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Current State and Future of Japan's Nuclear Power Programa

1. Top priority to nuclear safety and trustworthiness

Public acceptance is absolutely necessary for the industrial use of nuclear power. In order to gain trust from the public and especially from the local communities adjacent to the nuclear power plants, the Presidents of Japanese electric power companies are giving top priority to safety and making efforts to keep transparency of nuclear power generation.

2. Competitiveness of nuclear power generation

The rise of crude oil prices causes price increases in natural gas, coal and even uranium. However, the competitiveness of nuclear power is strengthened due to the difference of cost structure for power generation. Data for the Japanese case will be given in the presentation. Nuclear power is also preferred for the control of CO_2 emission.

3. Nuclear fuel cycle

Japan's spent nuclear fuels have been reprocessed in Europe. Japanese electric power companies are planning to use MOX fuels that are made of recovered plutonium. The MOX fuels will be fabricated in Europe, transported to Japan and loaded into the domestic light water reactors. These plans involve obtaining agreement of local communities surrounding nuclear power plants.

The return of high-level radioactive wastes (HLW) from the French reprocessing plant to Japan will be completed in a year. The return of HLW from the British reprocessing plant will be started in a couple of years. The return of TRU wastes from France is being discussed positively with local communities near the interim storage facility that would receive the wastes. Japan is in the course of fulfilling its responsibility resulting from overseas reprocessing.

Domestic reprocessing and MOX fuel fabrication have attained many years of experience at the research laboratory located in the village of Tokai. Construction of the commercial reprocessing plant located in the village of Rokkasho is now on the final step of active test that uses actual spent fuels.

Commercial MOX fuel fabrication plant to be constructed adjacent to the Rokkasho reprocessing plant is now under safety review by the Japanese regulatory authority.

A plutonium utilization plan has been announced by the electric power companies that would process plutonium recovered from domestic reprocessing at Rokkasho.

The development of a new centrifuge design for the uranium enrichment plant at Rokkasho is proceeding smoothly. Construction of the first interim spent fuel storage facility away from the reactor site has been accepted by the city of Mutsu, located in the prefecture of Aomori.

Siting of the final repository for HLW disposal is essential for the use of nuclear power generation and its fuel cycle. In order to get any offer as a candidate site for the underground repository, the Japanese electric power companies will continue to cooperate with Nuclear Waste Management Organization (NUMO) that is responsible for HLW disposal. Rule making for the underground TRU waste disposal has also been discussed positively by relevant organizations including the national government and nuclear reactor operators.

Since the nuclear fuel cycle significantly improves the sustainability characteristics of nuclear power generation, Japanese electric power companies are positively addressing the various difficult issues to be solved.

Japan is making every effort to rigorously maintain the peaceful use of nuclear power and physical protection of sensitive materials, which is understood worldwide to be necessary.

4. More effective use of existing nuclear power plants

Because the existing nuclear power plants have applied various modifications to the structure, system, components and operating procedures in order to improve safety, operability and maintainability, the plants today contribute a strong and stable basis for the business of Japanese electric power companies. In order to increase the capacity of nuclear power generation, it is still key to bring out the full potential of existing nuclear power reactors.

After a series of disclosed discussions among the regulatory authority, licensees, academic experts, representatives from local communities and mass media, it was concluded that the regulation of nuclear power plants would be reformed in two years in order to enable more flexible and streamlined operation and maintenance, such as reliability-centered maintenance (RCM), condition-based maintenance (CBM), on-line maintenance (OLM) and finally extended operation cycle length that is longer than the current upper limit of 13 months. Through the amendment of utilities' maintenance program and the modification of the authorities' regulatory procedures, safety performance will be improved, capacity factor will be increased and occupational radiation exposure will be decreased. The consensus of the local community to regulatory reform is inevitably important to realize the advanced maintenance programs and to make more effective use of nuclear power generation.

Continuous application to the extent possible of up-to-date technology and the latest knowledge obtained is essential to keep the viability of existing reactors. The introduction of severe accident management to enhance the reactor safety has already been completed in all existing plants. Plant life management programs to control aging would assure operation as long as 60 years. Although the new aseismic design criteria is prepared for the application of reactors to be designed in the future, electric power companies have already announced their intent to check existing reactors based on the new criteria and to reinforce structures and components if necessary.

The update of nuclear fuel design has been delayed compared to Western countries, however this means that Japanese utilities have more opportunity to improve the economics of nuclear power generation by introducing higher burn-up fuel in the future.

5. Construction of additional nuclear power reactors

It is inevitable that the construction of a new reactor is gradually delayed compared to the original planned schedule because of the slower increase of electricity demand and the tough discussions with local government about the siting. Moreover, construction of a nuclear power plant requires huge initial investment that can be recovered at the end of long-term service that lasts many years.

Japanese electric power companies, however, will continue to make efforts to achieve the target specified in the 'Framework for Nuclear Energy Policy' proposed by Japanese Atomic Energy Commission and authorized by the Cabinet, i.e., 'Even after 2030, nuclear power should supply more than or equal to the current share that is 30 to 40% of the total electric power generation.'

The achievement of this goal needs measures to reduce risks accompanied by a huge initial investment for the construction of nuclear power plants, such as modification of regulations which are reasonable and compatible with international standards, elimination of uncertainties of the fuel cycle back end, leadership of the national government to the local governments, etc.

6. Replacement of existing reactors

The existing light water reactors will one by one reach the service life of 60 years after the 2030's. This will require a tremendous amount of replacement capacity, as much as 1.5 GW every year.

In order to prepare for this age, a feasibility study for the development of Japanese next generation light water reactor has been started, which is sponsored by the Ministry of Economy, Trade and Industry (METI). Reactor vendors should take a main role in this study and propose an attractive next generation light water reactor design that could be one of the international standards in 2030's.

Electric power companies cooperate in this study by giving the utility requirements for the future reactors based on their abundant experience in nuclear power plant operation and maintenance.

The application of a standard design certification approach and minimized regulator's evaluation of site dependent design and analyses would be of great use for the rapid introduction of new reactors.

7. Fast breeder reactors in the future

The Japan Atomic Energy Agency (JAEA) and the electric power companies are conducting joint research and development for a fast breeder reactor (FBR) and its associated fuel cycle technology, as an alternative to the light water reactor cycle and an important energy source in the future. The technology selected for the Japanese FBR cycle concept is the combination of sodium-cooled FBR, advanced wet extraction method for reprocessing and simplified pelletization for MOX fuel.

For the earlier introduction of the FBR cycle, it is essential to acquire sufficient competitive edge and reactor safety that are better than the other power sources including LWR cycle around the 2050's. Strengthened features for nonproliferation of sensitive materials and a reduction of the burden on the environment are integrated in the design study for Japanese FBR cycle in the future. The R&D is aiming for the Japan's FBR cycle technology to be one of the international standards.

8. International cooperation

Safety is the world's common theme, and a top priority in using nuclear energy. Japanese electric power companies would like to contribute to the enhancement of the safety of nuclear power throughout the world by sharing their operating experience with and offering know-how to the countries that will newly try to start civilian use of nuclear energy in the future.

Japan is in the nuclear fuel supply side of the Global Nuclear Energy Partnership (GNEP) proposed by the United States. JAEA sponsored by Japanese Government will contribute to the research and development of FBR cycle technology in the scope of GNEP, especially with the prototype FBR Monju and the experimental FBR Joyo as well as the results achieved so far in the commercial FBR design study carried out by the joint efforts of JAEA and electric power companies in Japan.