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Outlook and Challenges for Nuclear Power Generation in 2019

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Japanese topics: Nuclear plant safety assessment, restart and operational lifetime extension application

1. The number of restarted nuclear power plants in Japan stood at nine as of December 2018. Units 6 and 7 of Tokyo Electric Power Co.'s Kashiwazaki-Kariwa Nuclear Power Station are in the final examination stage toward their restart, after acquiring approvals of the safety design from the Nuclear Regulation Authority (NRA) in December 2017. The Japan Atomic Power Company won NRA approval on the lifetime extension of its Tokai No. 2 Power Station in November 2018, planning to install additional safety devices as approved in the future. It is uncertain when the 10 plants now under safety examinations will be restarted with the examinations completed. The number of restarted nuclear power plants at the end of FY2019 may be at most 11.
2. On March 29, 2018, the Japan Atomic Power Company signed an agreement with Tokai Village, its five neighboring cities – Hitachi, Hitachiota, Hitachinaka, Naka and Mito – and Ibaraki Prefecture, including their effective advanced approval on the operation of the Tokai Daini Power Station and the lifetime extension. This is the first ever such agreement to include an advanced approval not only by a plant-hosting municipality but also by its neighboring municipalities in Japan. Attracting attention is whether other nuclear power plants would be subjected to such agreements.
3. On October 25, Tohoku Electric Power Co. announced a decision to retire Unit 1 of its Onagawa Nuclear Power Station, bringing the number of nuclear power plants subjected to retirement decisions in Japan since March 2015 to 10 at seven power stations, excluding Tokyo Electric Power's Fukushima Daiichi and Daini Nuclear Power Stations. Tohoku Electric Power explained that the decision resulted from the comprehensive consideration of various factors including the plant's capacity and the number of years for operation after its restart. This indicates that the decision reflected concerns about "the number of years for operation after the restart" even for the plant

that launched commercial operation in 1984. For six other plants that were launched 30 years ago or earlier in Japan, the time has come for some decisions on their future fates.

4. Safety investment costs have become a matter of concern regarding nuclear power plants put under safety examinations. Additional safety investment costs were estimated at more than JPY4.4 trillion for 35 such plants (with capacity totaling 34 GW) as of April 2018, based on data from their owners and media reports. Given that detailed designs are still left undecided for severe accident management facilities at some plants, the estimated costs may increase further as safety examinations make progress. We would like to pay attention to nuclear plant operators' decisions in 2019 on nuclear plant issues including the abovementioned number of years left for future operation.
5. On July 31, the Japan Atomic Energy Commission released the Basic Principles on Japan's Utilization of Plutonium, further clarifying "the principle of not possessing plutonium without specific purposes" by offering to "approve reprocessing plans under the Spent Nuclear Fuel Reprocessing Implementation Act so that reprocessing is to be carried out only to the extent necessary for steady pluthermal power generation, reflecting the operational situation of the Rokkasho Reprocessing Plant." We would like to pay attention to developments after the approval of the reprocessing plant's operation that will take some more time to be given.

International topics: Growing global presence of China and Russia, and innovative reactor development in developed countries

6. China and Russia have continuously been expanding domestic and overseas nuclear plant construction. In China, seven new nuclear plants launched commercial operation in 2018, including Tianwan Units 3 and 4, Yangjiang Unit 5, Sanmen Units 1 and 2, Haiyang Unit 1 and Taishan Unit 1. Sanmen Units 1 and 2 and Haiyang Unit 1 adopt the Westinghouse AP-1000. Taishan Unit 1 represents China's first European pressurized reactor built by Framatome. At the end of 2018, the number of nuclear plants in commercial operation in China stood at 44, the third largest in the world, surpassing Japan's 38 (including those for which restarting timings are uncertain). In Russia where 31 nuclear power plants were in operation as of January 2018, two more started commercial operation in 2018. They are Rostov Unit 4 launched in September and Leningrad II Unit 1 in October. In the two countries, new plants will enter operation in 2019 as well. Around 2020, therefore, Japan could have the world's fifth largest number of nuclear plants ready for commercial operation, trailing after Russia.
7. While steadily accumulating nuclear plant construction and operation experiences on their own, Russia and China have increased their presence in other nuclear power

generation markets. Russia launched the construction of the first nuclear power plants in Bangladesh and Turkey in 2018. Russia is expected to make progress in negotiations with Uzbekistan and Egypt on nuclear plant construction and complete nuclear plant construction in such countries as Belarus in 2019.

8. Nuclear plant construction projects have been stalled in Western developed countries, including Finland that has extended the construction period for Olkiluoto Unit 3 again, planning to complete the new plant of which the construction started in 2005. The completion of Vogtle Units 3 and 4, the only new U.S. power plants subjected to government loan guarantee, is still uncertain. Although the construction of the Vogtle plants adopting the AP-1000 model started earlier than that of China's Sanmen and Haiyang plants of the same model, the Chinese plants have started operation earlier.
9. In recent years, small modular reactors (SMRs) have attracted attention as a new technological solution to various problems with large light-water reactors. In November 2018, the United Kingdom, Canada and the United States released government documents on SMR development policies. The future challenges for SMRs include the regulatory readiness that gives consideration to the characteristics of SMRs differing from large light-water reactors and to ensure the predictability for business operators.