Nuclear Cooperation in the Pacific Basin - Responsibility to the Future[1]

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Thank you very much, Mr. Chairman.

Good morning distinguished guests, ladies and gentlemen, colleagues and friends. It is indeed an honor and privilege for me to be here today and to welcome all of you to the 16th Pacific Basin Nuclear Conference in Aomori. I am sure that the conference will provide you an exciting forum for sharing information on nuclear research and development activities and facilitating exchange among scientists, engineers and experts around the Pacific Rim as in the past.

Being in Aomori prefecture is particularly special for me since Rokkasho-mura in Aomori is the site of both Japanese nuclear fuel cycle industrial complex and a research center for Broader Approach to fusion research which is complementary to the ITER project, Mutsu-city, a site of spent fuel storage facility, Higashidoori-mura, a site of nuclear power plants in operation and in the licensing review stage and in Ohma-cho, a nuclear power plant is under construction.

The history of these grand nuclear activities in Aomori is comparable with the history of the PBNC and the Pacific Nuclear Council (PNC). It was in 1965 when the town council of Higashidoori-mura passed the resolution to invite construction of nuclear power plants, about 10 years before the first PBNC held in Hawaii in 1976. The Aomori prefecture accepted the request of the Federation of Electric Power Companies to locate fuel cycle facilities in Rokkasho-mura in 1985, when the PBNC Committee was established as the predecessor of the PNC that has sponsored the series of the PBNC conference as a non-governmental body to promote cooperation for advancing the peaceful uses of nuclear energy in the pacific basin region.

Those who many years ago inspired and have worked towards the formation of what are those today in this prefecture could not have been more visionary. On behalf of Japanese nuclear community, I would like to express my heartfelt thanks to the successive governors and mayors and the people of Aomori-prefecture and the residents of those municipalities for your enduring support to the construction and operation of these facilities over the years. Thanks should also go to those who many years have worked towards the development of the PBNC and the PNC.

But the job of the nuclear enterprise in this prefecture is far from finished: we are on the path towards the future and so is that of nuclear enterprise in the world. Indeed the challenges ahead may even surpass those of the past scientifically, technologically,

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institutionally, politically and internationally in both cases.

That being said, I would like to share with you this morning some thoughts on the future of the international nuclear enterprise and challenges we all face going forward. The nuclear enterprise includes not only nuclear energy for generating electricity but also application of nuclear science and technology that includes a myriad of commercial, medical and scientific uses of radiation and radioisotopes.

Let me first touch upon the application of nuclear science and technology that benefits most of us in our daily lives.

There are commercial products such as tritium exit-signs, smoke-detectors, and packages sterilized by radiation to keep items such as medicines safe for the user. There are various industrial applications such as radiography and the use of isotopes to determine the level of liquid in products and radiation processes for manufacturing radial tires, semiconductors and other industrial products.

In agriculture, radiation-induced mutations have been used to develop hundreds of varieties of field crops including flowers and fruits. Pre- and post- harvest pest-control utilizing radiation is now being used in over 30 countries for overcoming pests problems related to food and food products, including spices, fruits and chickens.

In medicine, as we all know, radiation and radioisotopes are used for diagnosis, cancer therapy, drug testing, and in medical products such as pacemakers.

Radiation and radioisotopes are used extensively in many fields of basic research, including nuclear-particle physics, materials and life sciences, isotope hydrology to support the integrated management of water resources related to ground or surface water, land resources and coastal zones, and such esoteric areas as the dating of artifacts and the dating of sediments cores for determining the history of environmental pollution.

In space exploration, radioisotopes are used to power both space vehicles and equipment. Indeed, without them, deep space exploration would be impossible today.

I am sure that you can sense from this rather quick overview that the quality of modern life enjoyed is in no small measure supported by radiation and radioisotopes applications. I believe, therefore, that the global nuclear community should do their best to develop more advanced and wider application of radiation and radioisotopes and, considering the overwhelming nature of development needs in the global community, mediate between developed countries and developing countries to work together to enhance acceptability, accessibility and affordability of these nuclear technologies for development.

Next I would like to look at where we are with nuclear energy. Nuclear power has been used to produce electricity for public distribution since 1954. Currently 30 countries operate 439 plants with a total capacity of 372 GWe which produced 2,608 TWh of electricity during 2007, that is approximately 14% of the world's electricity supplies and approximately 6% of total energy used worldwide. Furthermore, 34 units, totaling 28 GWe are under construction as of June 2008.

The contribution of nuclear energy to total electricity generation varies considerably by region. In Western Europe, nuclear generated electricity account for almost 30% of total electricity. In North America and Eastern Europe it is approximately 18%, whereas in Africa and Latin America it is 1.8% and 2.6%, respectively. In the Far East, nuclear energy account for 11.5% of electricity generation; In the Middle East and South Asia it accounts for 1.6%. There are no nuclear power plants in Southeast Asia and the Pacific region, so nuclear accounts for no electricity generation in these regions.

Commercial nuclear power is over 40 years old and about three quarters of all reactors in operation today are over 20 years old, and one quarter is over 30 years old. Through plant life management programmes many plants have had their original operational period extended to allow continuing operation for up to 20 additional years.

The industry now has more than 13,000 reactor years of experience and has become a mature industry with world-wide positive trends in industry safety records, particularly since the accident at Chernobyl. The improved availability and safety records are, in part, attributable to increased information sharing on best practices and lessons-learned in the industry, through implementation of risk- informed regulation, industry consolidation and international infrastructure in place such as the Operational Safety Review Team (OSART) Program of the IAEA and the peer review and technical support and exchange activities of the WANO to ensure continued progress in safety and international cooperation.

The manufacturing of fuel for reactors and the management of the fuel after use, or the fuel cycle requires several steps: they are normally divided into front-end activities including mining, conversion, enrichment and fuel fabrication to produce fuel assemblies to be inserted in the reactor and back-end activities to manage the spent nuclear fuel including storage, reprocessing and waste disposal.

Uranium mining takes place in 18 countries, with 7 countries accounting for 90% of world capacity. Currently 40% of uranium needs are covered by secondary supplies - stored uranium or ex-military material- and recycled materials. This has kept the uranium prices low, though recently the price has increased substantially in anticipation of increasing demands and reducing secondary supply.

Radioactive waste is generated at different stages of the fuel cycle and is classified as low, intermediate or high level waste. The treatment, conditioning and storage of all kind of waste are mature technologies. Storage periods of 50 years or more are not unusual. Disposal of low and intermediate level waste is done on an industrial scale in several countries as you can also see at the large-scale but tidy facility in Rokkasho-mura. It is now widely accepted among technical experts that the technologies used fulfill safety requirements.

The method of final disposal of high level waste and spent nuclear fuel is likely to be in deep geological repositories. Finland, Sweden and the USA are well advanced in their development, though none is likely to be in operation before 2020 as several decades are necessary to determine the sit and develop geological repositories there.

Then, what about the future of nuclear energy? The Intergovernmental Panel on Climate Change (IPCC) concluded in its Fourth Assessment Report released in 2007 that most of the observed increase in global mean temperature since the mid-20th century was very likely due to the increase in global atmospheric concentration of greenhouse-gases of human origin. This report then stated that in order to limit global mean temperature increases to the minimal acceptable level of 2.0 - 2.4°C above pre-industrial, greenhouse effect-gas emissions should peak within 10 years and should be around 50% of the 2000 level by 2050.

The International Energy Agency (IEA) made an estimate of a combination of measures that would attain this requirement, of which estimate included restraint of growth in the use of conventional fossil energy as well as rapid expansion in the use of renewable energy, nuclear energy and carbon-dioxide capture and storage (CCS) technology for fossil energy uses, in addition to significant energy conservation and energy efficiency improvement. In this estimate, world electricity demand in 2030 is about 160% of the current level and the amount of nuclear power generation reaches about 2.4 times the current level, accounting for about 12% of the total primary energy demand.

We know from the past experience that to achieve this amount of nuclear power generation in 20 years or so will require a great deal of effort as many factors will influence the actual outcome. These factors can be broadly categorized as technical, economic, infrastructural, social and political with many elements falling in more than one category forming a complex matrix of challenges to the future of nuclear energy. I would like to stress, however, that the overarching goal of our effort for this achievement is to establish and maintain public confidence in nuclear energy at strategic, programmatic and operational levels.

The action to be taken at the strategic level is to establish and maintain mutual understanding with the public about the characteristics of nuclear energy in the three dimensions of sustainable development, namely, economy, environment and society, so that nuclear energy is appropriately chosen in any energy strategy. Important characteristics to be shared with the public in the economic dimension are competitive energy production cost and its stability of supply. Those in the environmental dimension are the assurance of low human health impact, small volume of waste production and rarity of severe accidents that contaminate the land on a large scale, and those in the social dimension are the assurance in low neighbor disturbance, nuclear nonproliferation and long-term safety of radioactive waste disposal.

In order to establish and maintain such understanding, however, we are required at the programmatic level to take actions to assure that nuclear power plants and its fuel cycle facilities have, as a system, the afore-mentioned characteristics in the three dimensions of sustainable development. In the social dimension, as the association of nuclear technology with destructive capabilities is a major concern in the public perception of all things nuclear, effort towards nuclear disarmament, non-proliferation and nuclear security remains crucial to the public perception of nuclear technology.

Therefore, it is utmost important for global nuclear community to reinforce efforts to expand the effectiveness and efficiency of nuclear safeguards by universalizing comprehensive safeguards agreements with the IAEA and Additional Protocols, on the one hand, and pursuing more effective and efficient verification activities of the IAEA utilizing state-of the-art technologies and high caliber staff, in cooperation with nuclear vendors embedding safeguards features directly and deeply into their facility designs, systems and components.

Although past initiative for multilateral nuclear cooperation did not result in any tangible results mainly due to lack of sophistication from my viewpoint, we should continue to nurture these considerations as a possible multiplication of nuclear facilities over the next decades may well produce an environment more conducive to multilateral assurances of nuclear fuel cycle services.

One of the outgrowths of the experience of 9/11 has been a heightened focus on security at critical infrastructure of all types, including nuclear plants. Many countries have taken steps to prevent terrorists from causing a significant nuclear release. The IAEA actively helps member countries to enhance nuclear security through capacity-building activities such as training, regulation development, exercise reviews and more. Over time, with the Agency's technical support, international community should negotiate binding agreements that set effective global nuclear security standards.

At the same time, it is imperative not to lose sight of the importance of promoting innovation of technologies as it will be key for sustaining the competitive position of nuclear energy among various energy technologies over time. In this respect, it is important for us to pursue the research and development of fast breeder reactors and its fuel cycle technology, aiming to achieve an advanced fuel cycle system, and that of technology for non-electrical application of nuclear heat, as they can make it possible for global community to utilize nuclear energy over a long time. In order to promote these research and development activities in effective and efficient ways, international cooperation should be even more actively pursued through multilateral frameworks such as the Generation IV International Forum (GIF), Global Nuclear Energy Partnership (GNEP), cooperative research and development frameworks of the IAEA and other international organizations.

As the devil is in the details, it is equally important for us to work hard at the operational level: each individual plant operator as well as the nuclear community as a whole are required to make it sure that desired features of their nuclear energy systems are maintained through appropriate quality management activities and business risk assessment activities that include the review of the adequacy of preparation for undesired events.

Philosopher George Santayana once observed that those who do not learn from the past are condemned to repeat it. We should exploit the knowledge that can be gained from careful and thorough efforts to learn from existing operations, and, at the same time, we should make a strong international feedback system of operating experiences accessible to those countries with limited experience or only one or a few nuclear plants, as national feedback systems in such countries will clearly not suffice.

Lastly, I would like to stress the importance of cooperating with newcomer countries which have no past experience with nuclear power and have recently expressed interest in building nuclear power plants to put in place the necessary infrastructure, such as legal and regulatory capability, educated and trained manpower, a stable electrical grid, access to financial and industrial resources, and the nurturing of an appropriate safety and safeguards cultures in the generating entity, that can guarantee continuing attention to safety, security and safeguards for a period as long as a century or more.

As a bright future of nuclear energy depends on all those who want to use its benefits to get it right every time, I believe that international nuclear community should not spare its effort to assist such countries in light of the substantial challenge that establishing such infrastructure will present to a new entrant.

In conclusion, the nuclear landscape is changing. Although we are now entitled to be proud of our nuclear technologies that are serving our communities and countries, whether this technology will do so well in the future depends very much on the success of international cooperation and approaches to cultivate and maintain mutual understanding with the public on the effectiveness of the uses of nuclear energy and nuclear science and technology for sustainable development of the global society. So let us move wisely, expeditiously and together in cooperation aiming at ensuring that the uses of nuclear energy and nuclear science and technology are available for the benefit of humankind and the environment in the future.

Finally I wish you all have a wonderful time in Aomori and look forward to continued cooperation and success, not only in the Pacific Basin but throughout the world.

Thank you very much.