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Japanese approaches in meeting the requirements of the Kyoto Protocol

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1. Stable Energy Supply

Japan started nuclear power generation in 1966 under the Atomic Energy Basic Law. The law strictly limits the development, research and use of nuclear energy to peaceful purposes. The importance of nuclear power as an energy source has been growing since the nation does not produce coal, petroleum and natural gas to meet the increasing energy demands from its economic activities.

Nearly 80% of Japan's total energy supply is dependent on imports. In 1970 petroleum imported mainly from the Middle East supplied 77% of total energy supply. As a result of the Middle East oil crisis in 1973 and 1978, the construction of nuclear power plants has been accelerated to ensure a stable energy supply, with new reactors being started up at an average rate of 1.5 units per year. The share of nuclear power in the annual energy supply has been expanding year by year, from 2% in 1973 to 13% in 1999. As of 1999, 51 commercial nuclear power generation units supplied the nation with 316.5 billion kWh, or 34.5% of total power output of 917.6 billion kWh. As of 1999 the share of petroleum dropped to 52% of the nation's total energy supply.

Notwithstanding the economic depression since the 1990s, Japan's energy consumption, particularly in the household and commercial sector, is still increasing. The energy consumption in 1999 in these sectors grew by 11.9% and 12.7% respectively since 1990.

The world's energy consumption is projected to be nearly double by 2010 in comparison with that in 1990 due to population increases and economic growth in developing countries. World energy reserves are not sufficient to meet such rapidly growing energy demands. The technological development of new renewable energy sources, such as photovoltaic and wind power, has not yet reached the stage where it can substitute any existing energy sources.

2. Reduction of CO₂ under the Kyoto Protocol

At COP6 of the UNFCCC (UN Framework Convention on Climate Change) in 1997 in Kyoto, industrial countries ("Annex 1 countries") agreed to reduce greenhouse gas (GHG) emissions. A reduction target for the years 2008 to 2010 was set at 6% for Japan on a basis of the 1990 level. Since 80% of GHG emissions from Japan are CO₂ originating from fossil energy consumption, the government introduced a plan to reduce CO₂ emissions to the level of 1990 by 2010. As part of important measures to meet this target, the Energy Agency publicized a policy to build 20 more nuclear power generation units.

In view of the current increase in energy consumption in the transportation, commercial and household sectors, even with 20% more nuclear power plants, reduction of CO₂ by 2010 will be difficult to achieve unless innovative technologies are developed and drastic energy savings by the public at large are implemented. The government has reinforced its policy of reduction measures. Plans to introduce renewable energies, such as solar, wind power, biomass and photovoltaic energies have been strengthened. Manufacturers are now required by law to produce energy efficient automobiles, electric appliances and building materials. The expansion of the use of natural gas is also considered an effective measure to reduce CO₂ emissions. However, while nuclear power still plays an important role in implementing the GHG reduction target, there is little prospect of 20 more nuclear generation units being built by 2010.

3. Public Mistrust of Nuclear Power

The Three Mile Island accident in 1979 and the Chernobyl accident in 1986 caused serious concerns about the safety of nuclear generation all over the world. Because of public opposition to nuclear energy and its lack of cost competitiveness, some countries in Europe and the United States which had been engaged in nuclear generation retreated from the construction of new or additional nuclear power plants.

In Japan, in association with the experiences of massive radiation injuries from the atomic bombs in Nagasaki and Hiroshima in 1945, accidents at Three Mile Island and Chernobyl resulted in public apprehension and unease about the safety of nuclear power. In addition, public mistrust of nuclear power is growing as a result of recent nuclear power plant accidents such as a fire at a nuclear power plant, the sodium leakage accident of the fast breeder reactor Monju and falsification scandals in relation to MOX fuels. In particular, the criticality accident in 1999 at a uranium-processing plant operated by JCO Co Ltd in Tokai Village (“JCO criticality accident”) has significantly increased the level of public mistrust of government policy towards nuclear energy and the safe operation of the nuclear power industry. Since the Monju sodium leakage accident in 1995, it has become extremely difficult to construct new nuclear facilities and the government plan to build 20 nuclear power units has no prospect at this stage. The government currently expects to start operation of 10 to 13 new units by 2010. However, it might be very difficult to build more than ten units unless the public accepts government policy and understands the importance of nuclear power in implementing greenhouse gas reductions and in securing a stable energy supply.

4. Japan's Nuclear Policy in Coming Years

In spite of the unfavourable circumstances facing nuclear energy, Japan does not have a wide range of choices for the immediate future. With respect of energy security, as noted earlier, Japan is poor in energy resources and dependent on foreign suppliers for most of its energy requirements. It is also susceptible to world energy market or supply cutoffs. In addition, Japan is an island country that cannot exchange energy supplies with other neighbouring countries through transmission lines and pipelines.

In order to provide for all contingencies, every effort should be made to diversify energy sources and to ensure stable supplies of energy. It will take a long time for renewable energy sources to replace other energy sources, including nuclear. Even under the strengthened government policy to promote renewable energies, they are expected to supply only 3% of total energy supply by 2010, while nuclear energy currently supplies 13% and is expected to provide 15% of the total energy supply or 42% of electricity in 2010. Nuclear energy is a stable and reliable source of energy for this period.

With respect to global warming, the development of innovative technologies to improve energy efficiency and energy saving activities should, of course, be promoted in order to reduce CO₂ emissions. The new government's energy policy promotes various energy saving technologies,

such as clean energy cars, fuel cells and natural gas cogeneration. These technologies are expected to save about 14 million kl of oil in 2010, while nuclear power generation supplied energy equivalent to 77 million kl of oil in 1999. For the next twenty or thirty years there is no real prospect of being able to find a substitute for nuclear energy, which discharges practically no CO₂.

To secure a stable energy supply and to cope with global warming, nuclear energy seems to be an inevitable choice. However, as described above, the policy to promote nuclear energy currently has reached a stalemate due to public mistrust. It has become very difficult for nuclear power generating companies to get approval from local government for siting nuclear facilities. In some cases local residents have requested a local referendum. Recently, a referendum at Kariha Village turned down a plan to load MOX fuel in a light water reactor. This incident has affected adversely all projects in Japan to use MOX fuel as part of the nuclear fuel cycle. It is impossible for the government and power generating companies to promote nuclear power generation unless their plans are accepted by the public.

5. Issues to be Resolved to Promote Nuclear Power

There are many crucial issues to be resolved as a prerequisite to gaining public acceptance. Amongst others, the following are major issues that have been discussed at the Council under the Nuclear Energy Commission:

- The disposal of high level radioactive wastes.
- Safety and economic efficiency of nuclear power generation.
- Public acceptance.
- The necessity of the nuclear fuel cycle.

First, the disposal of high level radioactive wastes

While nuclear power generation began more than thirty years ago, the policy for the disposal of spent fuel has been discussed only recently. The government has been criticized for its slackness. As a result of recent studies, the government decided that the high level radioactive waste remaining after reprocessing should be vitrified and buried underground by the geological disposal method.

The Legislature enacted the Law on Final Disposal of Designated Radioactive Waste in 2000. This law provides for the establishment of an implementing organisation for disposal, the procedure for the selection of a disposal site and the collection of disposal costs from electricity charges. The geological disposal operation is expected to start around 2030. Public concerns have been expressed about the safety of geological disposal and some residents' groups are opposing even the construction of facilities for deep geological disposal.

Second, the safety and economic efficiency of nuclear power generation

The Atomic Energy Commission is charged with formulating nuclear policies, including the use of nuclear energy, under the Atomic Energy Basic Law. It has published long-term programmes for research, development and the utilization of nuclear energy since 1956. In May 1999 the Commission organised a 'Council' to formulate a new long-term programme. Unlike previous long-term programmes, this new programme was discussed in the face of public mistrust of the government's nuclear policy. From the outset of the discussions at the Council, the building of public trust in nuclear energy was a central issue. To restore public trust it is essential to ensure nuclear safety.

The Council discussed the responsibilities of central and local government and of the nuclear industry to secure the safe operation of nuclear facilities. Immediately after the JCO accident, the central government strengthened safety regulations including amendments to the Nuclear Reactor

Regulation Law. The Special Law of Emergency Preparedness for Nuclear Disaster was enacted to prepare for emergencies in the case of a nuclear accident.

The Council also discussed the economic efficiency of nuclear power generation. Nuclear power generation has been criticized for its high costs including those for high level radioactive waste disposal and for dismantling nuclear reactors.

Third, public acceptance

Apart from safety and economic efficiency, the Council discussed measures to restore public trust and to promote acceptance. These measures included information disclosure, two-way communication with the public, proper education on energy and nuclear issues, public participation in the policy-making process, the understanding and co-operation of residents in local siting communities, etc.

Fourth, the nuclear fuel cycle

Japan has adopted a policy for the nuclear fuel cycle under which spent fuel from nuclear power plants is reprocessed, and recovered plutonium and uranium from spent fuel are burned as fuel in fast breeder reactors. The purpose of the nuclear fuel cycle is to use uranium resources in a more effective and efficient way. While most spent fuel has until now been sent to overseas reprocessors, in future it will be reprocessed increasingly at a commercial reprocessing plant now under construction in Rokkasho village in the northern part of Japan.

Fast breeder reactor research has been conducted at the experimental reactor Joyo. The prototype reactor Monju has been shut down because of a sodium leakage in 1995. The Council recommended continuation of research and development on fast breeder reactors to increase the efficiency of uranium utilization. There are, however, concerns about safety and nuclear proliferation since nuclear fuel cycle technology produces plutonium. There are also doubts about the economic efficiency of research and development of the fast breeder reactor.

The Council submitted the draft of the 9th Long-Term Program to the Atomic Energy Commission after holding public hearings and receiving public comments on the interim draft for the programme. The Commission adopted the draft programme and reported to the Cabinet on 24 November 2000. In the Program the Commission maintains the policy of promoting nuclear power generation and the nuclear fuel cycle. However, it also clearly pledges to make all efforts to gain public acceptance by improving the transparency and accountability of its administration. The Commission attaches great importance to dialogue with the public in order to have its policy understood. Even those people who oppose the government's nuclear policy appreciate such a change in the attitudes of the Commission. The democratic change in approach to the public may affect the substance of the future nuclear policy.