, we cannot but mention its power engineering division, AtomEnergoMash (AEM). The group brings together Rosatom's subsidiaries manufacturing equipment for power generation — mostly for nuclear but also heat and gas generation, as well as for hydrogen economy of the future. AEM also does shipbuilding.

AEM group celebrates its 15th anniversary in April 2021. It goes without saying that the production facilities of the group are far older. For example, Atommash, one of its key manufacturing companies, turned 45 last December.

Nuclear engineering

AtomEnergoMash engineers and manufactures core equipment for nuclear power plants. The company is a single-source supplier of nuclear and turbine islands. Its product range counts hundreds of different articles.

Another AEM group company, OKB Gidropress (OKB stands for "experimental design bureau" in Russian), engineers and upgrades nuclear power units with VVER-type reactors. The company designs some of the systems and equipment for fast neutron reactors, while reactors themselves are engineered at OKBM Afrikantov (OKBM stands for "experimental design bureau in machine-building" in Russian). The latter also develops marine reactors, small modular reactors, and auxiliary equipment.

Back to contents

AEM group supplies machinery and equipment designed and manufactured at its companies to all new reactors in Russia and takes part in nuclear construction and upgrade projects in other countries.

This January, Atommash (based in Volgodonsk, Russia) began to manufacture a reactor and steam generators for Unit 6 of the Indian nuclear power plant Kudankulam. As set out in the contract for Kudankulam Units 5 and 6, Atommash will manufacture and supply two VVER-1000 reactors, two sets of steam generators, primary coolant pump casings, primary coolant pipes, tanks for the emergency core cooling and passive core flooding systems, and two pressurizers. The total weight of these components is around 6,000 tons.

Also in January, Atommash completed a fit-up assembly test on the components of a multi-purpose fast neutron research reactor (MBIR), which is constructed in Dimitrovgrad (Russia). The assembled structure was 12 meters high, 4.1 meter in diameter and weighed 83 tons. MBIR is primarily designed to carry out in-pile tests on innovative materials and dummies of reactor core components.

In the same month, PetrozavodskMash, a Petrozavodsk-based production facility of AEM group, started to manufacture primary coolant pipes for Unit 8 of China's Tianwan nuclear power plant. The total of 36 pipes will be connected to make 16 assemblies. The pipes are 850 mm in diameter and have a total length of 146 meters. They connect systems and equipment that belong to the plant's primary loop, such as the reactor, steam generators and primary coolant pumps. Earlier, PetrozavodskMash began to produce primary coolant pipes for Tianwan Unit 7 and Xudabao Unit 3 (also in China).

A few days ago, PetrozavodskMash finished the production of passive core flooding tanks for Unit 1 of Kursk II NPP in Russia equipped with VVER-TOI reactors. Each reactor unit has eight tanks, each capable of holding up to 120 cubic meters of water. The production process was controlled through penetrant testing, ultrasonic examination and X-ray imaging. After production, the tanks passed a number of tests, including pressure tests at 4.4 MPa.

This March, PetrozavodskMash started to manufacture guide vanes for the primary coolant pumps to be installed at Kudankulam Unit 5.

AtomEnergoMash will also supply equipment for an onshore SMR to be constructed in Sakha (Yakutia) in Russia's north and upgraded floating power units that will provide power to Baimsky GOK, a large mining and processing plant in the Chukotka Peninsula, Russia.

Shipbuilding

Shipbuilding is another area on which AEM focuses its efforts. AEM companies have long been producing nuclear propulsion units and other machinery for icebreakers. Here is a recent example: in April, OKBM Afrikantov started to manufacture equipment for Chukotka, the fifth out of five Project 22220 nuclear icebreakers. They are equipped with RITM-200 reactors.

Apart from Project 22220 vessels, AEM will supply equipment for the unparalleled Project 10510 icebreaker Rossiya. It will use a RITM-400 marine reactor, which is, in fact, a 1.8-fold more powerful evolution of RITM-200. Besides, AEM will supply propeller shafts, equipment for shaft lines and water propellers, and steering gear for Rossiya. Those components will be produced at AtomEnergoMash's subsidiary AEM Propulsion.

These icebreakers are designed to ensure year-round navigation on the Northern Sea Route by 2030.

Power engineering

The nuclear power industry is not the only one for which AtomEnergoMash engineers and manufactures equipment. Other industries include oil and gas. In late March, a large-capacity pump for liquefied natural gas passed durability tests on a dedicated medium-to-large capacity test bench in Saint Petersburg. The test bench was commissioned in December 2021. Multi-hour tests confirmed durability and reliability of the pump and functionality of the test bench. AEM plans to use it in the future to test equipment for hydrogen economy.

By and large, AEM group companies manufacture a wide range of equipment for oil, gas and gas condensate processing and equipment for refineries, including fractioning columns, reactors, adsorbers, absorbers, desorbers, tanks, receivers, shell-and-tube heat exchangers, pipe furnaces, and coil tubing. Among AEM customers are oil and gas companies and refineries. The company also engineers and supplies equipment for the chemical sector.

AtomEnergoMash aims to expand its presence in the power and marine equipment markets. For this purpose, it builds alliances, streamlines supply chains and fits into them, improves quality, optimizes costs, and invests much effort and money into new products.

To the beginning of the section

Back to contents

Global Nuclear Fuel Supply in Early 2022

Corporate annual reports are usually published in late March through the end of April. We planned to review the uranium market performance in 2021, but the global uncertainty made an article about nuclear fuel supply more relevant.

This text was written in the first half of April and does not take into account the latest developments.

Supply disruptions

Since the Russian special military operation in Ukraine began, the US, UK, EU and Japan have adopted several sanction packages affecting Russian business, particular businessmen and politicians.

The outcome was major supply disruptions, and each of them was caused by one or another ban on the part of the European Union, UK, US and Japan. And in each case, the result was growth of prices for energy, freight, transportation costs, etc.

The most affected was the EU because Russia is a high-profile player in each segment of the energy market. Russia accounts for 70%

Back to contents

of coal (data by Brussels-based economic think tank Bruegel), 45% of gas and 34% of oil (both figures by IEA) in European energy imports. Russia also has a share in deliveries of wood pellets used increasingly often for home heating and thermal power plants.

No sanctions were imposed on nuclear fuel. Uranium was excluded from the energy import ban that was announced on March 8 and then imposed by US President Joe Biden. There were increasing calls, though, in the US and EU at the highest political level to ban imports from Russia. **"Senator John Barrasso, Republican of Wyoming, introduced a bill in March to ban imports of Russian uranium, and a matching, bipartisan bill was introduced in the House last week,"** The New York Times wrote on April 1. On April 7, the European Parliament adopted a resolution calling for an embargo on all energy imports from Russia, nuclear fuel included.

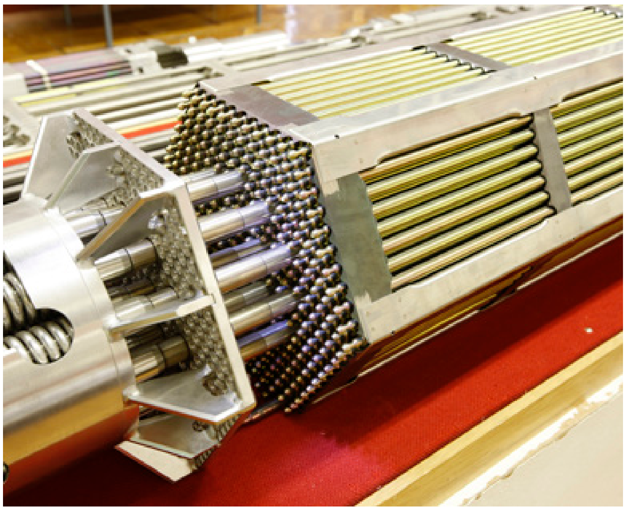
Production of nuclear fuel comprises several major stages, such as uranium mining, conversion, enrichment and fabrication. Russia's positions in each of these segments are strong.

Mining

As of 2020 (no later data is available), Russia accounted for a relatively small share in the global output of uranium (6% or 2,846 tons). Another 9% (4,276 tons) is produced by Uranium One (part of Rosatom), which holds uranium mining licenses in Kazakhstan in partnership with the world's largest producer Kazatomprom. From there, Rosatom companies account for about 15% of global output. This is not much, though. The USA is the country that worries the most about the security of uranium supplies since uranium from Russia makes about 20% of total demand from the US nuclear power plants.

US consumers have several options when it comes to buying uranium to replace imports from Russia. The first option is Canada, which is home to Cameco, one of the largest global producers of uranium. In February 2022, the company disclosed its plans to **"transition McArthur River and Key Lake from care and maintenance to planned production of 15 million pounds per year (100% basis) by 2024, 40% below its annual licensed capacity, and to reduce production at Cigar Lake in 2024 to 13.5 million pounds per year (100% basis), 25% below its annual licensed capacity. This announcement was a major development in our business."**

In April 2022, the company published its 2021 annual report, disclosing plans for 2022 to produce up to 11 million lbs. of uranium, purchase 11 to 13 million lbs. and sell 23 to 25 million lbs. That means the share of Cameco will nearly double if compared to 2021 (6.1 million lbs.), but sales will remain flat — almost no change from 24.3 million lbs. in 2021. There is no other uranium mining company in Canada, except Cameco.



Back to contents

Australia is another major producer of uranium. According to WNA, Australia had three large operating mines in 2020 — Olympic Dam, Four Miles and Ranger. However, processing operations were halted at the Ranger mine in January 2021. Uranium mined at Olympic Dam is a by-product of copper, which is the main local product, so any increase in uranium production depends directly on the total output growth. Speaking about Olympic Dam's performance for the six months ended December 31, 2021, CEO of BHP Mike Henry said, **"All I can say is that any growth ambitions we have around Olympic Dam won't happen unless the base business is running well… In the coming few years we'll look at whether we can turn all of that into a high return growth opportunity for us in copper. Of course, it will be aided if we have the tailwinds of higher uranium prices but that's probably it for now."** This does not sound like plans to increase production, does it? In 2020, BHP, an operator of the Olympic Dam mine, produced 3,611 tons of uranium, according to WNA. Its annual report for 2021 (ended June 30, 2021) says that the company obtained 3,267 tons of U3O8, which is 11% less than in the previous year (3,678 tons).

The third manufacturer is the Four Mile mine, which is currently owned by the US-based General Atomics. This company engages in nuclear technology projects and defense contracts. There is no publicly available information about the mine's performance, except for WNA data on the output for the last six years. A sharp increase in the output took place after the sale in 2015. The output of U3O8 jumped from 1,183 tons in 2016 to 2,130 tons in 2020. Taking into account the specifics of its parent company and recent announcements by AUKUS regarding the construction of nuclear submarines and development of hypersonic missiles, we dare to assume that uranium mined at Four Mile is unlikely to be sold in the civil nuclear reactor market.

Production at the Honeymoon mine has not resumed after Uranium One first mothballed and then sold it to the Australia-based Boss Energy. Boss Energy also announced this February that it would join forces with First Quantum Minerals from Canada for precious metals prospecting.

The combination of those factors shows that Australia is unlikely to become a source of growing uranium supplies.

Kazatomprom, the world's largest uranium producer, could theoretically increase global supply, but the company has not yet announced any changes in its production plans.

As a result of the recent frenzy around supply of uranium, its spot prices surged. According to UxC, the price was USD 59.5/lb. as at April 4 while in April 2021, the average spot price was as low as USD 28.9 per pound. The price growth was stimulated primarily by traders and financial institutions. Long-term

Back to contents

prices also began to grow this March after remaining flat at about USD 43/lb. since September 2021 when they surged on the back of inflationary price growth in 2021.

Conversion

According to WNA, five uranium conversion plants (plants that transform the U3O8 yellowcake into the UF6 gaseous uranium hexafluoride) operate across the globe (see **Table 1**).

Notes to the table read, however, that Orano has not achieved full production capacity yet — the process is not expected to be finished before 2023. The same is true for ConverDyn, a partnership between General Atomics and Honeywell and the only conversion plant in the US. The plant was shut down in November 2017 amidst declining demand for nuclear fuel and underutilization of conversion capacity after the Fukushima disaster. In 2021, it was decided to resume production at the plant, which is scheduled for early 2023.

The table shows that it is only Rosatom's conversion plant that operates almost at its full capacity. It is easy to calculate its share in the global market, making about 38%.

A quick look at the table gives an understanding that the share of Rosatom, even with domestic supplies excluded, cannot be replaced until 2023 at the earliest.

Enrichment

According to WNA, five companies in the world have the largest uranium enrichment capacity (see **Table 2**).

It should be noted that Urenco plant in the USA accounts for 4,700 SWU of the company's total annual capacity (almost 16,500 SWU). Rosatom holds a 36% share in the global enrichment market, and its

Table 1. ESTIMATED WORLD PRIMARY CONVERSION CAPACITY 2020

Company	Country	Location	Nameplate capacity (tU)	Capacity utilization (%)	Capacity utilization (tU)
Orano	France	Pierrelatte & Malvési	15 000	17%	2 600
CNNC	China	Lanzhou & Hengyang	15 000	53%	8 000
Cameco	Canada	Port Hope	12 500	72%	9 000
Rosatom	Russia	Seversk	12 500	96%	12 000
ConverDyn	USA	Metropolis	7 000	0%	0
Total			**62 000**	**51%**	**31 600**

World Nuclear Association Nuclear Fuel Report (2021 edition)

capacity cannot be replaced for the time being. Enrichment facilities in France and China cater for their own needs in nuclear fuel. Urenco does not disclose its output directly. Its annual report for 2021 says only that the company **"enriched enough uranium to generate an estimated 780,000 GWh of electricity from nuclear power."** Having converted this figure to SWU with an approximation formula proposed by WNA, we may assume that Urenco produced around 13,000 SWU, which makes about 70% of its design capacity. It is evident that the world does not have spare enrichment capacity to replace Russia.

But what if a new plant is built? **"A significant number of refurbishment and optimization activities for our customers' enrichment plants have been completed successfully; more are currently underway and upcoming in the future,"** representatives of ETC, a manufacturer of gas centrifuges and a joint venture between Urenco and Orano, answered a question by Energy Intelligence. After that Phil Chaffee, an author of the article, makes a reasonable conclusion: **"Refurbishment and optimization obviously doesn't mean new centrifuges, and even if Orano and Urenco put in orders for more centrifuges tomorrow, it would take time for ETC to ramp up production to meet that demand."**

The fabrication segment is more diversified, and the largest nuclear fuel consumers, including the US and EU, meet their demand independently.

Conclusions

In the years to come, Russia will be an indispensable supplier across all the key segments of the nuclear fuel market. This is admitted by many experts and market players interviewed by different media and consulting companies. **"There is not enough capacity in the western market to replace Russia,"** Cameco's Senior Vice-President and CFO Grant Isaac said in a talk with a representative of Scotiabank.

Table 2. WORLD ENRICHMENT CAPACITY — OPERATIONAL IN 2018 AND PLANNED

thousand SWU/yr.

Operator	2018	2020	2030
CNNC	6 750	6 750	19 644
Orano	7 500	7 500	7 500
Rosatom	28 215	27 654	25 000
Urenco	18 600	18 320	16 487
Other	46	66	450
Total	**61 111**	**60 199**	**69 081**

WNA Nuclear Fuel Report 2019

Back to contents

Nuclear power sector has been underinvested at least since 2011. The prospects of new investments are uncertain as market players are not confident in return on investments. Buying Rosatom fuel is just more cost-efficient and in some cases, it is critical for the profitability of nuclear power plants.

Any attempts to switch to another producer would mean that they will have to invest people, time and money at customers' expense. One can only wonder how much the customer would have to pay for all those three resources at each of three production stages (mining, conversion and enrichment) to get high-quality nuclear fuel, which also needs to be approved by regulators. **"We received a bid that was EUR 150 million higher (the estimated contract price was EUR 700 million — RN). Besides, they wanted us to cover all fuel development costs. The amount was too huge, so we opted for the Russian supplier. And fuel they make is really good,"** Branislav Strýček, CEO of the largest Slovenian power company Slovenské elektrárne, said in an interview for Dennik.sk. According to him, migration to Westinghouse fuel will result in a decrease in performance by a few percentage points and a loss of **"tens or even hundreds of millions of euros. We should realize that diversification will come at a cost."**

We can take an example of the gas market and gas-fired power plants to see how it happens. If compared with gas, nuclear fuel looks like a safe harbor, with prices rising much less dramatically than those for gas.

Taking into account economic aspects, a question arises: why start a hectic search for new suppliers? Is it for energy security and reliability of supplies? This reason might seem sound, but let us look back

at the history to confirm or refute the argument. Statements might be arbitrary, but past events lay a foundation for justified conclusions.

Has Russia or the Soviet Union ever failed to deliver on its nuclear energy obligations? No, it hasn't. There are no examples of such failures in history. By contrast, there is an example of how Russia fulfilled the 20-year HEU-LEU agreement, which came into force in 1993, the most difficult time of Russia's contemporary history after the collapse of the Soviet Union. What is more, Rosatom continues to supply fresh nuclear fuel even with logistics disrupted after the sanctions were imposed in February 2022. In March, Slovakia received a shipment of the two-year fuel supply from Rosatom. In April, fuel arrived in Hungary. The Czech Republic has received three shipments from the end of February: **"The Russian plane carrying nuclear fuel received a special permit for entry into the EU airspace, which was closed for Russian aircraft after February 24. This was the third and last flight with nuclear cargo. The Temelin NPP now has fuel for more than two years of operation, and Dukovany for three years,"** ČEZ spokesperson Ladislav Kříž says.

In his book The New Map. Energy, Climate and the Clash of Nations, American historian of the petroleum industry Daniel Yergin admits that the United States argued repeatedly against energy imports, feeling uncomfortable with the idea of political rapprochement between Russia and Europe (see the quote below for details).

It is very much remarkable how close the current situation resembles what was happening 40 and 60 years ago. But what is happening now shows once again that energy imports from Russia continue and remain reliable.

Rosatom is a reliable partner who takes care of safety — safety of people, nuclear stations and customers.

To the beginning of the section

"The debate about the political risks of importing energy from the Soviet Union and now Russia has been going on for a long time. The surge of Soviet oil exports to Europe in the late 1950s and early 1960s generated great alarm in the United States. Walter Levy, the preeminent oil analyst of the day, warned that the Soviets "regard oil as an instrument of national policy" and would "withhold it where it serves their political purpose."… Washington adamantly opposed what was called the "Soviet oil offensive." For the Europeans, it was more a matter of business… In the early 1980s, in the first years of the Reagan administration, dissension between the United States and Europe again erupted over Soviet energy exports — this time not about oil, but about natural gas… The Reagan administration, which was stepping up defense spending, did not want the Soviets earning money that would fund their own military buildup. Washington also feared that dependence on Russian gas, especially in Germany, could help Moscow generate fissures in NATO and provide a major pressure point if East-West tensions worsened. This was the time "to dig in our heels," President Reagan said, and "just lean on the Soviets until they go broke."