

LEAD STORY



New Points of Growth

In-house production facilities and vast experience in power generation and construction make Rosatom capable of handling large-scale wind generation projects. This was announced at the renewable power round-table discussion held last week as part of the Open Innovations 2017 forum devoted to digital economy and challenges of global transformations.

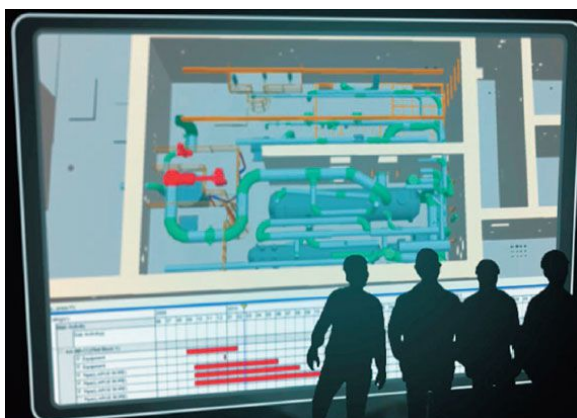
According to Kirill Komarov, Rosatom's First Deputy CEO for International Business, the engineering division of the Russian state-owned nuclear corporation has all the competencies it needs to deliver wind generation projects. The key factor of success is its unparalleled expertise in the construction of power production facilities. Rosatom considers wind power projects to be its major non-nuclear point of growth. Kirill Komarov also noted that Rosatom did not go greenfield with its wind power projects

since it had a long track record of constructing power generation facilities. Rosatom's another advantage is its in-house production capacity.

"AtomEnergomash, our nuclear engineering division, is a 'major champion' of the Russian mechanical engineering industry in terms of its operating scale and product range. We have thoroughly analyzed our competencies and production capacity and come to the conclusion that we do not need much investment to start the production of wind power equipment," Kirill Komarov said. He also added that Rosatom was capable of producing carbon fiber and associated products. "It is a unique opportunity for us to move up the value added chain by producing wind turbine blades from carbon fiber," he said. According to Mr. Komarov, these factors guarantee that Rosatom will fulfill its commitments to the Government regarding the construction of wind farms in Russia.

Our readers should remember that Rosatom won the bid in 2016 to construct

three wind farms with a total capacity of 610 MW in the Russian provinces of Adygea and Krasnodar. Following the renewable energy tender held this June, Rosatom won a new contract to build additional 360 MW of wind generation capacity. According to rough estimates, the project will create nearly 1,000 new jobs in Russia's Southern Federal District. SC NovaWind, a recently founded subsidiary, will take over the task of implementing Rosatom's strategy in wind generation. The company will consolidate Rosatom's innovative technology programs in this new energy segment. At the initial stage, NovaWind will bring together all wind generation assets owned by Rosatom. It will acquire Rosatom's indirect subsidiary VetroSGC, which is responsible for the wind generation business of the state nuclear corporation. It will also acquire the rights under the license agreement between OTEK (VetroSGC's management company) and Lagerwey and become a stakeholder in the joint venture that will produce wind generator components in Russia. The thermal power business of OTEK will be spun off into a separate business unit.



Why need a digital nuclear power plant

Kirill Komarov also spoke at the session dedicated to digital technologies. According to him, Rosatom is committed to developing digital solutions for the life

cycle management of nuclear plants. These solutions will enable Rosatom to retain leadership on the global nuclear construction market. At present, Rosatom's portfolio of international construction contracts covers 34 reactor units. "Transition to new requirements has become increasingly obvious of late. Our international customers say that they need no help in excavating a foundation pit because it is a simple process. They say they would rather buy a 'digital twin' of a nuclear plant and pay more for it than for the construction proper," Mr. Komarov said in his speech. According to experts, digital technology is the first step towards advanced management of the nuclear plant life cycle viewed as a set of interrelated processes that range from project design to plant decommissioning, with consistent digital data available at every project stage.

In plain words, this approach allows for building a digital 3D nuclear plant model and managing the life cycle processes of a nuclear power plant in close contact with a large number of counterparties (designers, authorities, customers, contractors, suppliers and clients) requiring timely exchange of large amounts of data. This modeling approach has long been applied to nuclear projects in Russia. Developed by Rosatom's NIAEP, the Multi-D technology uses detailed 3D representations to model construction and installation processes, optimize construction operations during the preparatory phase, analyze different resource consumption scenarios and, if needed, update the 3D model in the course of the project. Apart from the spatial model of facilities under construction (including drawings and 3D visualization), the Multi-D technology incorporates a construction schedule (based on standard progress rates) and quantified construction data. The level of detailing in the Multi-D system is that of

Level 4 project schedule. Construction and installation plans based on this schedule are applied step by step to construction levels, premises and installation areas.

In recent years, the Multi-D system has been repeatedly named by international experts as an efficient solution in the design and construction industry and won multiple awards. For instance, the life

cycle management based on Multi-D® Technology at Rostov NPP won the first prize in the Mega-Project Multi-Roadmap Element category at CETI Award 2016 earlier this year. Last year ASE-designed Multi-D-Based Project Management System won its first prize in Operational Excellence category at the World Nuclear Exhibition in June 2016.

CONSTRUCTION

Akkuyu Project Moves Forward

The Akkuyu nuclear plant project passed a major milestone as the Turkish regulator issued a limited construction permit last week. You will find more details in our report.

AKKUYU NUCLEAR JSC, an owner of the first nuclear plant construction project in Turkey, has obtained a limited construction permit from the Turkish Atomic Energy Authority (TAEK). The first step towards obtaining the construction license, this permit enables the company to start construction and installation operations on the nuclear plant's site, except for the facilities which are crucial for safety of the nuclear island.

"The limited construction permit is a major milestone of the Akkuyu project. We are now moving from the preparatory phase to on-site construction operations, which will be performed mostly by local subcontractors," said Yuri Galanchuk, CEO of AKKUYU NUCLEAR JSC. "Our next goal is to obtain a construction license because we want to start working on all the buildings and structures of the nuclear plant as soon as possible. But compliance with national and international safety standards remains our primary concern." The construction license is expected to be issued in the first half of 2018.



Documents needed for this purpose were filed with TAEK on 3 March 2007 and comprised the project design documents developed by AKKUYU NUCLEAR JSC jointly with Rosatom Group companies for Akkuyu Unit 1, Preliminary Safety Analysis Report (PSAR), and Probabilistic Safety Assessment (PSA) for the Turkish nuclear power plant. The limited construction permit was issued after close consideration of the documents submitted to TAEK.

The regulator's nuclear safety department will continue examination of the documents in the coming months. After it is completed, they will inspect the site and express an opinion about the company's application for the construction license. If the opinion passed is positive and unqualified, the Turkish Atomic Energy Authority will issue a construction license that will enable AKKUYU NUCLEAR JSC to proceed with the full-scale construction and installation on the site.

Our readers should remember that AEM Technologies, a subsidiary of Rosatom's nuclear engineering division AEM, has recently obtained an approval from the Turkish Atomic Energy Authority (TAEK) to start the production of equipment for the Akkuyu project. The certificate of approval issued by TAEK entitles two subsidiaries of AEM Technology – Atom mash (Volgodonsk, Rostov Region) and PetrozavodskMash (Petrozavodsk, Karelia) – to manufacture equipment for the Turkish nuclear power plant. In particular, Atom mash will produce reactor vessels for Akkuyu that will have four Russian-designed Generation 3+ units based on VVER-1200 reactors and

fully compliant with post-Fukushima requirements. Each of the units will have a capacity of 1,200 MW. Turkey expects to commission the first unit in 2023.

Akkuyu is constructed under the BOO (Build – Own – Operate) model. Rosatom Group holds an almost 100% stake in AKKUYU NUCLEAR JSC. On 19 June, Rosatom signed a term sheet to sell 49% in the company to the Turkish consortium of Cengiz-Kolin-Kalyon. The deal is planned to be closed by the end of 2017. The parties have not disclosed the deal's price. The total cost of Akkuyu project is about 20 billion US dollars.

IN FOCUS



Paks II Profitability Confirmed by EC

The Paks II construction project will bring Hungary a 7.35% annual rate of return, says the statement made by the European Commission following the project profitability study.

The European Commission came to the conclusion that the project drew no illegitimate support from the government and was otherwise profitable and competitive. The project is also confirmed to have the rate of return that is comparable with rates available on the local financial market. This topic was widely discussed in Hungarian mass

media last week. They cited EC estimates based on the February 2017 data that say that the project's expected internal rate of return averages 7.35% per annum, which applies to the entire life cycle of the investment, including a ten-year preparation period and at least 60 years of operation. The Paks II nuclear project is 100% owned by the Hungarian government and is financed with a sovereign loan issued by Russia.

The 88-page expert opinion published by the Commission says that the Hungarian government has agreed to the annual return on investment that is 0.5 percentage point lower than the rate (7.88%) that a private investor would expect of a similar project. For this reason, Paks II project was initially considered to be improperly supported by the national government. Later the European Commission came to the conclusion that the Government did support the project but its actions were found to comply with the EU rules.

According to Attila Aszódi, the Hungarian Government's commissioner for the Paks

expansion project, the decision to invest in Paks II can be considered state aid, but it is fully in line with EU rules, even though the expected return on investment is lower than a private investor would expect to receive.

The European Commission also took into account the power price forecast for the European and Hungarian markets. The forecast expects power prices to boom and compares the internal rate of return (IRR) for Paks II and the weighted average capital cost (WACC). The expected cost of electricity is calculated using Monte Carlo simulations. The European Commission assessed the project's profitability by taking into account a variety of technical factors, electricity costs and wholesale power prices. Based on its assessments, the Project's IRR is estimated to lie in between 6.79% and 7.90%. A private investor in a similar project might expect it to be at about 7.40–8.35%.

Cash flows from the new power units will be sufficient to cover costs, including the cost of capital, interest, fuel, operation,

maintenance, waste management and potential dismantlement, and provide return on investment, explains Mr. Aszódi citing the EC report. The Monte Carlo simulation results indicate no negative return, with the lowest forecast rate being 5.7%. This is why all the scenarios analyzed by the European Commission show that the project is profitable and will have a 7.35% internal rate of return.

"I would like to draw your attention to the results of Paks II profitability study published by the EC. Almost a half of the 88-page report is centered on the fact of government aid and whether it complies with the European legislation," Attila Aszódi wrote on his blog.

According to Brussels, the Paks II project adheres to the principles and facilitates performance of the Euratom Treaty. Hungary's nuclear capacities also serve interests of the European Union and make power supplies to its member states more reliable, Mr. Aszódi said with reference to the resolution passed by the European Commission.

IN BRIEF

Russia, Japan Discussed Development of Fast Breeder Technology

In mid-October, Rosatom, Japan Atomic Energy Agency (JAEA) and Japan's Ministry of Economy, Trade and Industry held a meeting to discuss the future of fast breeder technology. "Russia and Japan continue working on the development of a closed nuclear fuel cycle and fast neutron technology. The two countries consider these areas to be essential for improving competitiveness of the nuclear industry, slowing down accumulation of spent nuclear fuel, and enabling efficient

use of uranium resources," Vyacheslav Pershukov, Rosatom's special envoy for international and R&D projects said. At present, Russia is a leader in fast breeder technologies. The country brought a BN-800 fast neutron reactor online last year and continues the development of a more powerful BN-1200 fast breeder. As part of its long-term strategy, Russia is also developing BREST reactor with inherent safety features. This lead-cooled fast reactor to run on nitride fuel is developed in accordance with an on-site nuclear fuel management concept. Russia is also pushing ahead with fast reactors cooled

with lead-bismuth eutectic and designed to be used in local power grids in the long term.

Balakovo NPP Service Life Extended by 26 Years

The life extension license was issued by Russia's Federal Service for Environmental, Technological and Nuclear Supervision (Rostekhnadzor). The unit will operate till 2043 and serve to prove the reliability of Russia's nuclear technology. Balakovo Unit 2 generated its first electricity in 1987 and has safely operated throughout its design life of 30 years, with over 186 billion kWh supplied

to the national power grid during the entire operation period. Facility inspections and preparation of life extension documents began in 2012, accompanied with an extensive modernization program. Balakovo NPP is located in the city of Balakovo, Saratov Region. The plant has four upgraded VVER-100 reactors with an installed capacity of 1,000 MW each. Balakovo NPP is one of Russia's largest and most advanced power plants and accounts for a quarter of power generated in the Volga Federal District. The plant ensures sustainable power supply in the Volga Region, Central Russia, Urals and Siberia.