ROSATOM NEWSLETTER #167

Rosatom in the Arctic

The rich and yet untapped potential of the Arctic region helps Rosatom develop its non-nuclear businesses. Rosatom Group companies are active in every sector of the Arctic economy, from mining to logistics and research, laying the groundwork for effective development of the Arctic. In an interview to TASS news agency, Rosatom CEO Alexei Likhachov speaks about Rosatom's plans for mining operations on Novaya Zemlya, icebreakers of the future and energy security of the Arctic region.

– Rosatom was represented by more than one group company at the International Arctic Forum. What are your basic lines of business in the Arctic?

– The Arctic is a region with a vast, yet untapped potential. First, it is rich in natural resources, but their development per se can deliver a huge boost to the national economy. Second, it is the Northern Sea Route offering expansion of Russia's transit capacity. It holds much promise both for the national economy and Russia's position on the international market. Third, it is about national defense and security. Rosatom is present in each of these areas and therefore takes much interest in this forum.

– Which of the areas you have mentioned is of the highest priority for Rosatom in the Arctic?

– They all are of equal importance for us; we have projects and boast achievements in each of them. Our flagship project is the Northern Sea Route. Rosatomflot [Russia's nuclear fleet operator] gains momentum and will not lose it because year-round navigation on the Northern Sea Route is impossible without nuclear icebreakers. As for Russia's largest Pavlovskoye deposit of lead-zinc ores, the project has more than regional or even national importance. It has great potential and excellent prospects.

– What does it mean that the Pavlovskoye deposit on Novaya Zemlya 'has more than regional or even national importance'?

– A specific feature of the Arctic is that development of the Pavlovskoye deposit goes far beyond ore mining or processing. It will entail development of the archipelago, construction of a sea port infrastructure on the Yuzhny Island, inclusion of the new port into the Northern Sea Route, and new contracts for companies in the Arkhangelsk Region. In fact, the deposit becomes a local economic hub that will bring in more taxes on the municipal and regional levels, create new jobs and open up new prospects of the regional development. Proven lead and zinc reserves measure around 50 million tons. We think that, following detailed exploration, this figure is likely to double. Ores from the deposit also contain silver. These reserves are sufficient for 30–35 years of production at the Pavlovskoye deposit. I think, though, that the economic life of the deposit will be twice as long if we take into account total mineral resources available on Novaya Zemlya. Our key interest is zinc as it is used in many of Rosatom's technologies and products. For example, zinc is used to increase the service life of primary loop piping and in high-precision medical equipment. It is also in demand in metallurgy. After the deposit reaches its designed capacity, we expect it to yield annually up to 65,000–70,000 tons of zinc concentrate. I believe that this total amount will find a buyer on the Russian market. I should also add that zinc is one of a few metals growing in price. It means the project has good economic prospects. By contrast, lead and lead concentrate are planned to be exported. We have already reached a preliminary agreement with China's largest state-run steel manufacturing company and Sweden's Boliden. Boliden has expressed its preliminary consent to being our partner in the lead concentrate processing and distribution on the European market.

– What is your estimate of lead concentrate exports to Asia and Europe?

– According to our preliminary estimates, about 50,000 tons of lead concentrate from Pavlovskoye will go to China and roughly 200,000–210,000 tons will be sent to Europe.

– At present, Rosatom is building three new icebreakers. Will they be enough to support major Arctic projects to be commissioned soon and deliver the company's strategy for the Northern Sea Route? Does Rosatom consider placing orders for the fourth and fifth icebreakers?

– It is true that the icebreakers in operation – Vaygach, Yamal and Taymyr – will be decommissioned in the mid-term. We will take steps to extend their service life, but they will be nevertheless taken out of service in the 2020s. The 50 Let Pobedy nuclear icebreaker and the Sevmorput nuclear lighter will not be decommissioned. At present, the Baltic Shipyard is constructing a new line of nuclear icebreakers – Arktika, Sibir and Ural – to replace those in operation. We expect them to be accepted in 2019, 2020 and 2021 respectively. We look forward to receiving these icebreakers and hope that the shipbuilders will not let us down.

This is our tomorrow, but we are already thinking about the day after tomorrow and have designed the next-generation nuclear icebreaker Lider (Leader). With a capacity of 110 MW, it is almost twice as powerful as the current generation and three times wider, thus being capable of escorting bigger vessels. I believe that further expansion of the icebreaker fleet should be based on more powerful vessels like Leader. It makes no sense to build one flagship vessel with no plans to build more, and we will need to construct three to five icebreakers of the new generation. In any way, we now have to make a decision about when to lay the keel of Leader.

– How much cargo did the nuclear fleet escort through the Northern Sea Route in 2016? What is your forecast for 2017 and for the medium term till 2025?

– In 2015, Rosatom's nuclear fleet escorted 195 vessels with a total capacity of 2 million tons. In 2016, the number rose to 410 vessels that carried 5.3 million tons of cargo. The year on year growth is more than twofold, and I expect it to continue into 2017 since we already have relevant contracts. We will see how it goes, though. We also believe that the freight traffic on the Northern Sea Route will reach 30 or even 35 million tons in 3–5 years. The best proof is that Novatek's Yamal LNG and Gazprom Neft's Novoportovskoye oil field projects already use it.

– Being in Arkhangelsk, it is reasonable to ask about Rosatom's approach to organizing power supply in the Arctic region.

– Rosatom builds many power plants both in and outside Russia. However, technologies we use in nuclear power plants are too powerful for the Arctic. For instance, our flagship project Novovoronezh II Unit 1 launched in March has a capacity of 1,200 MW. We realize that projects with a capacity of over 1,000 MW are hardly suitable for the Arctic. This region needs power sources with a capacity that is often less than 100 MW, and mobility here is a key factor. We are now working hard to commission a floating power station in Pevek on the Chukotka Peninsula in 2019. Once implemented in the Russian Arctic, this project may well become exportable. But we should first try it in action in Russia before bringing it to the global market. We also have power plant designs with even lower capacities of 5–6 MW or 20–30 MW. These are movable – and even underwater – power plants to be used at offshore fields.

You can read the full interview here: http://tass.ru/opinions/interviews/4142888

CONSTRUCTION

Reactor Vessel Put in Place at Belarus Nuclear Plant

The construction at the Belarusian Nuclear Power Plant passed a new milestone as the reactor pressure vessel (RPV) was placed in position at Unit 1.

The vessel was manufactured by Russia's AEM Technologies (a subsidiary of AtomEnergoMash, Rosatom's mechanical engineering division). It weighs more than 330 tons and measures 11 meters in length and 4.5 meters in diameter. Prior to the installation, the RPV passed incoming inspection in accordance with all regulatory requirements. Its engineering and supporting documents were checked for consistency and quality. Special equipment was used to perform visual, dimensional and other examinations. Once the incoming inspection confirmed the quality of the product, it was approved for installation. The vessel was installed in two stages. First, it was lifted with a gantry crane and moved into the reactor hall by rail. Then the vessel was pulled by the polar crane into a vertical position and placed on the support ring inside the reactor pit.

“It takes almost surgical precision to mount a reactor vessel in its permanent position,” said Vitaly Mediakov, NIAEP Vice President for Belarus NPP Project. “Since the support ring bears the entire load, the gap between the axes of the vessel and the ring should not exceed one millimeter." The new VVER-1200 is the most powerful Russian-built reactor at the moment. The key advantages of VVER-based units are high performance, long service life (60 years) and safety. The Belarusian Nuclear Power Plant is based on one of the world’s most advanced designs and complies with the most stringent international regulations and IAEA guidelines. Novovoronezh II Unit 1 with the VVER-1200 reactor

incorporates the AES-2006 design featuring a number of definitive advantages over the VVER-1000 reactor design. In particular, it provides for a 20% higher power capacity and a doubled service life (60 vs. 30 years) of its core components, a reactor vessel and a steam generator body.

More important is that the new design is fully compliant with the post-Fukushima safety requirements.

The Russian AES-2006 design features an array of unparalleled safety systems. One of them is a core catcher, a unique safety device designed by Russian nuclear engineers to mitigate effects of a nuclear meltdown. Structurally, it has a cone-shaped body installed at the bottom of the reactor pit.

In case of an accident, the core catcher medium mixes with the molten core materials and distributes them evenly inside the catcher body. The catcher can hold the molten core for an unlimited period of time, preventing nuclear materials from getting outside.

Stress tests passed

Last year, Belarus was reported to perform stress tests based on the specifications developed by the European Commission and the ENSREG (European Nuclear Safety Regulator Group). At present, the Belarusian regulator Gosatomnadzor is preparing a stress test report to be published and presented to the European Commission. Stress tests are aimed at checking the ability of nuclear plants to withstand extreme conditions and adapt to emergencies. The tests are designed to evaluate the resistance of nuclear plants to extreme impacts from outside, such as floods, harsh weather conditions, safety system malfunctions due to loss of power supply at the facility.

"We have reached another milestone in the reactor construction," notes Sergei Olontsev, **Senior Vice President for National Projects at NIAEP**. "Emplacement of the reactor vessel is a starting point for assembling the main circulation loop of the reactor."

TECHNOLOGY

Rosatom's New Businesses: Composite Materials

Rosatom Newsletter continues a series of reports on new businesses of the Russian nuclear corporation. This article deals with the production of high-strength, high-modulus carbon fibers and carbon-based fabrics.

UMATEX is a new name in the Russian industry of composite materials. Founded in 2016, UMATEX Group will manage Rosatom's composite materials division comprising a research center and manufacturers of high-strength, high-modulus carbon fibers and carbon-based fabrics.

Composite materials are used in diverse areas. In the aircraft industry, carbon-based composites serve as a material for principal structural elements, such as wings, center wings, fins and many more. In automotive engineering, composites are also widely used to make both race cars and mass produced vehicles. Composite materials have also found use

in the aerospace industry, medicine, design and many other areas.

What are the advantages of composites?

To answer the question, let us consider a few examples. In aircraft engineering, carbon-based composites help reduce the airplane weight by 30%, with structural robustness not compromised. Composite materials are also highly resistant to vibration and corrosion, thus greatly increasing the service life of a product and adding to its safety. By the way, air plane brakes are also made of composites ensuring a five to six time longer service life in comparison to ordinary brakes.

INTERESTING FACT

Carbon fiber reinforced nuclear buildings were the least hit by the severe earthquake in Japan in 2011. This opens up great prospects for carbon fibers to be used as a reinforcement material in nuclear facilities.

Apart from that, composites are widely used to enhance the safety of nuclear facilities. These advanced materials are essential for the construction and repair of nuclear power plants.

Composites owe their durability to the high strength of carbon threads forming the material structure and exceptional adhesion between the matrix and the reinforcement material.

Carbon-based composites have an advantage particularly valuable for the nuclear power industry. They resist corrosion and magnetism and preserve their properties at ultra-low temperatures. The latter allows for using carbon fibers at nuclear plants in any part of the globe regardless of the climate.

Carbon fiber reinforcement ensures more than a twofold increase in the robustness of reinforced concrete and brick structures.

Plant of the future in Tatarstan

In 2016, Tatarstan-based Alabuga-Fibre, the largest UMATEX Group company, began manufacturing and exporting new products, such as UMT49 carbon fiber made in line with the highest global standards and similar to T700 produced by Toray, a global leader in the carbon fiber industry.

Other new products of the company are medium-strength UMT40 fiber for aircraft engineering and design, UMT42 for wind power and automotive industry and the high-modulus UMT400 with an elastic module of 400 GPa and above.

The UMATEX Group research center is working on the technology to synthesize polyacrylonitrile (PAN) precursor enabling the fabrication of high-strength (over 4.9 GPa) carbon fiber.

This technology will be deployed at a new UMATEX plant that will produce 5,000 tons of PAN precursors per annum. By late 2019, the plant to be built in the Saratov Region will begin supplying the Alabuga-Fibre and Argon facilities with feedstock and thus become the last link in the vertically integrated value chain, from feedstock supplies to finished products.

Apart from precursors, the company continues research on matrices and coupling agents. In 2016, the company developed a new formulation of the coupling agent for vinylester-compatible carbon fibers and put it into production. Vinylester matrices have found application in the ship building industry due to its high resistance to aggressive media, particularly sea water. Vinylester-compatible carbon fibers are also used in the production of sheet molding compounds (SMC) for automobile parts. UMATEX Group will release this product in the second quarter of 2017.

Development of an end-to-end value chain is a priority for the company. As part of this effort, the group is working to set up the production of filament-wound composite pressure vessels.

Local production of wind turbines
In early 2017, Rosatom's Integrated Thermal Power Company (OTEK) announced its cooperation with Lagerwey, a Dutch wind power plant vendor, to develop the production of wind power generators in Russia. As a stakeholder of the project, UMATEX Group will take on the manufacture of wind turbine blades. According to expert estimates, Russia's wind power market can make 200 billion rubles per year by 2024, with power generation to reach 3.6 GW.
To facilitate export sales, the company has opened distributor offices in the Czech Republic and China. Both of them have well-supplied warehouses and ensure quick order processing and deliveries.

IN BRIEF

Kudankulam Unit 2 Begins Warranty Operation

Unit 2 of the Kudankulam Nuclear Power Plant built with Russia's involvement has been handed over to India to be operated under Russia's warranty. During the warranty operation period, the reactor unit will be tested for reliable performance under standard working conditions.
Following this period, the unit will be finally transferred to the Indian party for full-fledged operation. It is reported that Russia and India have signed a preliminary acceptance report for Kudankulam Unit 2. The reactor unit operates under the warranty of the general designer and the Russian machinery suppliers. This means that all glitches and malfunctions of the plant equipment will be remedied by the Russian party. The unit first reached 100% capacity on 22 January, followed by comprehensive dynamic tests.

Erection of Paks II Auxiliary Facilities to Start in Fall

Erection of auxiliary facilities on the construction site for two new Paks units to be built by Russia in Hungary will begin in the autumn of 2017, Rosatom CEO Alexei Likhachov said.
Auxiliary facilities comprise a set of production, storage and other buildings to be used by contractors during the project period. "I think we will start operations on the construction site already in the autumn," Mr. Likhachov told the media. In late 2014, Russia and Hungary signed an agreement to construct units 5 and 6 at Paks, Hungary's only nuclear station, with Russian-designed VVER-1200 reactors.