Japan's Policy for Sustainable Development and Utilization of Nuclear Energy for Future Energy Security[1]

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Thank you Mr. Chairman for your kind introduction. Good morning Ladies and Gentlemen. It is my great pleasure to be invited to this symposium and to talk about Japan's nuclear energy policy.

Today, first, I touch on the role of the Atomic Energy Commission specifically for the participants from oversea countries to have some sense. Then, I talk about energy situation including nuclear power generation in Japan. After that, I would like to focus my talk on our nuclear energy policy mainly based on the "Framework for Nuclear Energy Policy" which we decided about a year ago. In connection with this issue, I would like to extend my talk on present status to realize our nuclear energy policy. Then, I also very briefly touch on international cooperation in the development of nuclear energy and transparency of its peaceful use. Finally, I summarize my talk briefly.

Before I talk about the role of the Atomic Energy Commission, I would like to touch on the Atomic Energy Basic Law. The Atomic Energy Basic Law sets it in 1955 as a fundamental principle for Japan to pursue the research, development and utilization of nuclear energy based on her own initiative under democratic management, strictly limiting them to peaceful purposes and ensuring safety, make the results public, and contribute through these activities to international community willingly. This Law also stipulates that the objectives of promoting nuclear activities are to secure energy resources in the future, to pursue the progress in science and the promotion of industries, and thus contribute to the welfare of human society as well as to the elevation of the national living standard. The Atomic Energy Commission, AEC, was founded in 1955, and one of the roles of the Commission is to plan, deliberate and decide a long-term program for research, development and utilization of nuclear energy. The Commission decided new "Framework for Nuclear Energy Policy" in October, 2005. Another mission of the AEC is to check the progress along the program or framework and to give advice to the related organizations if necessary.

Now, I move on topic of energy situation putting emphasis on electricity generation in Japan. The annual amount of primary energy supply becomes 3 times for the last 35 years. Before the first oil crisis, more than 90% of the primary energy was supplied by oil and coal. However, nuclear power and natural gas have been adopted increasingly and share about a quarter of the total energy sources at present. On the other hand, oil shares nearly a half of the total now. Another point which I would

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like to tell you is the ratio of electricity consumption to primary energy supply, which has increased from less than 20% to 40% in the same period. Japan, other countries as well, faced the first oil crisis in 1973, and tremendous efforts were initiated to construct numbers of nuclear power plants, and today, the total number of nuclear power plants in operation is 55 with total installed capacity of nearly 50,000 MWe. Nuclear power contributes to one third of the total annual electricity generation at present although it supplied only 2.4% of the total in 1973. On the other hand, the share of oil for electricity generation decreased from 71% to 10% in the same period. 55 nuclear power plants in operation are located widely in Japan. Furthermore, 3 plants are under construction, 4 plants are under safety review by the licensing authority and another 7 plants are in preparation for the application permit.

Japanese Government enacted “Energy Policy Basic Law” in 2002 and the Ministry of Economy, Trade and Industry, METI, established “Fundamental Energy Plan” in 2003 following the law. There are three principles required for energy sources in the future described in these law and plan. These are stable supply, harmonization with global environment and economical competitiveness. As concerns stable supply of energy, energy resources in Japan are very limited, in fact, the energy self-sufficiency in Japan is only 4% mainly supplied by hydro-power, and it becomes 19% at most even if nuclear energy is included. Therefore, Japan has to import nearly 100% of fossil fuels and uranium, and this is a very keen issue for stable supply to Japan. As for oil, we import nearly 90% of the total quantity from Middle East countries where are not always stable from the political point of view. Japan wish to diversify countries where can supply oil to us. Concerning natural gas, most of the supplier countries are politically rather stable, but the quantities of production or supply are being decreased. As concerns coal and uranium, we can import them from developed countries or politically stable countries. However, there is some fear for future of obtaining uranium because of its limited resources. Japan has been devoted to develop and utilize renewable energy such as wind power, solar energy. The present installed capacities of wind power and solar energy are about 1100 MW and 1400 MW, respectively, in Japan. As you know, however, these contributions to the total electricity generation are very small and furthermore electricity generation by them is unstable.

As concerns harmonization with global environment, one of the issues is global warming caused by increase of atmospheric concentration of CO_2, methane, etc by emission of these gases. The other issue is emission of nitrogen oxide NOX and sulfur oxide SOX and small cinders produced by burning of fossil fuels, which bring acid rain to make trees die and asthma to people. According to amount of lifecycle CO_2 emission for each electricity generation source, nuclear energy, hydro-power and renewable energy do not emit CO_2 in electricity generation process, however, CO_2 emission by use of fossil fuels and electricity during fabrication of parts, construction of plant, transportation of various materials, etc. should be taken into account. An amount of CO_2 emission per kWh by fossil fuels is larger by more than ten times than that by nuclear energy and renewable energy, in which solar energy emits the largest amount of CO_2. Electricity generation by nuclear

energy contributes to reduction of total amount of CO_2 emission by about 15% in Japan.

As for economical competitiveness, the METI evaluated electricity generation cost for various energy sources in Japan. The plant operation period of 40 years, load factor of 80% are assumed and fuel prices in 2002 are taken for cost estimation. Nuclear fuel recycling is taken into account for nuclear energy. Electricity generation cost by nuclear energy is the cheapest among them and a half of that by oil. The electricity generation cost by fossil fuels, especially by oil, becomes much higher in the present time due to recent enormous rise of fuel price. Therefore, it is concluded that nuclear energy satisfies these three principles, and, it is appropriate to aim at maintaining or increasing the current level of nuclear power generation of 30 to 40 % of the total electricity generation in the Framework for Nuclear Energy Policy. In order to achieve this, the Framework adopts the following guidelines for promotion of nuclear power generation in the future.

In the first place, the existing light water reactors (LWRs) should be used efficiently and as long as possible, possibly 60 years as their life time on the premise of ensuring safety, and strenuous efforts in constructing new plants under planning should be continued on the basis of understanding and consensus of the public. With respect to replacement of the existing LWRs starting around 2030, advanced model of the current LWRs should be developed in accordance with demand outlook. Then, fast breeder reactors (FBRs) should be hopefully introduced in the market from around 2050. The timing of introduction of FBR system into the market much depends on success of the development of FBR system with economical viability as well as safety, reliability, proliferation resistance, and so on. If I draw illustrative image of mid- and long-term prospect of nuclear power generation in Japan based on the guidelines which I described, most of the existing LWRs will be operated until 2030 to 2040, and replaced with advanced LWRs, and fast breeder reactors may be introduced from around 2050 gradually.

Research and development of advanced or innovative reactors for electricity generation and / or process heat production, hydrogen production, for example, are also recommended to promote in the Framework for Nuclear Energy Policy. If I mention an example, that is HTTR hydrogen production demonstration facilities. The HTTR is a high-temperature helium gas-cooled test reactor, which has already produced high temperature helium gas of 950℃ at reactor outlet. Hydrogen production will be made by utilizing such a high temperature heat through hot gas duct.

The radioactive waste management and disposal are also very important issue. Our policy for radioactive waste management and disposal is as follows. The management and disposal of radioactive wastes shall be implemented by the organizations which have produced and will produce radioactive wastes and should be implemented safely, rationally and cost-effectively. In this process, mutual understanding with the public and inhabitants in the site is essential.

Now, I would like to describe the current status and plan to realize our nuclear energy policy, I may say in other words, to establish nuclear fuel recycling. Japan adopts fuel cycle for LWRs, namely, to reprocess LWR spent fuels and use recovered plutonium in LWRs until FBR system becomes commercial. I would like to summarize the current status and plan of nuclear fuel cycle related facilities in Japan. We have Rokkasho uranium enrichment plant in operation. As concerns interim storage of spent fuel, Recycling Fuel Storage Center will be constructed at Mutsu-city, Aomori prefecture by 2010. We have Rokkasho reprocessing plant with capacity of 800 tons per year, and its substantial operation already started and official commercial operation will start next year. The MOX fuel fabrication plant will be constructed also at Rokkasho by 2012. As concerns plutonium utilization in LWRs, the utilities have planned to start to use plutonium in 16 to 18 LWRs by 2010. Currently two plants are in preparation of MOX fuel fabrication, another three plants are under safety review by licensing authority. As concerns spent fuel reprocessing, about 7000 tons of spent fuels have been reprocessed in UK and France, and 1000 tons reprocessed in Tokai plant. From now on, Rokkasho Plant is used for reprocessing of spent fuels from commercial reactors.

As for FBR system development, we have experimental reactor JOYO and prototype reactor MONJU. For the development of commercial FBR systems which contain not only reactor itself but also associated reprocessing of spent fuel and fuel fabrication, the feasibility study has been made for several promising FBR systems for the last several years. The evaluation on the result of the feasibility study by the special committee under the MEXT has completed and the most promising candidate with various innovative concepts is selected. That is a loop-type sodium–cooled fast breeder reactor associated with advanced proliferation resistant aqueous reprocessing system. Basic design of this commercial FBR system and confirmation tests of its technological feasibility will be performed for another ten years.

As regards radioactive waste, low-level radioactive waste disposal has been performed in the site at Rokkasho village. Geological investigation for disposal of relatively higher radioactive wastes is progressing in the same site. As for high-level radioactive waste disposal, the implementing entity, Nuclear Waste Management Organization of Japan (NUMO), was founded in 2000 and offers for public preliminary investigation areas. The site for repository construction will be selected among the areas for detailed investigation around 2025 and the operation will start around 2035.

As for international cooperation in the development of nuclear energy, Japan participates in the various collaboration framework such as GIF / Generation IV, INPRO, ITER in the fusion field, etc. Here, I would stress on transparency of utilization of nuclear energy and nuclear material in Japan. In the first place, nuclear activities are strictly limited to peaceful purposes as I already explained. Furthermore, Japan declared to the international community in 1967 that we, Japan has three principles for no nuclear weapons, that is, no plans to possess, develop or allow nuclear bombs on its soil. Secondly, Japan concluded Full Scope of Nuclear Non-Proliferation Treaty (NPT) and has

actively made efforts to strengthen it, and also accepted safeguards by IAEA to keep transparency of all of the nuclear activities in Japan. The IAEA appreciated our full transparency of nuclear activities and applied the integrated safeguards to Japan. Thirdly, specifically as for transparency of plutonium utilization, we report annually plutonium inventory to IAEA, and the Atomic Energy Commission also established the special plutonium guideline to the users. I would say that the nuclear test and possession of nuclear bombs by North Korea are absolutely unacceptable neglecting such great efforts for nuclear non-proliferation by international community as well as Japan.

Let me conclude my presentation. The Energy Policy Basic Law sets it as three principles of stable supply, harmonization with global environment and economical competitiveness for Japan to pursue future energy security. Nuclear energy clearly satisfies these three principles as one of the major energy sources. The Atomic Energy Commission decided that it was appropriate to aim at maintaining or increasing the current level of nuclear power generation of 30 to 40% of the total electricity generation. In order to achieve this, continuing utilization of LWRs while replacing the old ones with advanced ones in the first half of this century is indispensable, and switching to FBR systems is desirable from around 2050. Meantime, research and development of advanced or innovative reactors for electricity generation and/or process heat production are recommended. In order to pursue sustainable utilization of nuclear energy, Japan has been and is being devoted vigorously to develop and construct comprehensive nuclear fuel recycling systems including FBR system. Some works are in progress collaborating with international framework such as GIF. The utilization of nuclear energy must be strictly limited to peaceful purposes and transparency of plutonium utilization and nuclear non-proliferation are essential factors as Japan has shown ever since the beginning.

Thank you for your kind attention.