Actions to Promote Nuclear Energy Utilization for Addressing the Sustainable Development of Global Community[1]

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Thank you, David, for kind introduction. Good morning ladies and gentlemen. I would like to begin my talk by thanking the organizers for inviting me to take part in this forum on the integration of sustainability, safety and security of nuclear technology.

It is important to recognize that the degree of the contribution nuclear energy can make toward enhancing environmental protection and energy security in many parts of the world in future, suggested, for example, in the Cool Earth 50, Japan's proposal to cut the global emission of greenhouse-effect gases by half from the current level before 2050, will depend on the technical and managerial innovations to be introduced incessantly in the design and operation of global nuclear energy systems. It is also important to recognize that such innovations will be realized only through meticulous preparation and persistent effort for success all over the world.

It is based on these recognitions that the JAEC has recommended, in the Framework of Nuclear Energy Policy, a portfolio of diverse actions across three different time frames; near-term, mid-term and long-term, in addition to a set of cross-cutting actions to maintain the basic conditions for the utilization of nuclear energy. In this talk, I will like to share with you the important aspect of these actions.

In Japan, ten electric power companies operate 55 light water reactors (LWRs) currently, which supply about 30% of electricity and contribute to the increase

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in Japan's energy self-supply ratio from 4 % to 18 %. Three units are under construction and two applications are in the final stage of regulatory review. Furthermore, electric utilities have announced that they will start construction of eight more plants in ten years or so.

The objectives of nuclear energy policy specified in the Framework are to make the share of nuclear power in electricity generation after the year 2030 greater than the current level of 30 %; utilize fissile material recovered from spent fuel through reprocessing in these LWRs for the time-being and dispose the glassified high-level radioactive waste from the reprocessing process into geological disposal facilities; and pursue the commercialization of fast breeder reactor and its fuel cycle technologies before 2050 that contribute to better utilization of resources and possible reduction of the heat generation rate of the high-level radioactive waste.

The first set of actions relevant organizations are asked to incessantly promote are those essential for the promotion of nuclear energy utilization: they are:

a) To assure strict limitation to peaceful purposes;
b) To assure safety and security of such activities;
c) To maintain openness and transparency of policy-making and safety-related decision-making processes and assuring public participation in policy-making, giving the public both formal and informal opportunities to learn what nuclear energy is;
d) To secure number and quality of talents for these activities;
e) To promote the safe disposal of radioactive wastes and the determination of the site for a high-level radioactive waste disposal facility in particular, as until now no mayor of municipalities has successfully applied to the invitation of the Nuclear Waste Management Organization, NUMO, to accept the site suitability investigation;
f) To promote international cooperation and contribution.

The near-term actions are those to make it possible to utilize existing assets most effectively: the actions specified in the Framework are a) to continue safe operation of existing plants, incessantly cultivating the public confidence in operators and regulators, b) to improve the operation of existing plants with a view to attaining aiming higher availability and longer plant life, and c) to

promote the MOX fuel utilization in LWRs by utilizing plutonium recovered and stored in Europe and that to be recovered at Rokkasho Reprocessing Plant (RRP), which is currently in the final stage of commissioning test.

As for safe operation of existing plants, Japanese operators should be proud of the fact that the annual frequency of unscheduled shutdown of Japanese NPPs has been sufficiently low for 20years.

As for the efficient operation of their plants, however, they have suffered for low plant availability factors in recent years. The reasons are;

a) Lengthy communications between local governments and operators have been necessary before the governments agree to restart plants after an incident, partly because cover-up actions of operators are identified in relation to incidents or a new regulatory position on the repair work had not been understood beforehand by the local government,

b) The frequency of legal periodic plant inspection has been prescribed as once in 13 months, though the situation will be improved as a new system in which plant specific meticulous legal inspection will be down at every 13 or 18 or 24 months depending upon the plant condition.

c) Onagawa, Shika and Kashiwazaki-Kariwa NPPs have experienced seismic motions exceeding the design-basis seismic input and for their restart, operators were required to submit the report on the integrity of the plant and the report to re-evaluate the seismic safety of the plant based on a renewed reference seismic input chosen through the seismological investigation updated.

In the case of 16 July 2007 Earthquake at Kashiwazaki-Kariwa NPP of TEPCO, for example, the seismic input to the plant significantly exceeded the level of design basis seismic input of the plant, though the operating units were automatically shutdown and all plants behaved in a safe manner, during and after the earthquake. Any significant damage of safety-related structures, systems and components (SSCs) of the plant has not been reported, whereas non-safety related SSCs were affected mainly by anchorage failures due to significant soil deformation as they were not connected to the bedrock.

The detailed study on the cause why the peak grand accelerations observed at the site were significantly higher than that estimated by a distance-attenuation formula widely used brought to the light that the cause are a) more intense seismic wave was radiated from the fault, b) seismic wave was focused to the site due to the existence of irregularity in the deep underground of the site, and c) seismic wave was amplified due to the existence of folding structure under the plant site.

TEPCO and other operators of all NPPs in Japan have recently submitted the interim report on the seismic safety of their plants based on the detailed survey of faults around the site in accordance with the Nuclear Safety Commission's new seismic safety evaluation guideline published in 2006 that asks any applicant to take these factors into consideration. I hope that Japanese nuclear community will recover from this extraordinary situation in a few years.

Now I would like to talk about actions taken on the ageing management and safe long-term operation of existing plants. As you know, a quarter of LWRs in the world were over-30 years old at the end of 2007: 48 units in USA, 13 units in Japan, 4 units in Sweden and Germany, 3 units in Switzerland and Belgium, 1 unit in Spain, France etc. Considering the importance of safe long-life operation, Japanese regulatory authority have asked since 2000 operators of these plants to submit a report on the safety of operation beyond 30 years before arriving at the age, and reviewed the report and both the method for evaluating ageing phenomena at 30 years of operation and the plant operation and management program that should assure more than 10 years of safe operation after the evaluation, in particular.

The Japan Nuclear Energy Safety Organization, JNES, that has supported the regulatory body, NISA, to review these reports, has recently established a three-stage strategic plan for four task-areas based on the knowledge and data obtained in this review activity. The goal of the stage 1 that ends in 2010 is to prepare guidelines for reviewing both the evaluation of ageing phenomena at 40 years of operation and the proposed program of plant operation and management for ten years to come. The goal of the stage 2 that ends in 2020 is to prepare guidelines for reviewing both the evaluation of ageing phenomena at 50 years of operation and the proposed program of plant operation and

management program for ten years to come, and that of stage 3 that starts in 2020 is to review the feasibility of over-60 years operation on the one hand and to reflect the knowledge-base for plant ageing management on the design of the next generation LWRs

The four task areas of the plan are;

a) to develop technological knowledge and information structure, such as ageing DB, operating experience DB, technological information networks, system for processing and applying knowledge of plant ageing and management, international collaboration;
b) to promote safety research and technology development on neutron irradiation embitterment, stress corrosion cracking, fatigue crack, thinning of piping, degradation of I&C cable insulation, degradation of concrete, seismic safety evaluation etc;
c) to develop codes and standards for effective regulation of ageing management with a view to establishing seamless set of codes and standards, risk-based plant life management guidelines, surveillance guidelines for unexpected degradation and damage;
d) to promote the improvement of maintenance, including the optimization of maintenance strategy based on risk information and the development of human resource for maintenance.

We hope that the steady implementation of the strategy lead by the JNES will facilitate a) strategic knowledge management activities, b) collaborations and effective sharing of information, data and knowledge among industries, government and academia, c) creation of feedstock to the design of next generation plants, and d) international collaboration among interested parties in the world.

The mid-term actions are those to prepare ourselves for the need for replacing existing technologies and systems. One such initiative is to construct interim spent fuel storage facilities in parallel with LWRs, as the RPP can reprocess only a part of spent fuel to be generated during 40 years of its planned life. Currently one application for construction of 5000 ton interim storage facility is under regulatory review.

The other important mid-term action is to develop the next generation LWRs, consolidating Japanese experiences in construction and operation of LWRs and making the most of various innovative science and technologies on the horizon. The project is to start this year, aiming at the completion of basic design in 2015. I believe the project is timely because we have developed both ABWR and APWR in the framework of joint government and industry projects of improvement and standardization of LWRs in 1980s and several ABWRs have been operated for several years and the construction of two APWRs are just to start.

Some of important utility requirements to this project are output power of 1.7-1.8GWe, plant life of 80 years and fuel burn-up of 70GWd/t and less than 30 months of construction time. The technologies under discussion are seismic isolation technology, advanced construction technology, synergy of new material development and new insight of water chemistry for elongation of component-life and reduction of occupational exposure, and total information management system for optimization of design, construction, operation and decommissioning of the plant, based on the advanced information technology and feedstock from the plant life management activities for operating plants.

As for long-term actions that explore the possibility of business innovation in future, Japan put emphasis on the R&D of fast reactor and its fuel cycle technologies as the technologies makes it possible to utilize nuclear fuel material far more effectively, in addition to the persistent promotion of basic research and development activities in nuclear science and engineering and research utilizing particle beams from accelerators, in particular.

As for the development of fast reactor technologies, we are asking the project team at present to submit us in 2015 a conceptual design that may be competitive in the energy supply technology market of the latter half of the 21st century. Among a set of performance requirements or design goals specified for the project, economy and friendliness to the neighbor will be key factors for success, although enhanced safety, reliability, utilization of fuel, and proliferation resistance are important as a matter of course.

Finally I would like to briefly touch upon the policy for international cooperation, which is one of the important cross-cutting basic actions. The

AEC has traditionally believed it important to promote international cooperation, recognizing that peaceful uses of nuclear energy are beneficial for the socio-economic development of the international society. The objectives of the cooperation are therefore;

a) to contribute toward shaping the environment for nuclear energy uses, establishing international schemes for assuring nuclear safety, security and nonproliferation, as can be seen in Japan's recent actions to promote the adoption of Additional Protocol and call for the recognition of the importance of nuclear safety, security and safeguards among emerging countries;

b) to globally share knowledge for nuclear energy uses for the benefit of global community, as can be seen in Japan's initiative to promote the Forum for Nuclear Cooperation in Asia (FNCA) in parallel with active participation in the IAEA activities; and

c) to pursue mutual benefit with other countries for the effective and efficient promotion of nuclear energy R&D: Examples are Japan's positive participations in the GIF, international forum for generation four nuclear reactor R&D activities and the ITER project.

Lastly the AEC has set it also an objective of international cooperation in recent days to support the activities of other countries to utilize nuclear energy for combating climate change, and proposed the Government to take actions for building a global consensus that the expansion of safe, secure and proliferation-resistant use of nuclear energy is an essential measure against global warming.

In conclusion, it is important to pursue sustainable nuclear energy technologies if we want to make nuclear energy contribute to the sustainable development of global community. Keeping the importance in mind, Japan is promoting a thoughtful mix of near-term, mid-term and long-term actions for sustainable development of nuclear energy utilization, rectifying the weakness of existing technologies and systems, and improving the competitiveness of the technologies.

Professor Scott E. Page said in his book titled “The Difference” that the power of diversity creates better groups, firms, schools and societies. I sincerely hope that my quick summary of the situation beyond the Pacific Ocean will stimulate the exchange of opinions for better nuclear technology and system in this forum.

Thank you for your attention.