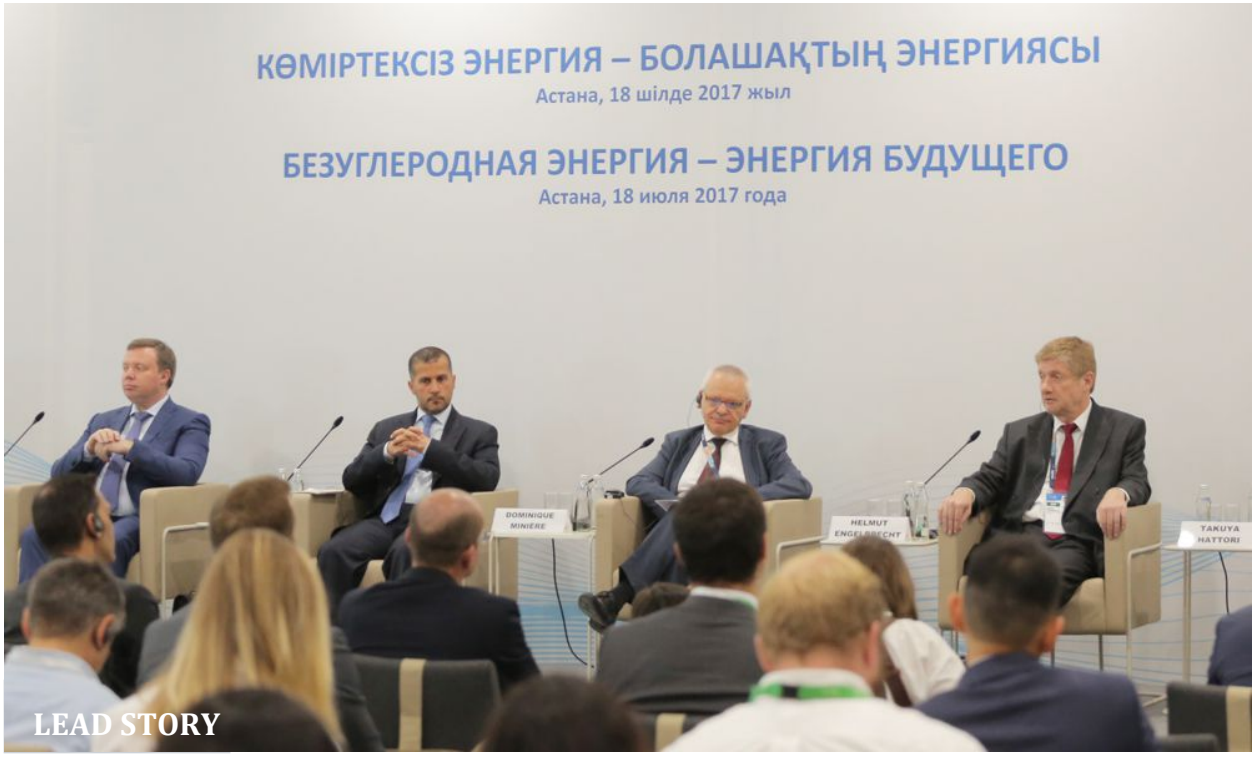


LEAD STORY

Nuclear Power Role Was Discussed at EXPO-2017

Nuclear power will play a major role in the future energy mix. This was a central talking point at the Carbon Free Energy as the Energy of the Future panel session held late last month at the EXPO-2017 Nuclear Week in Astana, Kazakhstan. Nuclear industry leaders from all over the world discussed prospects of the nuclear energy development. For more details on the discussions read our report.

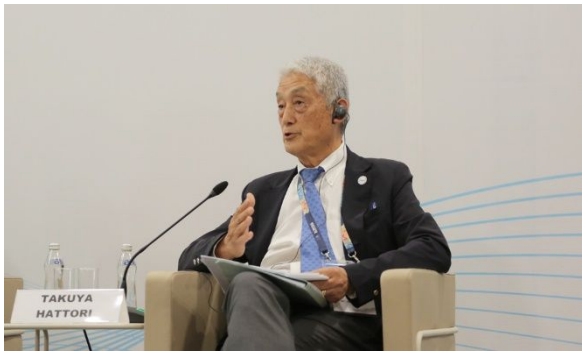
The panel session was held as part of the Nuclear Week organized by Rosatom in the Russian Pavilion at Astana EXPO-2017 International Exhibition. Speakers shared their views on nuclear power as an indispensable element of the low carbon energy mix on a par with solar and wind power.

"We all remember the declaration made at the Paris Climate Conference as most countries decided to consolidate their efforts in creating green energy future," said Kirill Komarov, First Deputy CEO for Corporate Development and International Business at Rosatom. "The time has come to deal with details. When talking about clean energy, people think mostly of solar, wind or hydro power and they often forget nuclear, which is undoubtedly a part of the green energy mix. Clean energies should not compete, but rather be used in combination."

According to Kirill Komarov, who quoted some scientific research, 40% is a reasonable share of renewable sources in the national energy mix. "This is not an absolute figure, but we have to identify a clear role of each power source. We believe that constructing 1,000 GW of new capacity by 2050 is a realistic target."

Luis Echávarri, former Director General of the OECD Nuclear Energy Agency (NEA), pointed out that to develop renewable energy sources was as necessary as to secure baseload electricity.

"The share of nuclear power in the global energy mix is 11%," said Helmut Engelbrecht, Chairman of the World Nuclear Association's Board. "If we construct nuclear plants at the same rate we did in the 1970-1980s, we will be able to reach 25% of global energy consumption by 2050." He also stressed the importance of following international rules for the use of nuclear power, including the need to obtain approvals for nuclear construction projects from neighboring countries.



Takuya Hattori, Counselor and former President of the Japan Atomic Industrial Forum, named energy security, environmental security and cost efficiency as three main principles of nuclear power development. Since Japan imports 100% of the power used in the country, "everybody understands why we need nuclear power." "Public attitude is negative, but we are progressing towards improving it." Takuya Hattori emphasized the significance of public acceptance efforts. According to him, Japan set a target for nuclear power to reach 30% of the national energy mix by 2030 while commissioning of 10 more reactors is scheduled by the end of 2017. He also noted that Japan planned to reduce CO2 emissions by 26% before 2030.

Tom Blees, President of the Science Council for Global Initiatives, drew attention of the audience to the expected growth of power demand. He said that experts forecast a 30% increase in energy consumption by 2040, let alone energy for desalination, electric cars and electric aircraft.

Talking about nuclear, Kirill Komarov called it a reliable and predictable source of power for economic development. According to him, nuclear establishes a clear-cut operating framework and stabilizes energy costs on a 60-year horizon (service life of a nuclear plant) since commodities make less than 3% of total generation costs at a nuclear power plant. "For comparison, gas and coal account for 60–70% of total generation costs at conventional power plants."

The experts participating in the panel session agreed that nuclear power would play a major role in the future energy mix. Nuclear power provides a long term price guarantee and reliable baseload power without emitting greenhouse gases, and is independent from weather conditions or geographic location. The experts also stressed the necessity of gaining public acceptance as a condition for the nuclear power development.

FOR REFERENCE

EXPO is a global event that is unparalleled in terms of scale and significance for the social, political and economic life of the

country and is only comparable with the Olympics in terms of public interest it arouses. Since the early 20th century, these international exhibitions have played an important role in the global promotion of advanced solutions, expansion of industrial production and trade, and establishment of better contacts between nations. This year, more than 115 countries and 22 international organizations take part in the exhibition, and over two million visitors are expected to attend it. The central theme of this year's event – Energy of the Future – attracts global leaders of the renewable energy market and those relying on green technologies for energy security. Rosatom is an official partner of the event and a key exponent of the Russian national pavilion. Along with taking part in the permanent exposition, Rosatom organized a themed week devoted to Russian nuclear technologies from July 17 to 23. A temporary exposition was organized in Russia's pavilion.

IN FOCUS

Rosatom's Nuclear Tech at EXPO-2017

Rosatom presented its latest solutions for the nuclear energy development at the Nuclear Week in Astana.

The Nuclear Week was organized in Astana at EXPO-2017, in the Russian Pavilion featuring Rosatom's nuclear technologies. "A lot of people ask a question of what the energy of the future is. We are sure that an ideal energy mix of the future is a combination of green energy sources, and a great number of international experts support our view. Nuclear power plays, and will continue playing, a great role in this energy mix. Nuclear is not just power. Our exposition shows clearly how nuclear technologies improve everyday life by contributing to such areas as medicine, agriculture, desalination and water treatment. Nuclear power is also used in space exploration bringing the future closer", said Kirill Komarov, Rosatom's First Deputy CEO for Corporate Development and International Business at the opening ceremony of the Nuclear Week.

Georgy Kalamanov, Commissioner General of the Russian Section at EXPO-2017 and Deputy Minister of Industry and Trade, noted that Rosatom was carrying out 34 international nuclear construction projects, as well as projects in nuclear medicine and new energy sources, thus fully fitting into the theme of Astana's EXPO.

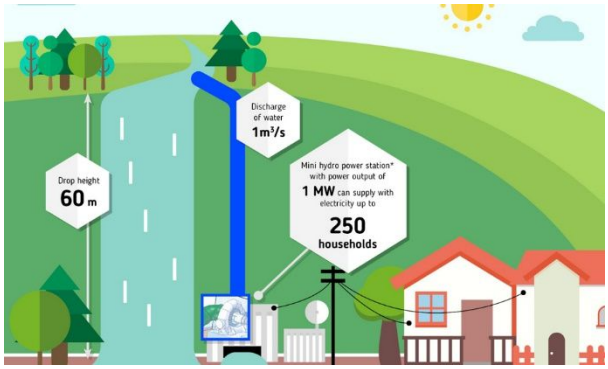
Guests attending the opening ceremony were invited to the Russian Pavilion featuring Rosatom's temporary exposition devoted to nuclear energy as 'a driver of the future'. They made a virtual tour of a Generation 3+ reactor unit and had an opportunity to see how nuclear technologies improve the quality of life by offering innovative solutions for agriculture, medicine and desalination, and also how the future is brought closer by the use of nuclear in space exploration, supercomputers, closed fuel cycle, superconductors, and thermonuclear power.

Rosatom's permanent exposition in the Russian Pavilion presents an innovative Leader nuclear icebreaker. Rosatom has long supported navigation in the Arctic waters and development of the region with the world's only nuclear fleet. Visitors to the pavilion have a chance to see the icebreaker design presented on a radial 3D display. Making a year-round navigation in the Arctic possible irrespective of weather conditions, Leader is a true icebreaker of the future, capable of traveling through two-meter Arctic ice at the speed of 10 knots and considerably reducing the shipment time by the North Sea.

The pavilion also features a 3D model of Akademik Lomonosov, the world's first floating nuclear power plant (FNPP). This is the first ever towable low-capacity power unit designed as a decentralized source of power for remote areas. The FNPP can be used to supply power to settlements and production facilities located far away from the grid.

Akademik Lomonosov is now under construction at the Baltic Shipyard in Saint Petersburg. It is planned to start generating power in the port of Pevek (Chukotka Peninsula, Russia) already in 2019. The floating unit is 96% complete.

TECHNOLOGY



Rosatom Presented Non-Nuclear Products in Kazakhstan

Rosatom has long been active in the development of non-nuclear products. Its advanced technologies and non-nuclear solutions were presented during the Nuclear Week at EXPO-2017 in Astana. You will find more details in our report.

Rosatom's non-nuclear products were presented at a round-table discussion entitled 'High Technologies for Kazakhstan's Sustainable Development'. The discussion was organized by Rusatom International Network. Its President Alexander Merten noted that the event offered the company a unique chance to

demonstrate its products and open up new opportunities for the development of cooperation in manufacturing, establishment of business alliances and joint ventures.

"We have set a strategic target that new products should generate at least 30% of the company's revenue by 2030. Our 10-year contract portfolio for new products amounts to 16.8 billion US dollars. Revenue from new products in 2016 reached 3.15 billion US dollars. We have everything we need to succeed, including labor force, production capacity, and research expertise. Rosatom's activities in the areas that are new for the company are a way to establish new and efficient lines of business. In this context, these new activities offer a great opportunity to develop mutually advantageous international relations."

Small HPPs

Much attention during the round-table discussion was paid to small hydro power plants (HPPs), Rosatom's new product. Speaking about small HPPs, Roman Murashov, Director for International Business at AtomEnergoMash, noted that their key advantages were relatively low costs of power generation, short lead-in and commissioning periods, and simple installation. Small HPPs are produced by Ganz EEM, a Hungary-based subsidiary of AtomEnergoMash. According to Roman Murashov, these plants are cost-efficient solutions for remote areas. They do not require construction of dams and do no harm to the environment.

As he said later at a press conference, Rosatom is considering opportunities to deliver small HPPs to Central Asia. The potential market size in the region is estimated to be 100–150 units. "We have conducted a market survey and come to the conclusion that the regional market size is about 100–150 small HPPs," Murashov told media at the Russian Nuclear Week event organized at EXPO-2017 in Astana. According to Murashov, Rosatom is considering a possibility of delivering small hydro power plants to Kazakhstan, Uzbekistan, Tajikistan and Kyrgyzstan. "We try to be proactive and want to assess the market potential and develop a unique market offering before these countries announce tenders. We are looking for contractors that will be able to offer comprehensive EPC (engineering, procurement and construction) project solutions based on our plants," Murashov said.

Our readers should remember that Rosatom has signed the first contract to supply small HPPs. Rosatom's nuclear engineering division AtomEnergoMash is to ship the first containerized small hydro power plant to Georgia. International Energy Co., Ltd from Georgia will purchase a pilot plant to be shipped later this year, followed by more plants varying in capacity from 0.6 MW to 2 MW.

For clean water

Ilya Lychev, Strategy and Development Director at AtomEnergoMash, made a report devoted to clean water as a key factor of environmental security. He spoke about water desalination plants integrated with a source of energy (a nuclear or thermal power plant) and presented a comprehensive solution for waste water treatment and water production for industrial facilities in Kazakhstan.

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IN BRIEF

UMATEX Group Started Certification Process for Aircraft Carbon Fiber

This was announced by Andrei Igantiev, Sales Director at Rosatom's subsidiary Umatex Group during the press conference at Astana EXPO-2017. UMATEX Group has been supplying aircraft composite materials based on carbon fiber manufactured at Argon for several decades. New carbon-based materials produced at Alabuga-Volokno are half the way there. "We have started the process of obtaining certificates for our new carbon fiber to be used in the aircraft and shipbuilding industries. This material is already used as reinforcement abroad, and we are working to obtain permits to use it in the national construction industry. Simultaneously, we are working to make our way to international markets. They follow the same rules as we do: in order to use the new material in the car industry, shipbuilding or aviation, we have to prove that the product complies with technical and economic requirements," he said. Ignatiev noted that European manufacturers used carbon fiber from Germany, the United States or Japan. "Meanwhile, carbon fiber made in Russia can be used internationally in most applications. It is mandatory, though, to check the declared specifications of the new material and verify its compliance with the requirements for end products. Tens of companies are testing our fiber; some tests have been passed successfully. We are drafting supply contracts," Ignatiev said

Research Plan for Kazakh Tokamak Approved

The CIS Commission on Peaceful Uses of Nuclear Energy held a meeting on the margins of EXPO-2017. The meeting was attended by members of the Commission, industry experts and representatives of government bodies from Armenia, Belarus, Kazakhstan, Kyrgyzstan, Tajikistan and Russia. The meeting approved an updated plan of material tests and research to be conducted in Kazakhstan's tokamak. In June 2017, the country completed the first phase of the tokamak's startup with the active assistance of Rosatom. The plan is to reach a standard operating mode in November 2017. The parties also agreed to Kazakhstan's proposal to include its legacy uranium mining facilities into the CIS Uranium Mining Site Rehabilitation Program. Another item on the agenda was a draft agreement to implement a joint initiative of using Yttrium-90 generators to produce this isotope for pharmaceutical purposes. The draft was approved in general, and the working group was tasked to develop a roadmap for the project.