Framework for Nuclear Energy Policy

(Tentative Translation)

October 11, 2005

Japan Atomic Energy Commission

October 14th, 2005

Resolution of the Cabinet Meeting for the "Framework for Nuclear Energy Policy" of the Atomic Energy Commission

The Government decides to respect the "Framework for Nuclear Energy Policy", which was decided by the Atomic Energy Commission on October 11th, 2005, as a basic principle for the nuclear energy policy and promote research, development and utilization of nuclear science and engineering.

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Introduction

According to the Atomic Energy Basic Law, the goals of research, development and utilization of nuclear science and engineering in Japan, are, strictly limiting all activities to peaceful purposes and placing the greatest importance on safety, to secure energy resources for the future, to promote science and industries, and thereby, to contribute to the improvement of welfare of society and the living standard of people, based on the premise of safety assurance. The Atomic Energy Commission has formulated a total of nine long-term plans for research, development, and utilization of nuclear science and engineering (hereinafter referred as "long-term plans") approximately every five years since 1956, with an aim to contribute to the systematic implementation of national policies to achieve these goals. The current long-term plan was formulated in November 2000.

Research, development and utilization of nuclear science and engineering includes those related with advanced and big science and engineering that require a large amount of investment, and they are to be pursued with the support of scientific and technological researches outside the realm of nuclear science and engineering and other diverse industrial activities, as well as with the understanding of the people. Thus, in order to achieve the above-mentioned goals of research, development and utilization of nuclear science and engineering, the Government needs to play a significant role by promoting research and development activities and providing regulations, guidance, financial measures, etc.

The administration of research, development, and utilization of nuclear science and engineering or nuclear energy administration, abridged, has been executed based on the long-term plans of the Atomic Energy Commission, which was transferred to the Cabinet Office as a part of the Government reorganization in January 2001. The Commission annually formulates basic concepts of necessary measures to achieve these goals based on the long-term plans, and the relevant administrative authorities have planned, implemented, and evaluated necessary measures to materialize these concepts.

Based on the prospect of domestic and international situations involving the research, development and utilization of nuclear science and engineering in Japan over the next several decades and on the recognition that it is necessary to promote short, medium- and long-term approaches in an integrated manner as the Japanese society is facing an era of change, the Commission has decided to formulate a new policy plan targeting the period over next ten years. In June 2004, the Atomic Energy Commission set up for this purpose a New Nuclear Policy-Planning Council (hereinafter referred as "Planning Council") comprising not only leading experts in the nuclear energy field but also leaders and well-informed persons from various sectors of society, including academia, business, legal professions, local governments, mass media and non-governmental organizations, in addition to the Commissioners.

The Atomic Energy Commission, which was transferred to the Cabinet Office in 2001, is expected to provide basic policy guidelines for the ministries and agencies to implement nuclear energy policies, taking into consideration that the Government has formulated both the Basic Energy Plan and the Science and Technology Basic Plan which embody the objectives of energy policies and science and technology policies and are closely related to nuclear energy policies. Therefore the new policy plan was designed in the form of a framework for nuclear energy policy which specifies basic concepts of nuclear energy policy or measures to be taken by the government concerning research, development and utilization of nuclear science and engineering and guidelines for planning and promoting such measures

at the administrative level, and express expectations for local governments and business entities that are closely related to nuclear energy administration as well as for the people at every level, whose understanding is indispensable to the implementation of nuclear energy policies.

Discussions were basically conducted at the Planning Council, regarding it important to draw a conclusion based on a comprehensive viewpoint. The Council focused its discussion on the nature of future approaches based on the evaluation of the current status of the implementation of existing long-term plans by priority issues, giving due consideration to the internal and external changes. The results were compiled in a series of Interim Reports/Summary Reports. The Council started out with the deliberation of the basics, reflecting on the way to respond to the expectations of the people, analyzing the current conditions that those involved in the research, development and utilization of nuclear science and engineering in Japan cannot yet successfully deal with apprehension and distrust among people due to a series of accidents and improper activities. When there were various opinions on a specific topic, the Council gave fair deliberations to each of them and tried to reflect the results in the Summary Reports and other documents. Moreover, as far as discussions on both nuclear fuel cycle policies and international issues are concerned, the Technical Subcommittee and Working Group on International Issues were established to work out the points of discussions about the technical matters for the Council.

Based on the Summary Reports and others, the Planning Council finally set forth a framework for policies to be followed for drafting a new plan and compiled a document titled “Components of a New Plan,” on which the Council asked public opinion and received 758 opinions from 393 citizens. The Council continued the deliberation taking these opinions and compiled a preliminary draft of the Framework for Nuclear Energy Policy. The Atomic Energy Commission asked the public to comment on the draft and held Public Hearings at five different venues. The Council finalized the draft, taking the 1717 opinions from 701 citizens thus gathered into the consideration.

Discussions at a total of 31 Planning Council meetings, Technical Subcommittee meetings (six in total), meetings of the Working Group on International Issues (three in total) and public hearings on the long-term plan, held along with the Planning Council (21 in total), were all open to the public. In addition, documents circulated at the meetings and the conference minutes were published on the Atomic Energy Commission’s web site, in an effort to achieve maximum transparency.

In the following, Chapter 1 specifies the basic objectives to be pursued in the research, development and utilization of nuclear science and engineering in Japan, analyzes current situations, and presents common principles for future approaches. In Chapters 2 through 6, presented are the basic concepts of the future approaches for each main policy area, taking into consideration of these common principles.

The Atomic Energy Commission expects that the research, development and utilization of nuclear science and engineering in Japan will pursue the basic objectives, giving shape to basic concepts for future approaches under the common principles each of which are laid down in the Framework for Nuclear Energy Policy. In doing so, all the personnel concerned in nuclear energy should bear in mind at all times that potential risks lurk in the nuclear facilities, and never overestimate the quality of the potential of nuclear technologies overwhelmed by the phenomenal nature of these technologies. The Atomic Energy Commission strongly hopes that they will carry the burden and expectations the public

has placed on them by competing with other energy technologies in the pursuit of better performance, improving themselves by learning from rivals, and reforming the approaches without hesitation whenever necessary over the many years to come.

Chapter 1: Common Principles of Approaches to Research, Development and Utilization of Nuclear Energy

1-1 Basic Objectives

The goals of research, development and utilization of nuclear energy in Japan, according to the Atomic Energy Basic Law, are to secure energy resources for the future, to promote academic progress and industrial advancement and thereby, to contribute to the welfare of society and the improvement of people's living standard, based on the premise of safety assurance, while strictly limiting the activities involved to peaceful purpose. It should be an aspiration to realize the following four basic objectives when planning and promoting various approaches for the achievement of these goals.

1. It is the premises of activities related to research, development and utilization of nuclear energy to assure their safety, to limit them to strictly peaceful purposes, to appropriately manage and dispose of radioactive wastes generated through them, and to realize the coexistence of them with the people of local communities. Therefore it is important to establish and maintain frameworks to assure their satisfaction, of which soundness should be constantly and carefully reviewed so as to maintain their work standards to meet the expectations of the people.

2. The utilization of nuclear energy has been contributing to the stable supply of energy and to measures against global warming per electricity generation in Japan: however, there remains much room for modification and improvement. Thus, in order to increase the degree of contribution by continuously competing and cooperating with other energy technologies, it is important to promote efforts to further enhance its characteristics and overcome issues, which will contribute to the advancement of the academic mission and to the prosperity of the industries during the process.

3. Radiation application technologies are playing a significant role in the areas of academia, industry, agriculture and medicine. It is important to promote efforts to further enhance their characteristics and to continuously overcome issues, so that these technologies will widely contribute to the advancement of the academic mission, to the prosperity of the industries, and to the improvement of the welfare of mankind and living standard of the people.

4. It is important to pursue the implementation of the most effective and efficient government initiatives from the perspectives of not only economic efficiency and social acceptability but also from the viewpoints of the enhancement of public welfare, for nuclear energy research and development activities and the regulations, inducements and fiscal measures for utilization of nuclear energy etc. as well as for those activities which support them as premises.

We evaluate in the following section the current activities concerning research, development and utilization of nuclear energy in Japan toward the realization of these basic objectives and present in section 1-3 common principles to be emphasized in future approaches, based on the evaluation results.

1-2 Current Situations

Regarding the utilization of nuclear energy in Japan, 53 commercial nuclear power plants were in operation as of the end of June 2005. Their total capacity of electricity generation is approximately 47 gigawatts, and their annual output accounts for about one third of national electricity generation, making

nuclear power a key source of electricity in Japan. In addition, steady progress has been observed in nuclear fuel cycle businesses which supply nuclear fuel necessary for nuclear power generation and manage spent fuel as well as radioactive wastes generated. However, due to the occurrence of accidents and other problems, which have negatively impaired the public's trust in nuclear energy, the Government and relevant entities involved in the electric utilities need to work toward the improvement in safety assurance and the restoration of trust among the people.

Construction of nuclear power plants has been inactive abroad following accidents at Three Mile Island in 1979 and at Chernobyl in 1986. Germany and Sweden have decided to gradually phase out their existing nuclear power plants. On the other hand, plans for the construction of new power plants have regained momentum in recent years in, for example, the U.S. and Finland, where construction had been in the doldrums, in light of measures against global warming and for stable energy supply. Moreover, China and India, where demand for electricity is rapidly growing, have been steadily promoting the construction of nuclear power plants.

In the wake of these developments, a new movement in the area of international cooperation in research and development has gotten underway, with the goal of researching and developing next generation nuclear reactors to be used in a society that aims to attain sustainable development from the long-term perspective. The Generation IV International Forum on nuclear energy systems, which represents such efforts, has launched activities looking at the development of innovative nuclear reactor systems, such as fast reactors and very-high-temperature reactors.

Radiation application technologies have been used in the areas of academia, industry, agriculture, medicine, among others, and the utilization of the technologies has been incorporated into the daily activities of people (not to mention the use of radiation to improve the quality of radial tires), contributing to the development of sciences and technologies in a wide area of fields and to the improvement of people's living standard. We expect to realize a radioactive therapy with fewer burdens on the bodies of patients and to utilize radiation in a wider scope of science and technology areas and academia in the future. In order to make these things into reality, it is necessary to conduct not only research and development activities but also provide sufficient explanations to the people about the advantages and disadvantages of the use of radiation, characteristics of radiation, impact of radiation on the human body, etc. so as to promote understanding among the general public.

When implementing policies and measures and evaluating programs and actions that promote research, development and utilization of nuclear energy in Japan in pursuit of the realization of basic objectives mentioned above, one should not only bear in mind these international as well as domestic movements but also give consideration to the following current situations.

1-2-1. Public Trust in the Research, Development, and Utilization of Nuclear Energy Based on the Premise of Safety Assurance

When designing, constructing and operating nuclear facilities, it is necessary to develop and maintain both the safety measures that reliably suppress the risk that the contained radioactive material may pose a health hazard to the general public due to dysfunction or malfunction of the facility, in addition to natural disasters such as earthquakes, and the protective measures that manage the risk of

obstructive or destructive conduct. To this end, the Government has called for the implementation of necessary and sufficient measures to control these risks under the “defense-in-depth” principle of providing multiple layers of protection based on the assumption that “man makes mistakes and machines break down,” and has developed a framework of safety assurance, in which operating entities would voluntarily assure the maintenance of the required measures at quality depicted in relevant standard by conducting quality assurance activities.

In recent years, however, a series of events have shaken the people’s trust: the inappropriate actions at the nuclear power plants of Tokyo Electric Power Company discovered by a series of investigations following the disclosure of improper conduct; the rupture of a secondary steam pipe at the Mihama nuclear power station of Kansai Electric Power Company, which claimed the lives of a number of workers; inappropriate construction of facilities at the Rokkasho Reprocessing Plant; among others. These incidents have greatly reduced the public’s trust in government with respect to the effectiveness of the administration of safety regulations, as well as the operators of these facilities. In consequence, the operation of many nuclear power generation units was suspended and the transfer of spent fuel to the Rokkasho reprocessing plant was halted for a long period of time. This has demonstrated that if the trust of the people is not given to the safety management of operating entities and the safety regulations of the Government, availability of nuclear facilities throughout the country would deteriorates and it would be difficult to play the roles of nuclear power generation expected, such as contribution to a stable energy supply and to the measures against global warming,

Based on these facts, the Government has reviewed the safety regulation system, and at the same time, the operating entities have reviewed their safety efforts out of deep self-examination of the accidents and troubles due to imprudence. Based on these efforts, they have been working on the strict compliance of laws, the improvement of quality assurance systems, the disclosure of information, etc. As 20 commercial nuclear reactor facilities in Japan will have been operating for thirty years in 2010, efforts toward the improvement of measures against aging facilities that were developed so far have begun. Moreover, the Government has performed technical reviews on individual items of safety assessment guidelines, and conducted a systematic improvement of the overall guidelines in a planned manner, in coordination with relevant academic and technical professional societies. In particular, proactive measures are required regarding the guidelines for assessment of aseismic design of nuclear power plants since incessant efforts are necessary to further develop trust in seismic safety, and every possible consideration has been given for the improvement of the relevant guidelines using collected and organized information about the most up-to-date knowledge and other topics. The Nuclear Safety Commission has formulated the Prioritized Plan for Nuclear Safety Research which indicates research needs prioritized in each area including safety of light water reactors (LWRs), nuclear fuel cycle facilities, radioactive waste, management systems, radiation effects which will be useful for the improvement of safety regulation.

The Government and relevant entities need to make efforts to regain the trust of the people by constantly assessing their efforts in view of both domestic and international experiences, by providing the people with explanations about these efforts, and by continuing dialogues, while listening intently to various opinions.

1-2-2 Guarantee of Peaceful Uses

Japan has been promoting research, development and utilization of nuclear energy strictly for peaceful purposes, while having set the goal of eliminating all nuclear weapons and adhering to the "Three Non-nuclear Principles" of not possessing, not producing, and not permitting the introduction of nuclear weapons into Japan, as the only country that suffered nuclear attacks. Japan has ratified the Non-Proliferation Treaty (NPT), and concluded the Comprehensive Safeguards Agreement and the Additional Protocol with the International Atomic Energy Agency (IAEA). In addition, it has developed and improved corresponding domestic safeguards systems. In recent years, Japan has established the measures for the implementation of large-scale safeguards activities at the Rokkasho Reprocessing Plant in cooperation with the IAEA, including the development of the Rokkasho Safeguards Center. For the reprocessing spent fuel from LWRs, Japan developed a proliferation-resistant technology of "co-conversion" which removes the processes of handling plutonium oxide powder at the occasion of the US-Japan joint determination coinciding with the start of the Tokai reprocessing plant. This technology has also been used in the Rokkasho reprocessing plant.

In view of the start of the use of plutonium in the form of MOX (Mixed Oxide) fuel utilization in LWRs (the so-called Plu-thermal) and full operation of the Rokkasho Reprocessing plant, the Government and the operating entities are required not only to re-acknowledge the importance of maintaining the principle of limit-to-peaceful use and observing international norms and treaties, but also to present the public and international community a clear picture of carrying out these commitments.

1-2-3 Management and Disposal of Radioactive Wastes

The generation of radioactive waste is involved in the research, development and utilization of nuclear energy at nuclear power plants, nuclear fuel cycle facilities, test and research reactors, universities, institutes, and medical facilities, etc. that use accelerators, radioactive isotopes (RI) and nuclear fuel materials. It is an essential part of activities associated with the research, development and utilization of nuclear energy to process and dispose of the radioactive waste in such a way as to prevent any significant effects on the human environment.

A disposal business has already been established for most of the low-level radioactive waste (LLW) generated at nuclear power plants and is buried as a private business, excluding part of the LLW. As for the remaining part of the LLW, discussions are under way among concerned parties regarding their treatment and disposal. It is important for the Government and operating entities to promptly clarify their disposal method and to work on the implementation of the disposal, so as not to delay the understanding of the people about nuclear energy administration, which might eventually hinder smooth progress in the research, development and utilization of nuclear energy.

As for the high-level radioactive waste (HLW) which is generated in the process of reprocessing spent fuel, it was decided to dispose of it after being vitrified in a geologic repository and the research and development for that purpose had been conducted mainly by the then Power Reactor and Nuclear Fuel Development Corporation, which was restructured as the Japan Nuclear Cycle Development Institute in October 1998. Based on the results, the Atomic Energy Commission compiled "Basic Concepts for the Disposal of High-Level Radioactive Waste" in May 1998 and the Japan Nuclear Cycle Development Institute compiled "The Second Progress Report on Research and Development for

the Geological Disposal" in November 1999. The Government worked to develop a disposal system taking into consideration these policy guidelines and scientific evidence, and enacted the Specified Radioactive Waste Final disposal Act in June 2000. The Nuclear Waste Management Organization of Japan (NUMO) was created in October 2002 as an implementing body for disposal specified in the Act. In December 2002, NUMO started "Open Solicitation," which induced all municipalities to consider the acceptance of investigating the suitability of their local area for developing a deep repository for HLW. Meanwhile, electric utilities and others have been accumulating funds for the disposal of HLW.

1-2-4. Securing Human Resources for Research, Development and Utilization of Nuclear Energy in the Next Generation

In order to promote research, development and utilization of nuclear energy, while continually working on safety assurance, it is necessary to develop and secure human resources to support the work. However, concerns have been raised over the maintenance of human resources to support the work for the next generation in consideration of the progression of an aging society with fewer children, a foreseeable decrease in population, the anticipated retirement of a large number of skilled labors and engineers, fewer opportunities for building nuclear power plants and a resulting shift of major works to the operation and maintenance of the existing nuclear power plants, and the decline of public and private investment in research and development of nuclear energy in recent years. It is also pointed out that from the perspective of securing diversity, measures should be taken to develop young, women and foreign researchers and to promote their utilization. In order to continue a wide range of activities concerning nuclear energy over many years to come and to develop new possibilities of them, it is crucial to continue to secure excellent human resources.

1-2-5 Coexistence of Nuclear Energy and People/Local Community

In order to promote research, development and utilization of nuclear energy, the understanding and trust of the people and the local community are imperative. It is essential to this end to assure transparency of processes of planning and decision-making of nuclear policies to regulate and induce the activities concerning research, development and utilization of nuclear energy, including discussion on the advantages and disadvantages resulting from them. The Government and operating entities have set up opportunities for dialogues with the local community, and sent personnel to the community to proactively conduct public hearings and publicity activities, in addition to disclose relevant information to the public. Through these activities, they have reflected the opinions of all types of people including those of members of the local community on the policies of their activities. However, the system to promote citizens' participation in the policy-making process that starts from information disclosure is still in its initial stage. Meanwhile, some point out that there are some problems in terms of effectiveness and efficiency in public hearings and publicity activities about the research, development and utilization of nuclear energy. The Government and operating entities are required to exert sincere efforts to encourage more active participation by the people and to make public hearings and publicity activities more effective.

Although some opportunities have been offered to those who wish to learn about nuclear energy and improve their literacy as part of a life-long learning framework, it is still required for concerned parties to further improve this scheme.

Activities in research, development and utilization of nuclear energy are only made possible

through the development of sites for related facilities, and their contribution to the public are only made available through the stable promotion of such activities at the site. With this in mind, concerned parties have been expending their efforts to gain understanding and cooperation for various nuclear-related activities, with the recognition of the local people's vision on regional development, by supporting and participating in the local communities efforts to realize their vision. In addition, local governments, being responsible for protecting the lives and property of the local residents, have been active from the viewpoint of residents in grasping the activities of operating entities to ensure safety and those of the National Government to regulate them.

The Government has enforced from the viewpoint of securing a stable supply of electricity the Three Laws on Power-Source Siting, namely the Electric Power Development Taxation Law, the Special Budget Law for the Development of Electric Power, and the Law for the Adjustment of Areas Adjacent to Power Generating Facilities and based on them provided subsidies and other benefits to the local public entities which accept the locations of useful power generation facilities and other facilities closely related to nuclear power generation, such as reprocessing facilities, etc, which support their efforts to develop public facilities as well as their projects that contribute to the promotion of industries in the region.

In recent years, regional development policies have placed emphasis on local initiatives for revitalization based on local characteristics and people's needs. Therefore the Government is preparing a framework to provide support for that purpose. At some nuclear facility sites, research and development institutions, including operating entities and universities, participate in these efforts as partners aiming at "coexistence." Thus, it has become important for the Government to take measures to enable power-source areas to effectively and efficiently use the Government subsidies for these initiatives.

The people and local community receive much of the information pertaining to nuclear energy from the mass media. Therefore, the mass media is expected to accurately report facts and inform the public of various opinions about the facts.

1-2-6 Contribution to a Stable Supply of Energy and Measures against Global Warming

Japan's self-sufficiency rate of energy (excluding nuclear energy) is a mere 4%, the lowest among the developed countries, and Japan imports most resources from foreign countries. Nearly half of the primary energy supply is oil, of which 87% comes from Middle Eastern countries. On a global scale, as demand for oil will drastically increase due to economic and population growth, mainly, in developing countries, it is predicted that the relation between supply and demand of fossil fuels will become tight, followed by consequent price hikes, and therefore the world may face intensified competition for the acquisition of fossil fuel sources. Thus, considering the fact that, it is difficult for Japan to receive electricity from neighboring countries as Japan is an isolated island country, it is indispensable for Japan to evolve further into an energy-saving society on the demand side and to ensure stable and reliable energy supply by diversifying import sources, on supply side.

Global warming, which will be furthered by the impact of increased energy demand in the world, is one of the most critical environmental issues looming on the horizon, and is a possible threat to human existence. The Kyoto Protocol, adopted as the first step toward long-term and continuous

reduction of greenhouse-effect gas emission, entered into force in February 2005, and Japan faces the task of reducing such greenhouse effect gas emissions to the level of 6% below its 1990 emission level during the first commitment period, between 2008 and 2012. Therefore, Japan needs to maximize the use of energy sources that emit less carbon dioxide, the major greenhouse gas, in addition to making maximum efforts to save energy.

Specifically, besides continuing maximum efforts to save energy and conduct research and development on technologies for the separation and disposal of carbon dioxide, it is important to shift energy sources to fuels that emit less greenhouse gases or non-fossil fuels. New energies such as solar and wind power are non-fossil fuels are in this category and have characteristics of distributed energy sources. However, their energy density is low, and the issues of economical efficiency and stable supply need to be addressed at present. On the other hand, nuclear power generation is recommended as a promising means to contribute to long-term energy supply and as a measure against global warming due to the following characteristics: uranium resources are dispersed in politically stable countries; carbon dioxide is not emitted in the process of power generation; the total amount of carbon dioxide emitted during the lifecycle is about the same as solar and wind power and, when compared with natural gas-fired power generation which emits less carbon dioxide than oil and coal fired power generations, emission is lower by a single digit; radioactive wastes can be disposed of without significantly affecting the living environment of the people; nuclear power generation further improves the stable supply of energy by recycling nuclear fuels; commercialization of fast-breeder reactor (FBR) cycle can drastically improve efficiency of nuclear fuel resource utilization. Therefore, it is rational for Japan to adopt the so-called optimum energy supply mix, in other words, to maximize the use of both new energies and nuclear power, taking advantage of characteristics of both. Needless to say that the policies will be periodically reviewed based on assessment from various aspects in response to changing technologies as research and development of energy technologies are performed on a continuous basis. Therefore, in order to continuously position nuclear power generation as a key player in energy sources to support the sustainable development of society, all the concerned parties need to commit themselves to constantly improving safety, economic efficiency, environmental adaptability, and nuclear proliferation resistance of the technologies.

1-2-7 Building Nuclear Fuel Cycles

The nuclear fuel cycle is comprised of two parts. The first part includes activities to supply nuclear fuels to be loaded into the reactor, specifically, securing uranium resources, conversion, uranium enrichment, re-conversion, and fuel fabrication. The other part includes activities to separate reusable resources and wastes from spent fuels and dispose of the wastes, namely, reprocessing of spend fuel, fabricating MOX fuel, intermediate storage of spent fuel, and treatment and disposal of radioactive wastes. As recycling activities of nuclear fuel by reprocessing spent fuel improve such characteristics of nuclear power generation as excellent supply stability and ensure an enduring energy-supply based on uranium resource, Japan’s basic policy has been to reprocess spent fuel and to effectively utilize collected plutonium and uranium, etc. Under this basic policy, various efforts, mentioned below, have been made with the aim of establishing autonomous activities related to the nuclear fuel cycle as far as reasonably practicable.

As for securing natural uranium, the electric utilities have been encouraged to purchase it based on long-term contracts since Japan is not endowed with natural uranium. It is expected that the electric

utilities will continue this policy in the future, taking into consideration the prediction that, in the future, competition for uranium resources will be intensified on a global scale as the balance between supply and demand of uranium will be shaken due to an increase in demand caused by the development of nuclear power generation activities in China and other countries, inventory reduction in European countries and foreseeable termination of supply from conversion of enriched uranium released from decommissioned nuclear weapons. With respect to uranium enrichment, although most of the domestic demand is met by foreign sources, commercialization of domestically developed enrichment technology has also been promoted by Japan Nuclear Fuel Limited (JNFL) by constructing and operating a factory of moderate size. Based on the experiences obtained so far, JNFL is currently developing a more economically efficient centrifuge machine. In the case of conversion, everything is dependent on foreign countries. As for the capability of re-conversion, there is only one operating entity left in Japan after the criticality accident at the uranium conversion facility in 1999. The capacity of fuel fabrication plants is sufficient for domestic demand. It is expected that these operating entities will take into consideration with regards to their future planning the fact that competitive international markets have been established for these activities, though an oligopoly is emerging in foreign markets.

The reprocessing of spent fuel from LWRs has been commissioned to foreign reprocessing companies, except for some work commissioned to the Japan Atomic Energy Agency (name given to the new agency that was formed after the merger of the Japan Atomic Energy Research Institute and Japan Nuclear Cycle Development Institute on October 2005). Throughout this period, the Rokkasho Reprocessing Plant has been under construction, and although there were some delays in the schedule, test operation is currently underway with the goal of full operation by fiscal 2007. The use of plutonium and uranium collected from reprocessing as MOX fuels utilization in LWRs (Plu-thermal) is considered to contribute to the improvement of fuel supply stability for nuclear power generation in Japan and the development of industrial infrastructure and the social environment necessary for full-fledged resource recycling in the area of nuclear fuel cycles in the future. Plutonium recovered by foreign re-processors is slated to be fabricated into MOX fuel abroad and plutonium recovered by Rokkasho Reprocessing Plant domestically. In order to realize this scheme, procedures have begun to build a MOX fuel fabrication plant by operating entities with the expectation of full operation by fiscal 2012. The project of electric utilities to load MOX fuel into LWRs has been delayed beyond its scheduled date due to scandals such as the quality control data falsification by British Nuclear Fuels (BNFL). Nonetheless, some progress has been observed recently; for example, some electric utilities submitted applications for approval of the loading of MOX fuels.

In addition, intermediate storage of spent fuel makes temporal coordination possible until it is reprocessed, and it is therefore important as a means for contributing to the flexible operation of the overall nuclear fuel cycle. Operating entities are currently working on its construction for future operation.

The Japan Atomic Energy Agency has been leading research and development activities of technologies for the FBR cycle. The “Monju,” the prototype reactor in the Japanese FBR project, has been shut since 1995 after the sodium leak accident. However, the Agency completed the national safety investigation, and as a result of preliminary permission being granted, based on the Safety Agreement with Fukui Prefecture and Tsuruga City in February 2005, works for improvement has been performed since September 2005.

1-2-8 Impact of Liberalization of Electricity Market and Others

When making decisions on the construction of nuclear power plants, electric utilities take into account various parameters comprehensively, including economy, investment risks, environmental protection, structural balance of electric sources, understanding and trusting relationship with the local residents, consistency with national energy policies, etc. In recent years, as liberalization of electricity market proceeds, demand secured by legal monopoly is no longer present and cost collection by comprehensive cost basis is no longer assured. Therefore, the weight of economy and investment risks have become relatively greater in the decision making process on large-scale investments such as the construction of nuclear power plants, which have long cost recovery periods. Due to these factors, some electric utilities seem more reluctant to construct new plants, faced with large uncertainty in the prediction of future electricity demand. Thus, it gets even more important, though far from panacea, to improve the competitiveness of nuclear power generation through the reduction of capital costs and the construction period of plants, and the improvement of the reliability of technologies.

To assure the economic integrity of the business for the treatment of HLW in the age of de-regulation, an implementing entity was established based on the Specified Radioactive Waste Final Disposal Act in order to conduct disposal activities that will extend over a long period of time in a planned and assured way and a framework to safely accumulate necessary funds for its implementation has also been established. As operations other than this also take a lot of time to decommission facilities related and to complete the disposal of generated waste materials, the necessity to secure funds to conduct the tasks have been recognized, and the establishment of a legal framework of economic measures is under way for reprocessing and other activities.

1-2-9 Utilization of Radiation

Radiation technology used for measurement, processing and therapy is one of diverse technologies used in the area of academic, research, agriculture, industry, and medicine. Radiation technology has been applied when it is superior to other technologies or when its unique characteristics are indispensable. Today, the technology significantly contributes to the advancement of science and technology in a variety of fields, such as understanding the magnetic structure of high-density discs by neutrons, etc. At the same time, it is contributing to the improvement of health and living standards of the people and industrial prosperity, among others, through various activities, such as radiation diagnostics, radiation treatment for cancer, insect pest control or sprout inhibition of potatoes using radiation, growing of disease resistant pears or low-protein rice by radiation breeding, and production of semi-conductors and radial tiers, etc. However, it has been pointed out that utilization of radiation technologies have yet to be optimized in such areas as food irradiation, due to lack of provision of technological information and educational activities for the public.

On the other hand, due to technological innovation in recent years, a new realm of technology, which is to be called “Quantum Beam Technology,” is being established: this technology consists of generating and controlling electromagnetic waves such as high-strength and high-quality photons, and synchrotron radiation, and particle beams such as neutron radiation, electron beams, and ion beams, etc. using accelerators, high power laser devices, facilities and high flux research reactors for research purposes, and utilizing them to perform high-precision processing or observation, etc. These technologies are expected to lead to a dynamic improvement in the level of science and technology, contributing to the progress in advanced academic sectors as well as various areas of science and

technologies and industries.

1-2-10 Research and Development of Nuclear Energy

In order that nuclear energy is to be competitive and a stable energy source for a long period of time, it not only needs to respond to immediate issues but also needs to make efforts to commercialize innovative technological systems which can replace the existing ones. It is therefore necessary to promote research and development activities of different time frames in parallel. In other words, in order to achieve superior and internationally competitive performance of the nuclear power plants, it is important to promote short term research and development activities focusing on the improvement and modification of current systems and technologies such as technology to extend the life of existing facilities, inspection technology to respond to the flexible implementation of legal periodical inspections, and safety assessment technologies to realize the power uprating. In view of replacing the existing technologies or preparing technologies to develop new markets, it is also important to promote mid-term and long-term research and development activities focusing on the commercialization of next generation nuclear power technologies, FBR and its fuel cycle technology which is competitive with other energy technologies in future, and innovative technologies, such as hydrogen production technology using nuclear energy.

Similarly, as for radiation utilization technology, which has increasingly been applied in a wide area of familiar settings, it is essential for the people not only to improve the existing technologies but also to strive to develop innovative technology that can replace the existing ones and / or acquire new markets simultaneously.

Furthermore, it is necessary to note that the basic and fundamental research, which plays the role of maintaining and developing the technology base for the research, development and utilization of nuclear energy and of improving the intellectual base for the safety of nuclear energy, will provide the seeds of innovative technologies through the proof of new technological principles. At the same time, the basic and fundamental research contributes to the acquisition of new knowledge as an asset for all mankind. It is also necessary to bear in mind that large-scale research and development facilities, such as accelerators and research reactors that support technological developments, provide indispensable research tools in the areas of life science and nanotechnology/material technology, etc.

Such nuclear research and development activities, particularly the ones conducted by the Government, due to their comprehensibility, influence the maintenance and improvement of the technological level of the private sector and international competitiveness of Japan and have a high degree of usability. Amid severe financial constraints of the Government in recent years, however, the national nuclear energy research and development budget has been declining, in combination with the allocation of budgets for the priority areas of science and technology other than nuclear energy and with reorganization and rationalization of special public corporations. Thus, with the establishment of the Japan Atomic Energy Agency in October 2005, which was formed by the merger of the Japan Atomic Energy Research Institute and the Japan Nuclear Cycle Development Institute, it is now important to promote these activities effectively and efficiently by selecting them in thoughtful ways and concentrate resources on them in efficient ways based on the review of cost-benefit analysis, with due consideration of the consistency with and complementarity between energy policies and science and technology policies, while recognizing the importance of continuous efforts.

1-2-11 International Approaches

Japan has long been working on strengthening the international regime for non-proliferation of nuclear weapons and nuclear disarmament to realize a peaceful and safe world free of nuclear weapons. However, several nuclear-related issues have emerged in recent years, including nuclear weapons testing by non-members of the NPT, North Korea's withdrawal from the NPT and its admission of possession of nuclear weapons, discovery of the underground network that facilitated nuclear proliferation, and Iran's nuclear activities without informing the IAEA. Thus, it is recognized as necessity to strengthen the NPT and IAEA regime, which are the frameworks for achieving balance between nuclear non-proliferation and peaceful use of nuclear energy, and based on this recognition, international discussions have been taking place on improving export controls of nuclear materials and equipment and technologies. Following the 9/11 terrorist attacks in the United States, concerns have grown regarding terrorist activities by non-state organizations, and efforts for security of nuclear materials and radioactive sources (hereinafter referred as "nuclear security") have become important as a new critical issue. In response to these movements, the International Convention for the Suppression of Acts of Nuclear Terrorism was adopted in April 2005, and the Convention on the Physical Protection of the Nuclear Material was amended in July 2005.

At the same time, through bilateral and multilateral cooperation and international agencies, Japan has committed itself to the exchange of knowledge and technology, the cooperative research and development program, and the support for the utilization of radiation and nuclear energy in developing countries. In addition, operating entities of Japan, making many of the technologies fostered in Japan, have started receiving orders for equipment for overseas nuclear power plants, and have been actively involved in new business opportunities, such as the recent construction programs in China, in cooperation with overseas entities.

1-3. Common Principles of Future Approaches

Based on the recognition of current situations reviewed in the previous section, in order that the research, development and utilization of nuclear energy in Japan are to fulfill the basic objectives, the Government and operating entities should plan and promote efforts in each respective area, emphasizing the followings as their common principles.

1-3-1. Assurance of Safety

Assurance of safety is a prerequisite for the promotion of research, development and utilization of nuclear energy. Therefore, we have been developing not only conditions to be met by the personnel who are involved in the activities and charged with primary responsibility for ensuring safety but also the framework to regulate them. Emergency plans and safeguards measures have also been developed to protect the people in the unlikely event of an emergency. What is important, in addition to these safety measures, is the establishment of the public's trust in the assurance of safety through these efforts. Although such trust cannot be built in a day, it could be lost in day as a result of even slight misconduct. Thus, the personnel engaged in the research, development and utilization of nuclear energy must bear that in mind, place priority on safety over everything else, accumulate safety credit by maintaining and developing a safety culture in organizations, and thus devote themselves to the establishment of public's trust toward the overall safety of research, development and utilization of nuclear energy in Japan.

1-3-2. Multilateral and Comprehensive Approaches

The following multi-dimensional efforts are necessary to achieve the goals of the research, development and utilization of nuclear energy: promotion and guidance of the research and development so as to gain knowledge about nuclear power; regulation and guidance of industrial and medical activities using the knowledge generated by the research and development from the perspective of improving public welfare; development and securing of human resources necessary for the research, development and utilization of nuclear energy; close cooperation with concerned local governments so that construction projects can be implemented in a timely manner and facilities can be operated efficiently; further attempt of harmonization of such activities with local community, etc. In addition, the nature of these efforts is closely related to energy policies, environmental policies, science and technology policies, and the given attributes of local governments, not to mention people's values. As far as measures relating to nuclear energy are concerned, it is therefore important to plan and promote the measures as comprehensive efforts as well as multidimensional efforts in cooperation with other related projects to share promotion bases.

1-3-3. Simultaneous and Parallel Approaches: Short-, Medium-, and Long-Term

If nuclear energy in Japan is to contribute to a stable energy supply, industrial promotion, improvement of people's living standard, and sustainable development of society in the future, approaches toward short-, medium- and long-term capacity are all necessary. Short-term approaches are to steadily implement the systems currently in place on the major premise of safety assurance, with due consideration to detailed measures for the maximum utilization of such system. Medium-term approaches are to prepare for the introduction of a new system that allows replacement of the existing systems with more efficient ones and to explore new markets. Long-term approaches, with the spirit of creativity and challenge, are to research and develop technologies that explore new areas of utilization and drastically replace the existing systems. The Government should rationally combine and promote these creative approaches from short-, medium- and long-term perspectives in parallel, and should accordingly define the roles of the private sector, and pursue cooperation. At the same time, the private sector is expected to make commitments in responding to these tasks.

1-3-4. Emphasis on International Partnership and Cooperation

Considering the impact of nuclear energy on society, research, development and utilization of nuclear energy should be conducted based on an international viewpoint. Moreover, in today's world, where competition and cooperation with people and organizations are crossing national borders and now a part of daily life, cooperative and collaborative work and network building across national borders are required from the perspective of pursuing mutual benefits. Thus, when planning and promoting efforts and measures concerning research, development and utilization of nuclear energy, one must not only make efforts to formulate and preserve international norms and treaties, but also try to effectively utilize international cooperation and international collaborative work as much as possible.

1-3-5. Emphasis on Evaluation for Effective and Efficient Approaches and for Common Understanding with the People

Considering the ever-intensifying severity of the financial situation, it is necessary to plan and implement national policies in such as way as to make them effective and efficient enough to achieve optimal outcomes with limited resources. Nuclear energy-related activities cover various areas and require concerted efforts over a long period of time to realize favorable outcomes, and achieving them is

accompanied by many uncertainties. Thus, in an ever-globalizing, growing, and complicated modern society, policy evaluation based on consistency and long-term perspectives is extremely important when planning and promoting measures of regulation and guidance, so that research, development and utilization of nuclear energy will contribute to public welfare. Therefore, such evaluation should be accurately performed. The Government, through such evaluation, should analyze the measures' degree of contribution to public welfare and the costs and risks over the full life cycle in the closest possible quantitative terms, and should review the details of the measures to make them effective and efficient. It is imperative to gain the understanding of the people regarding the importance of the measures when implementing them, and it must be fully noted that proactive disclosure of evaluation results will be effective in improving understanding of the measures.

Chapter 2: Strengthening the Basic Activities for Research, Development and Utilization of Nuclear Energy

2-1. Assurance of Safety

2-1-1. Safety Measures

(1) Responsibility of the Government and Operating Entities

For the promotion of the research, development, research and utilization of nuclear energy, it is a prerequisite to ensure that the health risks to the public and workers are kept under complete control at nuclear facilities. When designing, constructing and operating facilities, operating entities have the primary responsibility to adopt the concept of defense-in-depth, providing multiple protections based on the assumption that "man makes mistakes and machines break down," in order to control the hazard risks of radioactive materials and to ensure safety. However, abnormal occurrences and accidents in recent years have often been caused by organizational faults in the quality assurance system. Thus, it is strongly requested for operating entities to strengthen the following efforts: analysis of the root causes, establishment of measures to prevent the recurrence of similar incidents, strict observation of laws and regulations, constant improvement of the quality assurance system, and information disclosure in view of accountability.

In addition, it is important for operating entities to define a management system of entities in connection with the prevention of industrial accidents as well as radiation accidents, and to properly control and operate the system in all situations.

At the same time, the Government has obligations to determine the necessary safety standards, with a strong sense of fully controlling hazard risks, and to introduce a series of regulations based on the standards. The regulations include authorization of programs, approval of construction plans, approval of design and construction methods, pre-operation inspections, regular inspections following the start of operation, and safety audit. In order to fulfill the obligations, the Government is responsible to require the operating entities to take necessary and sufficient actions to manage hazard risks of nuclear facilities, to make sure they are being implemented, to ask the operating entities to take rectification measures whenever necessary, and to appropriately ensure accountability to the public regarding exercise of its powers. With a policy to implement scientific and rational regulations based on the most up-to-date knowledge available, the Government should take the following specific actions to maintain the high level of scientific and technological infrastructure: to steadily promote research on nuclear safety in line with the "Prioritized Plan for Nuclear Safety Research" formulated by the Nuclear Safety Commission; to assess their own activities by effectively utilizing international and domestic of function for surveillance of quality of regulatory activities; to improve and refine the methods of implementation and the application of regulations and laws.

The Government allocated the Nuclear and Industrial Safety Agency to the Ministry of Economy, Trade and Industry as an independent organization for nuclear and industrial safety regulation in 2001. In addition, in order to restore the public's trust in nuclear power due to the inappropriate actions at nuclear power plants, the Government has stepped up efforts to take the following actions more effectively and efficiently by appropriately allocating administrative resources, such as amending the Law concerning the Regulation of Nuclear Material Substances, Nuclear Fuel Substances and Nuclear Reactors (Nuclear Reactor Regulation Law) in fiscal year 2002 to improve the functions of the Nuclear

Safety Commission to monitor and audit successive regulatory activities implemented by regulatory ministries, reviewing the safety regulation system in fiscal 2003 to introduce new regulatory inspection systems. It is important therefore to review the workings of these reforms in conjunction with concerned parties from the viewpoint of regaining and maintaining the trust of the people in regulative administration.

Moreover, regarding the overlap of regulations for the medical use of radiation, adequate consolidation of regulations should be considered on the basis of the establishment of the necessary radiation protection system in accordance with the objectives of each law involved. The Government is expected to address the points to be improved in the regulation system in practice, soliciting opinions from academic and technical professional societies and others and reviewing the issues at the sites under regulations. On the other hand, medical professionals and academic and technical professional societies are expected to discuss how to ensure safety within the range of available medical resources, duly considering the scientific knowledge and the perspective of medical safety.

(2) Firm Establishment of a Safety Culture and Continuous Improvement of Operation Management

Top management of operating entities and related parties need to make efforts to develop and establish a “Safety Culture,” which prioritizes safety activities across the entire organization. They should also effectively and efficiently plan and implement safety activities, while observing safety standards based on the most up-to-date knowledge, assess the performance, and always review the performance to determine if there are points to be improved, while reflecting the opinions of external experts whenever necessary. The national regulative organizations should also carefully evaluate various issues from the perspective of safety in line with the Safety Culture, and take actions according to the degree of importance.

Through these approaches, the Government and operating entities should take specific actions based on the following notion: it is crucial that the nuclear facility and work place be vigorous and engaging. For example, they should consider a system where new approaches can be tested on the premise of safety assurance, so as not to discourage creative efforts in the work place, in view of implementing safety activities on the basis of the most up-to-date knowledge. At the same time, the most up-to-date scientific knowledge should be reflected in specific safety standards and the details of inspection methods through a periodic review process for standards and by reviewing the standards and specifications formulated and or updated by national and international academic and technical professional societies.

They should also focus efforts and resources on the following: steadily promote various research activities to maintain the high level of technological infrastructure necessary for safety assurance; encourage the reflection of research outcomes in the standards and specifications formulated by national and international standards organizations; foster experts who conduct inspections; enhance the education and training of inspectors to help them conduct effective and high quality inspections, in response to technological advances.

It is important to share new knowledge and lessons among countries as safety assurance is a global issue and it is desirable to internationally harmonize regulatory activities. Therefore we should make proactive efforts, such as having a sufficient number of Japanese experts participate in the process

of formulating safety standards and specifications in the international organizations, so as to share Japanese experience and knowledge with the international community and to make international safety standards and specifications consistent with our views.

(3) Utilization of Risk Information

Based on the notion that many of the safety activities are risk management activities, it is effective to utilize available risk information for the safety activities. Especially, with advanced technologies becoming available to assess risks, it is also possible to appropriately implement realistic safety activities with necessary and sufficient safety margins, well above the minimum, by utilizing the technologies. It is also appropriate for the Government, with reference to discussions going on at academic and technical professional societies and industries, taking into account the limit of the evaluation based on a model, to utilize risk information when considering various changes and amendments concerning safety standards and regulations, and to expand the scope of the utilization of such information. Moreover, the Government should address people's increasing concerns about earthquake risk at nuclear facilities, due to a series of large earthquakes in Japan and abroad.

Operating entities should exercise their ingenuity to make safety activities more effective and efficient by utilizing risk information pertaining to safety activities of specific areas, such as environmental safety and industrial safety and health, since it is recognized that the application of risk information is also useful in these areas.

(4) Measures against Aging

In designing nuclear reactor facilities, sufficient design margin for deterioration is introduced to the facilities that require a long period of time for replacement so as to be able to use them without replacement even under aging deterioration such as fatigue and corrosion, as in the case of general industrial designs. Other equipment and facilities are to be properly repaired and replaced in accordance with progress in deterioration predicted, though checking the validity of the prediction by inspections, and those to be replaced frequently are designed to be replaced easily. However, as we should be cautious about the validity of our knowledge with regards to the deterioration of facilities thirty years old or more, the Government, prior to reaching this stage, has obliged the operating entities to take measures against aging deterioration, for example, to appropriately evaluate the effects of aging deterioration expected to occur when used for approximately 60 years and, based on the results of the evaluation, to conduct additional maintenance activities such as additional surveillance and repair work.

In recent years, these evaluations had been applied to nine commercial nuclear reactors before they reached thirty years of age. Using this experience, the Government has reviewed the way to enhance these measures including the methods of maintenance and management and is planning to establish guidelines including policies and basic requirements of strategies in order to ensure the transparency of the measures against aging, and enrich the system to audit the implementation of long-term maintenance measures which are to include additional maintenance systems. The Government should operate this system, in cooperation with research and development institutions, industries and academia, carefully analyze and assess lessons and knowledge in both Japan and abroad, plan and implement relevant research and development activities, and make it possible to promote scientifically rational and effective long-term maintenance measures using the most up-to-date knowledge. It is important for operating entities to consider the possibility of unknown aging

deterioration in conducting periodic safety reviews (PSR) every ten years.

(5) Emergency Planning

In order to strengthen the measures to mitigate nuclear disaster, the Government, local governments, and operating entities should continue to improve and enhance various measures and facilities to fulfill their own responsibilities stipulated in the Special Law of Emergency Preparedness for Nuclear Disaster. The following measures are included: the development of contact networks, equipment, materials and medical facilities and institutions, which are all necessary at the time of emergency; the implementation of drills and training of implementation of emergency plan; the dissemination of knowledge to local people; the development of off-site centers.

Since emergency plan implementation drills conducted under an appropriate assumption of event progression at the site are extremely useful for building risk management capacity as well as for risk communication, the Government, local governments, and operating entities need to conduct the drills and contingency response training. At the same time, it is necessary to constantly improve and update the quality of drills based on the evaluation of the results of the drills, in consideration of the fact that responsible personnel of each organization are to be routinely transferred to different sections. Finally, the consequences must be reflected in the improvement of emergency plan itself.

(6) Communications on Safety Activities

The Government and operating entities have a responsibility to conduct risk communication activities which will contribute to the establishment of mutual understanding by explaining their implementation of safety activities to the general public, including the local residents and residents in the vicinity of nuclear power plants, and having discussion about it with them. The Government should continue to place emphasis on the efforts in disclosure and solicitation of opinions on the reports of the on-going safety investigations and solicitation of opinions at the time of enforcement and amendment of criteria for administrative measures.

It is also important for the Government to provide the local community with explanations pertaining to regulative activities, not only for general cases but also for individual and specific cases, and to exchange opinions. Furthermore, it is important for the Government to provide the local governments, which are responsible for the safety of local residents, with appropriate information concerning formulation and amendment of various criteria for safety regulations, to explain about regulative activities and to solicit opinions about the activities to deepen mutual understanding.

2-1-2. Physical Protection Measures

Movements toward strengthening safeguards for radioactive and nuclear materials have increased following the 9/11 terrorist attacks in the United States. In response to these movements, the Law concerning the Regulation of Nuclear Material Substances, Nuclear Fuel Substances and Nuclear Reactors (Nuclear Reactor Regulation Law) was amended and regulations were strengthened, including the formulation of Design Basis Threat, introduction of the physical protection inspection system, and creation of security information regulations concerning physical protection. The International Atomic Energy Agency (IAEA) adopted the amended Convention on the Physical Protection of the Nuclear Material in July 2005. Japan needs to consider the necessary steps toward the conclusion of the Convention. In the meantime, it is still important for the Government and operating entities to take

appropriate actions and to continue to improve and enhance the nature of the system itself.

In response to the development of laws concerning contingency measures, it is important for the Government and operating entities to take appropriate actions accordingly and to actively collaborate with local governments in view of securing their effectiveness.

2-2. Guarantee of Peaceful Uses

Japan should continue to uphold the "Three Non-nuclear Principles," promote research, development and utilization of nuclear energy for peaceful purposes, actively participate in the international non-proliferation regime, and secure strict application of the IAEA Safeguards as well as domestic safeguards. Also, concerned parties should continue incessant efforts to maintain the heightened awareness of nuclear non-proliferation and make relevant efforts in public hearings and publicity activities, so that all the Japanese people will share Japan's basic position that non-proliferation and the system for it are the major premises of peaceful use of nuclear energy, and continue to send strong messages regarding this position to the international community.

Furthermore, Japan has adopted a proliferation-resistant technology for reprocessing plants (the co-conversion technology) and has declared the principle of not possessing reserves of plutonium of which use is undetermined, and has been working on improving the control and disclosure of information pertaining to the plutonium stock, in order to improve both national and international understanding and credibility regarding Japan's strict adherence to the peaceful use of plutonium. The Atomic Energy Commission announced a decision entitled "Concerning the Basic Position on Japan's Use of Plutonium" in August 2003, in order to achieve further transparency in the use of plutonium. In regard to the future operation of the Rokkasho Reprocessing Plant, we expect operating entities and concerned parties to appropriately disclose their plutonium-use plans in accordance with the decision.

2-3. Treatment and Disposal of Radioactive Wastes

The generation that has enjoyed the convenience and benefits of nuclear energy assumes the responsibility to expend all efforts for safe disposal of radioactive wastes for the next generation. There are four principles of the treatment and disposal of radioactive waste: 1) the liability of generators, 2) minimization of radioactive waste, 3) rational treatment and disposal, and 4) implementation based on mutual understanding with the people. Under these principles, it is important to make appropriate classifications of the wastes and treat and dispose of them safely for each classification based on the recognition that the wastes may include materials with characteristics that take an extraordinary long time for the radioactivity to drop to insignificant levels.

Technologies to treat and dispose of wastes effectively and efficiently are indispensable for Japan that aims to establish a sound material-cycle society. Research and development institutions and others should conduct research and development of technologies to treat and dispose of radioactive waste with that notion in mind. We then hope that concerned parties, such as generators of radioactive waste, will apply new knowledge and technologies, thereby enabling safe, effective and efficient treatment and disposal of radioactive waste, which will then serve as a model case for our society. The Government should continue to prepare appropriate regulations and guidelines based on the above-mentioned principles in parallel with the promotion of these activities.

Moreover, it is important to promptly prepare and promote specific implementation plans for the waste of which treatment and disposal are still to be negotiated among concerned parties including generators, with the understanding of the people and local community through information disclosure and mutual understanding activities.

2-3-1 Radioactive Wastes for Geological Disposal

(1) High-level Radioactive Waste

In line with the Specified Radioactive Waste Final Disposal Act, final disposal facilities are planned for the geological disposal of HLW and are scheduled to start operation in the 2030s through the following three-step selection process: selection of preliminary investigation areas, selection of detailed investigation areas, and selection of the final disposal facility areas. When local governments wish to volunteer for "areas to be investigated as to the feasibility of constructing final depository of HLW" (of the Nuclear Waste Management Organization of Japan (NUMO)), it is important to foster sufficient understanding and awareness by the local residents about the advantages and disadvantages for the local community to the acceptance and the importance of construction of the final repository. To this end, not only the implementing body, namely NUMO, but the Government and electric utilities, under an appropriate separation of roles and partnership, should enhance the ongoing approaches with their creativity and ingenuity in order to gain understanding and cooperation from the electricity consumers who receive the benefit of nuclear power generation, in addition to the local residents and various sectors of the local community throughout the country, including local governments. It is then important to duly implement the responsibility of each party, such as consideration for new approaches, based on the results of these activities.

We also expect the Government, research and development institutions and NUMO, while giving due consideration to their own roles and in close partnership, to consistently promote research and development of geological disposal of HLW. We expect NUMO will safely implement the final disposal project of HLW and will systematically carry out technical development from the viewpoints of improving economy and efficiency of the activities. Research and development institutions, led by the Japan Atomic Energy Agency, through utilization of underground research facilities, should rigorously continue to conduct scientific research on underground geology, basic research and development toward the improvement of reliability of geological disposal technology and safety assessment methods, and research and development for safety regulations.

As for the outcomes of these research and development activities, while referring to knowledge and experience abroad, it is important to develop and maintain the knowledge as an advanced knowledge base that supports final repository projects and safety regulations, as well as to appropriately reflect it in NUMO's final disposal projects. To this end, the Government and research and development institutions should survey the entire issue and cooperate and collaborate to proceed with the program systematically and efficiently. It is important for research and development institutions to cooperate with the Government and NUMO in activities to gain the understanding and awareness of the people. Furthermore, it is necessary for the Government to develop specific rules concerning safety regulations based on the progress of these research and development activities.

(2) Radioactive Wastes containing Transuranium Elements to be Disposed of Geologically

Some LLW contains transuranium elements (hereinafter referred as "TRU waste"). Some of

the TRU waste needs to be disposed of geologically. If some TRU waste targeted for geological disposal can be buried together with HLW, the number of repository sites will be reduced, eventually improving economic efficiency. Thus, based on assessment results, such as influence on the integrity of the disposal when TRU waste that is targeted for geological disposal is buried together with HLW, the Government should consider its technical relevance. Based on the conclusion on its relevance, the Government then should consider necessary measures, including the nature of an implementing body and the Government's involvement.

LLW deriving from the overseas reprocessing consigned by Japan will gradually be returned from French and British reprocessing firms. French reprocessing firms suggest changing the solidification method from asphalt solidification to vitrification. British reprocessing companies suggest that cemented waste for geological disposal and miscellaneous solid waste for disposal with institutions control, among LLW, be converted to HLW (vitrified waste) with equivalent radiation impact for shipment. In light of these suggestions, it is expected that the number of shipments can be reduced and storage facilities in Japan for LLW awaiting final disposal can be downsized. Thus, the Government, in response to results of operating entities discussions, should assess the technical relevance concerning the treatment of waste by new solidification methods, as suggested by France, and the relevance of conversion indexes of waste, as suggested by Britain. And if suggestions are found to be acceptable, the Government should promptly discuss the institutional issues.

2-3-2. Radioactive Wastes for Disposal with Institutional Control

Methods of disposal with institutional control include near-surface disposal without engineered barriers, near-surface disposal with engineered barriers and sub-surface disposal with engineered barriers. Near surface disposal with engineered barriers is already in practice on LLW generated in commercial nuclear reactor facilities. Near-surface disposal without engineered barriers is conducted partly while operation entities improve safety regulation systems on the remaining part of the wastes. Operating entities are conducting studies and tests on sub-surface disposal with engineered barriers. Based on the results, it is necessary to promptly discuss the establishment of the framework, including safety regulations.

As for radioactive waste from RI (radioisotopes) usage, preparations for enactment of specific provisions are under way based on the amended "Law Concerning the Prevention from Radiation Hazards due to Radioisotopes and Others." In dealing with waste from research and development facilities, TRU waste and uranium waste, discussions on safety regulations have been undertaken step by step, and concerned parties should work on the implementation of disposal in line with the progress of the preparations for the safety regulations. Moreover, it is often effective and efficient to treat and dispose of radioactive waste in an integrated fashion according to the properties of the waste material regardless of the generators or waste sources, and therefore, the Government should employ various systems to make this a reality and consider further measures if necessary.

2-3-3. Decommissioning of Nuclear Facilities and Others

It is important to undertake the decommissioning of nuclear facilities, such as commercial power reactors, test and research reactors and nuclear fuel cycle facilities, on the major premise of safety assurance, under the responsibility of the installer, based on the amended Nuclear Reactor Regulation Law and under the safety regulations of the Government, while gaining the understanding and

cooperation of the local community.

Reuse of material from decommissioned nuclear facilities, which is not required to be treated as radioactive material, is reasonable because it is consistent with the concept of a sound material-cycle society. When material below the clearance level (material which has no need to be regarded as radioactive material) is treated, disposed of or reused, the Government and operating entities need to take appropriate measures in line with the amended Nuclear Reactor Regulation Law.

Moreover, it is necessary to discuss the handling of spent fuel from test and research reactors with due consideration to the rationality based on each individual conditions.

2-4. Developing and Securing Human Resources

Securing human resources is important for the sustainable development of research, development and utilization of nuclear energy. To that end, it is essential for the workplace in the field of nuclear energy to be engaging. The following efforts need to be made: to create a workplace with a learning cycle, in which workers can execute their mission by utilizing their full potential resulting in generating lessons through evaluations and then reflecting and improving these accomplishments in the missions; to create a workplace in which ingenuity and creativity developed at the workplace can be utilized through the most up-to-date knowledge and effective quality management; to realize an environment where such efforts are to be reflected in the regulations. In order to vitalize this learning cycle, it is effective to appropriately maintain human resources who are capable of recognizing things and making decisions from different perspectives through exchanges with other fields as individuals within an organization are likely to have similar views. Based on these arguments, the Government and operating entities should take various approaches in line with emerging conditions in order to secure and develop human resources.

Moreover, the operating entities, their cooperating companies, the Government and local governments should actively promote efforts, including the establishment of a technical qualification system for the maintenance of nuclear facilities in a cross-sectoral manner, the development of a network of training facilities and curriculums for the acquisition of qualifications, human resource development utilizing the network, etc. In doing so, it is necessary to consider the promotion by collaboration among the entire nuclear industry, utilizing horizontal cooperation among operating entities and their cooperating companies, in addition to the vertical cooperation between operating entities and their cooperating companies, with a view to the improvement of the capacity of human resources in the local community.

Universities are expected to provide both basic nuclear education concerning energy and radiation in general engineering education and professional education to develop human resources in the area of nuclear energy with knowledge and understanding of social science who will play a crucial role in pursuing technological innovation by exercising their creativity. In order to improve education of this kind, internship programs, graduate school consortium, and university-affiliated nuclear research facilities should be used more effectively, and we expect all the concerned parties to make efforts in these areas. We also expect nuclear engineering courses in universities to provide education to foster professionals who can actively participate in international activities and organizations. Some universities employ graduate students as research assistants using research funds obtained competitively

and conduct research by hiring postdoctoral fellows. The Government should evaluate and review each competitive financial system, whenever necessary, in order to enable these efforts to be more effective for the implementation of research projects and for the development of human resources.

Research and development institutions should contribute to the development of human resources by creating a learning cycle in which various human resources share opportunities, create new knowledge and technology by willingly challenging the limits, and push the limits again by learning from the outcomes. It is important, from this perspective, to create an environment where various types of human resources, including the young, females or foreigners, can be flexibly employed. The same is expected of universities and other operating entities.

Human resources with professional qualifications play active roles in the field of research, development and utilization of nuclear energy, such as chief engineers of nuclear power plants, supervisors in charge of the handling of nuclear fuel, supervisors in charge of the handling of radiation, nuclear and radiation engineers, etc. It is important for these persons to play more active roles utilizing their significant knowledge and ethical value as well as fulfilling their legal obligation. In addition, it is important for universities and research and development institutions to provide them with opportunities of continuous education and training opportunities, so that human resources with professional qualifications are able to maintain sufficient capacity.

Since there is a lack of specialists with expertise in radiation medicine, the Government, universities, and research and development institutions should make efforts toward securing and developing such specialists, in view of pursuing effective cooperation between medicine and engineering.

2-5. Coexistence of Nuclear Energy and People/Local Community

2-5-1.Securing Transparency

The trust of the people is indispensable for smooth implementation of the research, development and utilization of nuclear energy. Securing transparency in safety activities is important for gaining the public's trust, and it is important for the Government, operating entities and research and development institutions to disclose efforts for their safety management and report abnormal occurrences timely and honestly. Information concerning abnormal occurrences should be released immediately and accurately, desirably with information about the level of importance of the event to health risks of public and workers. Websites and other forms of dissemination should be improved, so that any interested party can view relevant documents. Giving sufficient explanations and having discussions about safety activities to the people, especially the local residents, and providing workers with ample information on activities concerning safety management in the facilities are also important as part of risk communication activities. As these activities at the same time provide operating entities with opportunities to carry out self-inspections of daily safety management activities, they must be carried out without fail.

At the same time, operating entities and research and development institutions conclude safety agreements with the local governments upon request; submit information concerning their safety activities; and give explanations accordingly. These activities are also important to society from the perspective of securing transparency of the operation activities.

When the Government introduces provision for confidentiality of related information in accordance with the global movements towards stronger safeguards for nuclear materials, it is important for the Government to make efforts for the fair and appropriate implementation of such policies by disseminating the purpose of the confidentiality, thoroughly explaining to third parties, such as academic experts, about the national recognition of the scope of confidentiality, and gaining legitimacy from the perspective of public interest.

2-5-2. Enrichment of Public hearings and Publicity Projects

The Government and operating entities should first prioritize the public hearings which are intended to understand what kind of information on nuclear development, research and utilization is sought by the people and local community as well as how they think about nuclear energy and why they do so in pursuit of a common understanding with the people and local community. The Government and operating entities should then promote publicity and communication activities based on the opinions and understanding obtained from such public hearings. Moreover, in order to deepen people's understanding of nuclear power generation, the Government and operating entities should continue multi-dimensional activities to promote understanding, including activities to enhance mutual understanding between the people in electricity production and consumption areas. It is extremely important to continue these activities, and at the same time, they need to be effectively and efficiently implemented. Therefore, it is necessary to examine past efforts, particularly the public hearings and publicity projects commissioned by the Government, and to make sincere efforts to conduct fundamental reviews on the nature of these approaches.

2-5-3. Development and Enrichment of Learning Opportunities

The core of people's understanding of nuclear energy involves interests of individual people in their relationship between nuclear energy and society and their learning efforts in daily life. Thus, it is important for the Government, operating entities and research and development institutions to promote mutual cooperation, diversify and further improve life-long learning opportunities for the people with regards to nuclear energy. This can be achieved through, for example, the development of web-sites and wide dissemination of these various learning opportunities. Furthermore, the Government, operating entities and research and development institutions should systematically develop human resources with knowledge on nuclear energy and risk communication capacity, who will take a leading role in furthering mutual understanding between experts and the people, especially the local residents.

It is important for the Government to continue to improve guidance at schools, such as primary, middle and senior schools, regarding energy issues including radiation and nuclear energy, according to the development stage of the students, and to improve support systems for education concerning energy and nuclear energy. We expect the local governments to actively utilize such support systems. For these activities, attention should be paid to the provision of wide range of information covering various views on controversial issues, so that students are able to gain not only scientific knowledge but also to deepen accurate knowledge about various aspects surrounding energy issues, including nuclear energy.

It is important for non-profit organizations (NPOs) to actively undertake independent activities for the provision of learning opportunities about issues related to energy and nuclear energy, and

therefore, the national and local governments should consider developing an appropriate environment for that to happen.

Opportunities to develop knowledge through experiences are important, and we expect people to use nuclear research facilities and science museums as a means to encounter such opportunities. Access to nuclear power facilities has been restricted due to enhanced safeguards for nuclear materials. However, in view of the importance of providing a first-hand experience of visiting the actual sites, we expect operating entities to continue their efforts to meet two requests: ensuring nuclear security and providing the possibility of visits.

2-5-4. Public Participation

The Government must continue efforts to secure transparency by disclosing discussions and deliberations for policies at advisory committees, holding public hearings to solicit opinions, from the viewpoint of preparing opportunities for public participation in the policy making process. In the cases of government deliberation of topics with high public interest, the Government needs to make the opportunities effective from the viewpoint of the public, for example, by offering public hearings at an early stage. Furthermore, the Government, operating entities and research and development institutions should sincerely cooperate with the local governments to implement activities to deepen common understanding among local residents.

2-5-5. Relationship between the Central Government and Local Governments

Research, development and utilization of nuclear energy should basically be promoted by national policies from both domestic and international perspectives, and those for promoting science and technology, the assurance of stable energy supply and the implementation of measures against global warming, in particular. However, specific activities are possible only when the related facilities are completed at some sites, and the expected contributions to society are possible through the smooth operation of the facilities at the sites. Thus, it is important for the Government and operating entities to carefully explain to and carry on dialogues with the local community on national nuclear policies and safety activities at the related facilities from an early stage of a project. Since local governments are responsible for protecting the life and property of the local residents, they undertake various approaches in support of the local residents. Such approaches include safety activities for the operating entities and efforts to understand the national regulations on these activities. Therefore, the Government and operating entities should cooperate with the local governments in their efforts. Based on the major premise that the Government and operating entities assume this role, we expect the local governments to closely cooperate with the Government when making decisions about and evaluating the nuclear power aspects by, for example, effectively utilizing the activities of the Government and operating entities. We also expect them to take appropriate measures to foster mutual understanding between the local residents and the Government and operating entities.

2-5-6. Coexistence with Local Residents

Construction of nuclear facilities is often approved as part of local development plans. Therefore, it is important for the concerned parties to understand the local community’s development vision, and then conduct activities to establish mutual understanding and to foster understanding and support for their activities. The subsidy system, based on the Three Laws on Power-Source Siting, is said to be the framework that allocates funds for various regional vitalization programs designed in

accordance with local conditions. In order to improve the effectiveness, the Government should continue to work on increasing transparency of subsidized projects and constantly review them, so that these projects can be implemented even more effectively and efficiently.

Local initiative efforts have recently begun to utilize the presence of nuclear facilities for long-term, broad-based and comprehensive regional development and to establish visions for sustainable regional development. Having the awareness of being a member of the region, operating entities, universities and research development institutions residing in the relevant region are expected to actively participate in such efforts, as partners from the planning stage, by extensively utilizing their resources and expertise.

Chapter 3: Steady Promotion of Utilization of Nuclear Energy

There are two types of utilization of nuclear energy: utilization of nuclear energy released by fission and utilization of radiation. The basic concepts of utilization of nuclear energy released by fission are presented in section 3-1 and those of utilization of radiation in section 3-2.

3-1. Utilization of Energy

3-1-1. Basic Concepts

Nuclear power generation is important as a measure against global warming and as a contributor to a stable energy supply in Japan. The Government should designate nuclear power generation as a key source of electricity and promote it steadily to maintain such contributions at an appropriate level from the perspective of public welfare. In addition, the Government should perform the following tasks to build necessary nuclear facilities in a timely manner and utilize them effectively: specify basic concepts, develop an operating environment, promote research and development, and foster public understanding through public hearings and publicity activities. We also expect the operating entities to work on the following tasks: to accumulate know-how to conduct projects using large-scale technologies; to build the confidence of the local community through mutual understanding activities such as honest risk communications; to consistently promote nuclear power generation and necessary nuclear fuel cycle projects over a long period of time, by investing required funds and by conducting technology development.

3-1-2. Nuclear Power Generation

(1) Basic Concepts

It is expected in pursuit of optimum energy supply mix for Japan in accordance with the characteristics of various energy sources that nuclear energy generation continuously contributes to the stable energy supply and to the measures against global warming. Therefore, it is appropriate to aim at maintaining or increasing the current level of nuclear power generation (30 to 40% of the total electricity generation) even after 2030. In order to achieve this, it is logical to make the followings as guidelines for the promotion of nuclear power generation in the future:

1. Pursue optimal utilization of existing nuclear power plants on the premise of safety assurance, and undertake strenuous efforts in building new plants based on the underlying premise of the understanding of the public including local residents;
2. Prepare advanced models of the current LWRs for the replacement of existing nuclear power plants, which will start around 2030. Large-size LWRs are a prime candidate from the viewpoint of enjoying scale merit, though standardized medium-size LWRs may be an option depending on its economy and the size of need for additional capacity and the trend of balance between supply and demand of each electric utility.
3. Strive for the commercial use of FBRs from around 2050 on the premise of meeting the necessary conditions, including its economic viability, the progress of nuclear fuel cycle projects for LWRs while considering the situation of supply and demand of uranium and thus promote efforts for commercialization reflecting the results of the “Feasibility Study on Commercialized of Fast Breeder Reactor Cycle System” and the operation of “Monju.” The time period when the requirements of introduction of FBR system are satisfied may be brought forward or even delayed. If it is delayed, the introduction of advanced LWRs will be continued until conditions are fully met.

(2) Future Efforts

In comprehensive consideration of public interests under the liberalization of electricity market, the Government should establish an environment for electric utilities to promote the business in line with the above-mentioned guidelines, while encouraging them to make long-term investment. To achieve this end, it is appropriate to consider specific measures and promptly implement them for the following policy issues, while sharing with concerned parties the visions for the future, such as the creation of conditions for a nuclear fuel cycle, and continuously reviewing those measures: institutional responses to the liberalization of electricity market, the nature of promoting the construction of new plants in view of the prolongation of the process of obtaining a new site, prioritization of strategic technology development projects, etc.

Nuclear power generation in Japan is lagging behind the U.S. and European nations in terms of plant capacity factor and collective annual radiation dose of workers. In light of this situation, we expect the electric utilities to make efforts in the following areas, sharing and utilizing domestic and foreign technical information through the Japan Nuclear Technology Institute, etc.: systematic and appropriate maintenance and conservation activities based on the technical evaluation of plant aging; improvement of maintenance management with an aim to achieve the world's top level of safety performance index; realization of nuclear power generation with excellent records of safety and stability. Furthermore, as for the pursuance of advanced utilization such as the improvement of plant capacity factor through increased flexible implementation of legal periodic inspections and extended operation cycles and power uprating, we expect them to make efforts to adopt inspection technologies for flexible implementation of legal periodic inspections and highly advanced safety evaluation technologies which can make it possible to rationalize the safety margin with sufficient evaluation and study from the view of safety assurance, referring to the experiences in Europe and the United States. The Government should listen intently to the proposal from the electric utilities based on their creative activities and strictly evaluate whether it is possible to realize these technologies while fully controlling risks.

Manufacturing companies, together with the efforts of the Government and electric utilities, are expected to strengthen the business structure so that they achieve the scale and competitiveness to compete internationally by working on the thorough standardization of nuclear reactor facilities, developing unique technologies based on innovative design concepts, increasing the interactive capacity based on these technologies, and dramatically improving efficiency of the projects with the strengthened cooperation among the companies.

3-1-3. Nuclear Fuel Cycle

(1) Securing Natural Uranium

It is important to secure a stable supply of natural uranium over a long period of time in the future. Based on the prospect of intensifying global competition over resources, it is important for electric utilities to secure a stable supply of natural uranium by means of diversification of supply sources, long-term purchase agreements, and development and import schemes, etc.

(2) Uranium Enrichment

It is important for Japan to improve the supply stability of enriched uranium and the autonomy of the nuclear fuel cycle. We expect operating entities to promote the development and

introduction of more economically efficient centrifuges and to improve the stability of operations and economic viability of the Rokkasho Uranium Enrichment Plant, based on past experiences. In addition, it is desirable to properly store depleted uranium generated from the enrichment process in Japan, for future use.

(3) Handling of Spent Fuel (Basic Concepts of the Nuclear Fuel Cycle)

Japan's basic policy has been to effectively use plutonium and uranium obtained by reprocessing spent fuel. Based on this policy, while commissioning the reprocessing to foreign reprocessing firms, Japan has also acquired the skill through the construction and operation of the Tokai reprocessing plant. Subsequently, Japan Nuclear Fuel has promoted the construction of the Rokkasho reprocessing plant, and the Government developed a legal framework to designate the implementing body of geological disposal of vitrified HLW generated during the reprocessing, the financing system, and the selection process for disposal sites in line with the framework. In recent years, however, the following situational changes have occurred: the delay in the use of plutonium obtained in the course of reprocessing in LWRs; the Rokkasho reprocessing plant which was scheduled to start operation in 2005 is still in a trial stage due to construction delays; the delay in the development of FBRs, due to the "Monju's accident," changes in investment patterns of electric utilities due to the liberalization of the electricity market; changes in nuclear policies of other nations, etc. Due to these factors, increasing concerns have been raised about the policy of promoting Japan's nuclear fuel cycle projects intending to reprocess spent fuel, in terms of economic viability, nuclear non-proliferation and safety issues etc.

The Planning Council assumed the following four scenarios for the handling of spent fuel in the future and evaluated each scenario from the following ten viewpoints: safety, technical feasibility, economic viability, energy security, environmental protection, nuclear non-proliferation, international trends, issues resulting from policy changes, social acceptability, and adaptability to emerging circumstances (adaptability to future uncertainty).

Scenario 1: Spent fuel is reprocessed after being stored for an appropriate period of time. In the meantime, FBRs are developed as a promising technical option, and are made available for use, accordingly.
Scenario 2: Spent fuel is reprocessed, and the spent fuel exceeding the life-long capacity of the reprocessing plant is directly disposed of.
Scenario 3: Spent fuel is directly disposed of.
Scenario 4: Spent fuel is stored for the time being. The decision to reprocess it or dispose of it is made at a later date.

The results are as follows:

1) Assurance of Safety

Required safety level can be secured in each scenario by taking appropriate measures. As things stand now, we do not have sufficient technical knowledge necessary for the safe disposal of spent fuel, therefore, this knowledge should be accumulated when the scenarios which include this activity are adopted. Although the number of facilities that release radioactive substances into the environment increases in the case of reprocessing, the impact of each facility can be lower than that from natural radiation when safety standards are honored, and therefore, there is no significant difference between

the scenarios with reprocessing and without reprocessing.

2) Technical Feasibility

For scenarios including reprocessing, sufficient systems and technical knowledge about the disposal of HLW are already in place. By contrast, technical knowledge accumulated thus far with regard to direct disposal is insufficient. With regard to scenario 4, it is necessary to maintain technical infrastructures etc. of reprocessing and other related activities for a long period of time; although, they may never be used in the end.

3) Economic Viability

Currently, scenario 1 compares unfavorably to the other scenarios, since the generating cost of scenario 1 is estimated to be approximately 10% higher compared with scenario 3. However, scenario 1 may not be inferior in terms of economic viability if costs resulting from policy changes are taken into consideration.

4) Energy Security

Reprocessing by recycling uranium and plutonium in LWRs contributes to the conservation of uranium resource by 10%-20%, and if the FBR cycle becomes practical, it will drastically increase uranium efficiency, enabling the use of nuclear energy for more than several hundred years with current proved recoverable reserves.

5) Environmental Protection

Reprocessing by extracting and using uranium and plutonium contributes to the reduction of the potential harm from HLW, the volume of HLW and the necessary area of the disposal site. Therefore, it has a high degree of compliance with the objective of creating a sound material-cycle society in which the quantity of wastes to be disposed of should be reduced by the greatest degree possible. Furthermore, if the FBR and its fuel cycle system become practical, it is possible to reduce the residual radioactivity of HLW over a long period of time and drastically lower the environmental load of energy generated.

6) Nuclear Non-Proliferation

When conducting reprocessing, it is necessary to implement internationally applied safeguards and physical protection measures and to take technical procedures agreed upon with the United States in order to avoid giving rise to international concerns about nuclear proliferation. In the case of direct disposal, considering that the disposed spent fuel contain plutonium, it is necessary to develop and implement safeguards and physical protection measures to assure the proliferation resistance of the disposed plutonium on which the international community agrees. When these measures are fully enforced in each case, there is no significant difference among the scenarios in this respect.

7) International Trends

Each country has selected either the reprocessing route or the direct disposal route based on her geopolitical factors, resource factors, and the scale of nuclear power generation, among others. As a whole, countries with small-scale nuclear power generation, those that have decided to retreat from nuclear power generation, and those with abundant energy resources tend to select direct disposal of spent fuel. Conversely, the countries that tend to choose reprocessing are those with large-scale nuclear power generation, those that have decided on a basic policy of continued use of nuclear power

generation, and those with poor domestic energy resources. Even in the United States, which has chosen direct disposal, governmental research into advanced reprocessing technologies has been initiated with a view to minimizing any increase in the number and size of the HLW disposal sites, considering the difficulty to consecutively find new disposal sites which are needed for continuing the use of nuclear power generation in the future.

8) Issues resulting from Policy Change and 9) Social Acceptability

Considering only one fact that we lack accumulated technical knowledge in regard to direct disposal that takes into account Japan's natural conditions, not to mention of the disposal of material containing plutonium, finding a site for final disposal of spent fuel at this stage can be more difficult than finding a final disposal site for vitrified waste. If we make a policy change from reprocessing to direct disposal, it is indispensable for the continuation of nuclear power generation to have communities that up until now have accepted selection as a site for nuclear facility, based on the assumption that spent fuel would be reprocessed, understand the new policy of direct disposal and accept the temporal storage of spent fuel at the site. It is clear, however, that it takes time to do so, as it is necessary to rebuild relationships of trust with the community after informing them of the policy change. It is likely that the nuclear power plants that are currently in operation will be forced to suspend operations, one after another, during this period due to the delay of the removal of spent fuel.

10) Assurance of Choice (Adaptability to Future Uncertainty)

Under scenario 1, infrastructure for technical innovation as well as international understanding for Japan's reprocessing of spent fuel can be maintained, which enables the society response to changes in circumstances. Even in this scenario, however, it has been pointed out that promotion of research on technologies other than reprocessing technologies will further improve the adaptability to changes. In contrast, although it can be claimed that the capacity to deal with uncertainty is maintained in theory in scenario 4, pending decisions on the path to be taken at future date, it was concluded that it is difficult to maintain the infrastructure and international understanding for long period of time without launching a real business related.

When promoting nuclear power generation in Japan, we should comprehensively consider such matters as ensuring economic viability, working to create a sound material-cycle society, ensuing energy security, and ensuring the capability to respond to future uncertainty. Taking the above mentioned evaluation of four scenarios from ten viewpoints into consideration, we have reached the conclusion that our basic policy is, aiming at using nuclear fuel resources as effective as reasonably achievable, to reprocess spent fuel and to effectively use the recovered plutonium and uranium, while ensuring safety, nuclear non-proliferation, environmental protection, and paying due attention to economic viability. Reprocessing of spent fuel is basically to be conducted within the country in view of securing the autonomy of nuclear fuel cycle activities.

With the above basic policy as a foundation, the Government, that has already enacted "the Law Concerning the Establishment and Management of the Reserve for Reprocessing of Spent Fuel at Nuclear Power Plants" in dealing with the promotion of nuclear fuel cycle activities by electric utilities, should promote research and development of innovative technologies effective for the attainment of the goal and develop economic measures necessary to sustain the business. We expect operating entities,

together with such efforts of the Government, to responsibly promote nuclear fuel cycle businesses by constructing and operating the Rokkasho reprocessing plant and its related facilities, with consideration to ensuring safety and trust of the public and improving economy, while expending all possible means to manage risks of the project. We also hope the construction and operation of those facilities will contribute to the consolidation and advancement of practical reprocessing technologies in Japan.

(4) MOX Fuel utilization in LWRs (Plu-thermal)

In accordance with the basic policy of reprocessing spent fuel and effectively using recovered plutonium and uranium within the country, plu-thermal program should be consistently promoted for the time being. Thus, the Government needs to expend further efforts, including proactive public hearings and publicity activities, for mutual understanding of the safety and significance of the program with the general public and the communities in which the facilities are located. We expect operating entities to promote the plu-thermal program systematically and firmly and to proceed with the development of a MOX fuel fabrication facility, along with the progress of the work at the Rokkasho reprocessing plant. Meanwhile, necessary fuel for plu-thermal program will be, for the time being, the plutonium recovered abroad, and will be imported to Japan after fabrication into MOX fuel. Therefore, both the Government and operating entities need to continue their efforts to further understanding by providing en-route countries with detailed explanations about the safety measures for the transportation, Japan’s nuclear policies and the importance of the transportation earnestly.

(5) Methods of Interim Storage and Subsequent Treatment

Spent fuel will be reprocessed, within the available reprocessing capacity, for the time being, and the surplus volume exceeding the capacity will be stored intermediately. Study on the measures to be taken for spent fuel stored at such interim storage facilities and spent MOX fuel from LWRs will start in around 2010, in response to the operations of the Rokkasho reprocessing plant, progress of research and development of FBRs and reprocessing technologies, international movement of nuclear non-proliferation, etc. Such study should be done based on the basic policy of reprocessing spent fuel and effectively utilizing recovered plutonium and uranium, and will be conducted with due consideration to flexibility. A conclusion is to be reached at such a time that the facilities that will be constructed based on the conclusion of the study will be ready for operation well before the termination of the Rokkasho reprocessing plant.

The Government needs to expend efforts in public hearings and publicity activities to further the mutual understanding with the general public and the communities in which the facilities are located for interim storage. Operating entities are expected to successfully implement the interim storage program.

(6) Responding to Uncertainties

Since there are uncertain factors such as technical trends and international situations over the long term, we expect that the Government, research and development institutions and operating entities will independently and/or collectively pursue surveys and research concerning direct disposal of spent fuel in an appropriate manner, which enables flexible considerations for policy choices in response to circumstantial changes.

3-2. Utilization of Radiation

3-2-1. Basic Concepts

Radiation has been utilized under appropriate safety conditions in the areas of academia, industry, agriculture and medicine, contributing significantly to furthering society. However, radiation can be harmful to human health if not properly managed, and there have been some improper incidents reported. We therefore hope that concerned parties review the safety measures and make efforts to ensure effective and efficient utilization under the strict safety control system.

The application of radiation and radioactive material has steadily expanded. In order to enhance the expansion, it is important to close the information gap, regarding information of available technologies including their merit and safety, for potential users. Thus, it is necessary to strengthen cooperation between various areas (such as medicine, engineering, and agricultural science) and to develop networks for mutual learning and interface for mutual exchanges among and between operating entities, people and researchers, from the perspective of promoting information provision, experience exchanges, collaborative development by strengthening the existing partnership between industry, academia and government.

The Government should take appropriate support measures for the advancement of radiation utilization technologies and develop advanced facilities and equipment, which are highly effective in science and technology activities of the Government and private sector organizations.

In the meantime, measures to promote local industry by local governments are effective in providing the local industry with opportunity to utilize advanced governmental facilities for radiation application, improving the technical levels, and performing various new activities for innovation. Thus, the central and local governments, under the initiatives of the local governments and in cooperation with neighboring universities and others should encourage effective utilization of such radiation facilities by attaching facilities useful to the local industry and thereby creating opportunities for local industry to share the merit of national innovation infrastructure.

3-2-2. Procedures in Each Area

(1) Science and Technology / Academic Areas

Radiation is important as an excellent tool to support basic research and a number of science and technology activities, and it should continue to be actively utilized in activities contributing to the advancement of science, technology and academic standards of Japan. Quantum Beam Technology is expected to support various areas, covering from highly advanced and important science and technology and academic areas, such as nanotechnology and life-science, to diverse industries, such as medicine, agriculture and manufacturing, among others. Thus, the Government needs to make continuous efforts to develop state of the leading-edge quantum beam facilities and equipment, such as high-intensity proton accelerators, as basic and common science and technology infrastructure in Japan. The Government should also create an environment at these facilities in which industry, academia and government can cooperate to utilize them and develop a flexible intercommunity and support system which make it easy for researchers and developers to utilize them.

(2) Industrial Areas

In order to help industries to effectively utilize results of research and development in the

radiation application area such as technologies to create and produce new materials and new processing and measurement technologies, it is important to enhance activities to disseminate information of such results. It is thus necessary to further promote cooperative and collaborative activities among industry, academia and government sectors, including the promotion of research partnerships and the use of advanced facilities by the private sector to facilitate smooth technology transfer.

(3) Medical Areas

The Government should take necessary measures to disseminate information on radiation therapy, which is less burden on patients than others, resulting from research and development of radiation medicine to the practice of medicine and medical education, and to make appropriate radiation therapy more widely available. With respect to the radiation exposure received by the patients for radiodiagnostics, we expect concerned parties to pursue cooperation with medical personnel in the field, and consider means to set the most appropriate level of the total radiation dose, for example, by formulating guidelines with reference to the safety level set by international organizations, in order to prevent unnecessary radiation exposure to members of the public.

(4) Other Areas

As for food irradiation, it is necessary to deepen mutual understanding, based on scientific grounds, between producers and consumers on the convenience and risks of actual tasks. Concerning foods irradiated in many countries, it is important that concerned parties assess the scientific rationality using scientific data and other materials, and that appropriate measures need to be taken accordingly. Radiation breeding in the area of agricultural biotechnology should continue to aim at creating new breeds, which will contribute to the elevation of people’s standard of living and to the promotion of industries. Regarding pest control by sterile insect technique and others, it is necessary to continue promoting technological development and projects for the eradication and prevention of pests. The Government should promote the advancement of radiation technologies for environmental protection and production of metal absorbents and appropriately support all the concerned parties working toward their commercialization.

Chapter 4: Promotion of Research and Development of Nuclear Energy

4-1 Promotion of Research and Development of Nuclear Energy

Maintaining nuclear power generation as a key source of electricity is of great public interest. Thus, it is necessary to constantly improve and modify the safety, reliability, economic viability, energy security and environmental compatibility of the existing technologies, including those of the nuclear fuel cycle. At the same time, it is also necessary to undertake research and development of competitive and innovative technologies that will lead the nuclear power supply in the next generation. In the area of utilization of radiation, numerous possibilities for improvement and innovation have been proposed in every process from the generation to the utilization of radiation. The realization of these possibilities will bring about academic success and industrial prosperity, and therefore, it is appropriate to carry on various research and development activities in the future. Basic and fundamental research and development activities, which support the base of nuclear development and utilization technologies and create new concepts, should continue in the future. In the meantime, the country of origin of the nuclear technology is crucial in the international arena. In many cases, it is not easy to pursue international opportunities if the technology is not domestic in nature. Therefore, we should keep it in mind that promotion of research and development leading to our own unique technologies is more important in the nuclear energy field than any other.

Furthermore, nuclear research and development possesses generality as can be seen in such case that large-scale nuclear research and development facilities offer effective research tools to diverse science and technology areas. It also offers seeds of various innovative technologies due to synergic effects of results from research and development activities in different time horizon, performed in parallel, ranging from long-term exploratory research to short-term research and development for improvement and modification of practical technologies.

Based on the above-mentioned points, it is appropriate to continue nuclear research development actions across five different time frames: 1) basic and fundamental research and development which generate innovative concepts, 2) research and development to pursue the feasibility of a technological system based on innovative concepts, 3) research and development to upgrade an innovative technological system to the point where they become a candidate for commercialization 4) research and development to put the innovative technological system into practice, and 5) research and development for improving and modernizing technologies already in practice.

The characteristics of nuclear research and development include: large uncertainties associated with commercialization of nuclear technologies, such as long realization periods; high risks that inhibit independent participation by private sector organizations; need for research and development facilities that can handle radioactive materials, and so on. Thus, in order to maintain and expand contributions and services of nuclear technologies, the Government and research and development institutions need to play a more prominent role in the area of nuclear research and development than in other science and technology areas, particularly, at the stage of upgrading the innovative technological system to a candidate for commercialization. Even in this case, however, the activities of the Government should be conducted effectively and efficiently by specifying expected outcomes from the perspective of public interests. Therefore, the Government should comprehensively evaluate and discuss various elements for each approach and allocate research and development resources effectively and efficiently in line with

the concept of “selection and concentration.” The elements to be evaluated and discussed include, expected outcomes and issues within a fixed period of time; cost effectiveness of investment based on results of multilateral evaluation of the outcome taking into consideration of the predicted environmental conditions during the period of application; separation of roles between the public and private sector and resource allocations according to the time frame or stages of research and development; feasibility of effective utilization of international cooperation, etc.

In addition, it is desirable in the discussions of the allocation of governmental investments in research and development to evaluate and appropriately consider the function of nuclear research and development in the context of the overall science and technology activities in Japan, including the fact that large-scale research and development facilities contribute to diverse science and technology areas as effective research tools.

4-1-1. Basic and Fundamental Research and Development

Basic and fundamental research and development activities are conducted to support the utilization of nuclear energy in Japan in a cross-cutting manner, to maintain its high level of technological infrastructure, and to acquire and create new knowledge and technical concepts. They also contribute significantly to the development of researchers and engineers. Therefore, research and development at this stage should be proactively promoted by the Government, research and development institutions and universities, while making effective utilization of international cooperation.

Since nuclear safety research is directly associated with the major premise of safety assurance necessary for utilization of nuclear energy and is a basis for the activities related to the research, development and utilization of nuclear energy, it needs to be consistently promoted based on the Nuclear Safety Commission’s “Prioritized Plan for Nuclear Safety Research.”

Major activities of basic and fundamental research and development include research and development of the base technologies of nuclear energy, such as nuclear engineering, nuclear reactor engineering, material engineering, and nuclear simulation techniques. They also include safeguards technologies, quantum beam technologies, and technologies that have potential to drastically improve economic efficiency of reprocessing, and research and development of partitioning and transmutation technologies to reduce the burden of disposal of radioactive waste by shortening life of long-lived nuclides in radioactive waste. As far as quantum beam technologies and radiation utilization research using radioisotopes and others are concerned, it is necessary to consistently promote research to seek innovative technologies, explore new usage and extend usage to areas other than nuclear energy. In addition, the Government should promote the basic research to survey technological options that allow flexible responses in future to social conditions in the promotion of the nuclear fuel cycle activities.

The Government should appropriately evaluate new knowledge and technical concepts developed at this stage and determine whether to designate them as activity targets for developing an innovative technological system.

4-1-2. Research and Development to Pursue the Feasibility of Commercialization a Technological System Based on Innovative Concepts

The Government should specify the approach of the research and development to pursue the feasibility of commercialization of a technological system developed by basic and fundamental research and development, according to the degree of public interest generated by the expected commercialization in relation to the costs required for the process.

Currently items for research and development in this category include technological systems for fusion energy production based on the Third Phase Basic Plan for Fusion Research and Development including the ITER (International Thermonuclear Experimental Reactor) project and technological systems for a high temperature gas reactor which can be a high temperature heat source for power generation with excellent economic efficiency and hydrogen production based on it. It is important to continue to promote research and development of such technologies by identifying essential tasks from a long-term perspective, giving due consideration to technical concepts and maturity of basic technology. In doing so, it is also necessary to consider efficient development of a large-scale technological system through the development of advanced simulation technologies. As far as quantum beam technologies are concerned, a technological system based on innovative technical concepts, such as cancer treatment systems utilizing small-size accelerators, must be developed under the same principle.

4-1-3. Research and Development to Upgrade the Innovative Technological System to a Candidate for Commercialization

Regarding research and development intended to upgrade the innovative technological system, which has good potential to bring about innovation in the utilization of nuclear energy as well as in various science and technology areas, and to point out the path to realize the commercialization of technology candidates, the Government and research and development institutions should take proactive initiatives, share a roadmap and other information with the industries and promote cooperation and collaboration with universities and industries. In doing so, it is essential to design a step-by-step plan that calls for the government evaluation of the outcomes at each step, and subsequently, using evaluation results to plan prioritization of research and development activities to be implemented in the next step. Furthermore, in order to create an environment where the industry can select commercialization targets, it is important for relevant administrative authorities in charge of research and development policies and industrial policies to facilitate policy coordination.

The major task at this stage is the research and development of FBR and its fuel cycle technology. As FBR and its fuel cycle technology has the potential of contributing to long-term energy security and reduction of the effects of potential toxicity of radioactive waste, it is necessary to consistently promote the research and development toward its commercialization led by the Japan Atomic Energy Agency, while fully applying lessons learned from past experiences. Specifically, the operation of “Monju,” the core of the place for its research and development, should be resumed at the earliest possible time, and the priority should be placed on achieving the initial goals of demonstrating reliability as an operational power plant and establishing sodium handling technology, hopefully, within ten years or so. After that, we expect “Monju” to be utilized as a location for research and development activities toward commercialization of FBR and its fuel cycle technology, in cooperation with the research and development activities of fuel production and reprocessing technology, based on the prospect of offering fast neutrons to relevant research and development activities. As far as specific

activities are concerned, plans should be made while evaluating up-to-date operational results and the results of the "Feasibility Study on Commercialized FBR Cycle System." Since international cooperation is important for these activities, it is necessary to develop "Monju" and its peripheral facilities as the center of international research and development cooperation, to implement research and development open to both domestic and foreign entities, and to demonstrate the achievements to both Japan and outside world.

Based on the achievements of "Monju" and other research and development activities, the Japan Atomic Energy Agency and electric utilities have been implementing a Feasibility Study on Commercialized FBR and its Fuel Cycle System, aiming to present, in around 2015, an appropriate picture of commercialization of the FBR cycle and the research and development plans leading up to the commercialization, in cooperation with Central Research Institute of Electric Power Industry, manufacturing companies and universities, etc. The Phase II outcomes are the intermediate summary of the activity, and will be compiled by the end of fiscal 2005. The Government will evaluate them and present guidelines, along which the subsequent research and development activities should proceed. In doing so, it is also important to integrate the relevant outcomes of the Generation IV International Forum.

The Japan Atomic Energy Agency will also utilize both domestic and international research and development facilities, including the experimental reactor "Joyo," and will conduct a wide range of research and development activities with FBR and its fuel cycle technology, inviting the participation of prominent researchers from other countries. We expect the Central Research Institute of Electric Power Industry, universities and manufacturing companies to pursue research and development in coordination with these efforts.

The Government should appropriately evaluate progress of these projects and present to the people flexible and strategic research and development policies. Particularly, in response to the Feasibility Study on Commercialized FBR and its Fuel Cycle System, the Government will promptly evaluate the results of the Phase II Study in view of starting on an appropriate picture of commercialization of FBR cycle and then present the subsequent step by step research and development policies to introduce the system into the market from 2050 onward. In the meantime, it is appropriate to decide on specific plans about demonstration reactors which should be placed as a task for the next step toward commercialization, upon examining various outcomes from the research and development process of these activities.

4-1-4. Research and Development to Commercialize the Innovative Technological System

The research and development planned and implemented to select the technological system for commercialization among candidates is basically conducted by industries that will eventually conduct business with the selected system, using their own resources. Only when the commercialized technological system is important from the perspective of public interest, should the Government support the activities following an appropriate and suitable cost-benefit analysis.

Major tasks at this stage include radioactive waste disposal technology, advanced LWR technology, full core MOX fuel loading technology etc. The Japan Atomic Energy Agency will continue giving technical support necessary for the Rokkasho reprocessing plant. Concerned parties will discuss

the framework of technical development for new reprocessing plants that are to continue the work of their predecessors, namely the Rokkasho reprocessing plant, in response to the formulation of policies based on the performance of the Rokkasho reprocessing plant and progress of the research and development on FBRs and reprocessing. Among them, demonstration tests of reprocessing high burn-up fuel and MOX fuel for LWRs will be performed by the Japan Atomic Energy Agency provided that the technical issues faced by the Rokkasho reprocessing plant and successor plants are shown to the Agency. It is also efficient to effectively utilize Japan Atomic Energy Agency's technical potential and safety test devices, etc. for the development of advanced LWR technology.

Since it is effective for industries to promote the research and development for radiation utilization at this stage by effectively using the knowledge accumulated in the earlier stages. Therefore the Government should further promote technology transfer and cooperation and collaboration between industry, academia and government in order to disseminate the knowledge.

4-1-5. Research and Development for Improving and Modernizing Technologies in Practice

Operating entities should use their own resources in conducting research and development activities to improve and modernize technologies already in practice. However, in the case where it is desirable to share the achievements among operating entities and the success of such research and development greatly contributes to public interest, it is reasonable for the Government to provide support and guidance by developing a framework of collaborative development projects, while appropriately and suitably assessing the details. Meanwhile, the stagnation of new construction of nuclear power plants is predicted to continue for some time and the prediction is raising concern over the maintenance of technical infrastructure that has been built by the industry. It is worthy to note that the continuation of above-mentioned technological developments would contribute to the maintenance of this technical infrastructure even in such occasion.

Major activities at this stage include the following: advancement in existing LWR technology and centrifuge uranium enrichment technology, establishment of MOX fuel fabrication technology to be adopted at a Japan's first private MOX fuel fabrication plant, and advancement of vitrification technology for the treatment of high-level radioactive liquid waste.

4-2. Large-scale Research and Development Facilities

Promotion of research and development of nuclear energy often requires relatively large-scale research facilities such as accelerators and nuclear reactors. Large-scale research facilities constructed for this purpose play a significant role in wider areas of science and technology activities; and because of this generic usability of the facilities, it is possible to form the Center of Excellence (COE) of scientific technology at their site. When planning facilities of this nature, the Government should determine the propriety of the construction based on the evaluation of not only the degree of benefit obtained from the facilities for research and development, which is the major objective, but also based on positive externalities, such as the drastic improvement in research standard that the facilities provide to other areas.

When constructing these facilities with the intent to open them to as many users as possible, the Government should call for operating research and development institutions to facilitate usability and to create an environment where users of various research areas can easily explore new ways of their

utilization and application, in cooperation not only with related research communities but also with operating entities and the relevant local governments. However, when using such research and development facilities and equipment, beneficiaries should basically bear their fair share of its cost, except for the case where research results are in the public's interest.

4-3. Development of the Knowledge and Information Base

It is important to promote research and development of centrifuge uranium enrichment technology, MOX fuel fabrication technology, reprocessing technology, radioactive waste treatment and disposal technologies, with a flexible implementing framework with respective roles of industry, academia, and government, since the private organizations solicit for technology transfer from these research and development activities of the Government or private organizations are performing them with technology transferred from the Government. It is necessary therefore to build an effective and efficient technology transfer system, while appropriately managing intellectual property, considering the importance of private utilization of research and development facilities and equipment not only for the transfer of human resources but also for the transfer of know-how in these endeavors.

In order to commercialize the technology obtained as an outcome of such research and development, and to proactively utilize the accumulated knowledge and experience in the next generation, it is necessary to systematically manage the knowledge and technology within and between the organizations and to smoothly transfer or pass these down to the next generation. Therefore, in order to establish intellectual collaboration among industry, academia and government from an early stage of the efforts toward commercialization, research and development institutions, researchers and engineers must attempt to facilitate the sharing of each other's research and development activities, and improve the network for mutual learning. Furthermore, they should promote the management of intellectual property beyond generations through these means.

In addition, in light of the usefulness of the international knowledge network for the research and development activities in Japan, multilateral and international networks should be established and developed, such as for the improvement of the mobility of human resources and development of infrastructure for transmission of research data and related information, etc.

4-4. Establishment of the Japan Atomic Energy Agency and Research and Development of Nuclear Energy

We expect the Japan Atomic Energy Agency, which will be formed in October 2005, to be an international center of nuclear research and development as the only institution stipulated in the Atomic Energy Basic Law. Specifically, it is to promote research and development with flexibility and promptness, while pursuing collaboration and integration between basic and fundamental researches and research and development of projects in view of a wide and various ranges of options. It will also contribute to Japan's nuclear research and development activities through the dissemination and promotion of utilization of research and development results; sharing of facilities; human resource development; contribution to international cooperation and nuclear non-proliferation; technical support for national policies, such as implementation of nuclear safety research; among others.

Chapter 5 Promotion of International Approaches

5-1. Maintenance and Strengthening of the Nuclear Non-Proliferation Regime

Japan, with the aim of realizing a peaceful and safe world free of nuclear weapons, will advance its nuclear disarmament diplomacy and further enhance the international regime for nuclear non-proliferation.

As for nuclear disarmament, Japan will continuously work toward early CTBT (Comprehensive Test Ban Treaty) ratification and call for FMCT (Fissile Material Cut-off Treaty) talks to start at the earliest possible time.

As an effort toward nuclear non-proliferation, Japan calls on the international community to conclude the International Atomic Energy Agency's (IAEA's) Comprehensive Safeguards Treaty and its Additional Protocol, in order to develop an environment that allows easy detection of undeclared nuclear material and nuclear activities. Japan also promotes the development of advanced measurement and accounting technology to detect diversion to military uses and proliferation resistant technology to prevent diversion to military uses.

In addition, as an effort to prevent proliferation in cooperation with the international community, Japan will be actively involved in the discussions of the Nuclear Suppliers Group (NSG) on export control issues for the maintenance and strengthening of the non-proliferation regime, and will strive for its realization. Also, Japan will actively participate in the Proliferation Security Initiative (PSI), which is a global effort that aims to thwart the spread of weapons of mass destruction, including nuclear weapons, by interdicting shipments.

Furthermore, Japan will actively participate in discussions on new proposals for maintenance and strengthening of the nuclear non-proliferation regime, including Multilateral Nuclear Approaches (MNA), while assessing whether to contribute to the enhancement of the global nuclear non-proliferation regime and promotion of peaceful use of nuclear energy.

In order to build a stronger foundation for non-proliferation efforts, we expect that the concerned parties, both domestic and foreign and including universities, will cooperate with each other to develop human resources capable of assuming these responsibilities.

Through a series of these activities in cooperation with the international community, Japan will foster a globally shared awareness that it is a major prerequisite for us enjoying benefits from the peaceful use of nuclear energy to strictly observe international norms and treaties, which have been enacted from the perspective of striking a balance between nuclear non-proliferation and the peaceful use of nuclear energy.

5-2. International Cooperation

When using knowledge and achievements of nuclear science and technology in efforts to elevate people's living standard and to combat global warming effectively and efficiently, Japan should promote international cooperation, such as exchange of information and experiences through bilateral and multilateral channels as well as through international organizations on condition that such activities

should be carried out, strictly limiting them to peaceful use ensuring nuclear non-proliferation, and assuring their safety and security.

5-2-1. Cooperation with Developing Countries

As for cooperation with developing countries, Japan should continue cooperation on the application of radiation in the areas of agriculture, industry and medicine, the development of human resources engaged in such activities of radiation application, and preparatory works for the introduction of nuclear power generation, with a view to contribute to the establishment of intellectual infrastructure concerning the utilization of nuclear energy in the recipient countries, to the improvement of social and economic infrastructure, to the establishment and enhancement of the nuclear non-proliferation regime, and to the building of safety nets; among others.

Japan should pursue proactive and positive cooperation with Asian developing countries, which have close geographical and economic ties to Japan. When cooperating, it is necessary to pay attention to the political stability, the state of utilization of nuclear energy, signature and observation of nuclear-related international treaties and frameworks by the recipient country in order to ensure the peaceful use of nuclear energy under non-proliferation regime. In the case where a recipient country does not satisfy these conditions, consideration should be given to the way to pursue international peace and reciprocity based on a forward looking concept, limiting cooperation in such universal areas as promotion of the activities of international organizations and safety assurance as appropriate.

It is appropriate in the cooperation with developing countries to put emphasis on the initiative of the recipient country and on the spirit of partnership, and effectively utilize multilateral or bilateral frameworks and international organizations, such as the Forum for Nuclear Cooperation in Asia and the IAEA's Regional Cooperation Agreement (RCA).

Furthermore, in order to enhance the effectiveness of cooperation, it is essential for recipient countries to have political will to promote the advancement of science and technology through the cooperation in the area of nuclear energy and to effectively utilize such advancement for their social and economic development. Thus, it is also important to bring nuclear-related topics into such high-level bilateral and multilateral policy talks as energy policy talk.

5-2-2. Cooperation with Developed Countries

Regarding cooperation with developed countries, Japan will actively cooperate upon specifying the areas of competition and the areas of cooperation with in order to fulfill the common responsibility of a developed nation to contribute to the welfare of all mankind, to alleviate uncertainties and burdens associated with research and development in Japan, to pursue to bring up national research centers into the international COE, to establish a multilateral human network, etc. The ITER and the Generation IV International Forum are the embodiment of this vision.

5-2-3. Participation and Cooperation with International Organizations

Japan has actively participated and cooperated with international organizations such as the International Atomic Energy Agency (IAEA) and the Organization for Economic Cooperation and Development/Nuclear Energy Agency. Japan should identify them as common infrastructure for the peaceful use of nuclear energy in the international community and continue proactive participation in

their activities, with due consideration to the importance of involvement from their early stages such as the planning stages.

It is important to actively participate in the international conferences, hosted by international organizations and international academic and technical professional societies, and in the formulation of standards, policies, etc. Through the activities for these international organizations, Japan should send messages regarding its objectives for utilization of nuclear energy and its commitment to the peaceful use of nuclear energy as well as appropriate and adequate information on accidents, etc.

5-3. International Development of the Nuclear Industry

Because the introduction and expansion of nuclear power plants of each country will moderate the international competition over fossil fuel resources and serve as measures against global warming, it is significant to internationally develop nuclear power plants technology which has been fostered by Japan's nuclear industry,.

When transferring nuclear material, equipment and technology, Japan should continue implementing strict and appropriate procedures and export controls in compliance with the framework of international non-proliferation policy. Furthermore, it is necessary to further enhance cooperation with other nations and regions to prevent roundabout export. The said transfer is also based on the degree of development of the system for nuclear non-proliferation, nuclear safety and security as well as the assurance of political stability in the recipient country, and the achievement of international and national understanding. Based on such premises, it is important to work in the following ways, taking the degree of the development of nuclear power plants of the recipient county into consideration.

For the countries with highly developed nuclear power plants, such as the U.S. and France, etc., the industry is expected to take initiatives in the search for the market on a commercial basis.

For the countries in the expansion stage of nuclear power generation programs, industries has worked on international businesses in cooperation with industries of other nations, with due consideration to licenses and various international norms concerning nuclear-related technologies. It is expected that the industry will continue international engagement with such countries under such policies in the future. The Government, based on the above-mentioned premises, should continue active efforts, such as cooperation in the areas of safety assurance and human resource development and announcement of the Government's position to provide maximum support for the nuclear energy industry. We also expect electric utilities to offer cooperation and consultation, etc. based on the knowledge and experience they have cultivated from the construction and operation of nuclear power plants.

For those countries intending to launch nuclear power plants in the future, it is appropriate, from the perspective of supporting regional development, for the Government to provide indirect support by offering knowledge, experience and expertise, such as the non-proliferation regime, safety regulation systems, and system of liability and compensation for nuclear damage, according to the development level of the recipient country. In addition, based on the above premises and specific needs of the concerned countries, the Government should take measures suitable for cooperation, including construction of a framework for the transfer of material and equipment under bilateral agreements, etc.

Chapter 6: Improvement of Evaluations on Activities for Research, Development and Utilization of Nuclear Energy

The measures by the Government to achieve the basic objectives of the research, development and utilization of nuclear energy must be effective and efficient in improving public welfare. It is not easy, however, to plan necessary measures toward an uncertain future from the long-term perspective, and to promote them amid a globalizing, growing and complicated environment, obtaining the understanding of the people about such measures. Accordingly, the Government should work on the continuous evaluation and improvement of nuclear energy measures, regarding the stipulated policy evaluation as part of the PDCA activities (Plan-Do-Check-Action) for policies, and explain the processes and the results to the people. In doing so, it is important to perform multilateral and quantitative evaluations because nuclear energy policies require comprehensive promotion based on the major premise of safety assurance over a long period of time under active management of uncertainties. In the evaluation of research and development program as a part of such activities, not only the degree of possible benefits the project may yield and its outcomes from scientific and technical perspectives, but the significance to the development of the economy and environmental protection should also be assessed, and the result should be reflected in the implementation plans.

The research and development conducted by independent administrative institutions should be evaluated appropriately and adequately by the Government in line with the General Law on the Independent Administrative Institution, paying due attention to the above-mentioned concepts as well as the rule that they should be administered autonomously. Particularly, as research and development that requires large-scale public investment should be promoted in a step-by-step manner, the Government should always perform evaluation based on the above-mentioned concepts when deciding whether to progress it from one step to the next.

The Atomic Energy Commission will follow up the implementation of policies on nuclear energy by the concerned administrative bodies appropriately and adequately; periodically evaluate the relevance of policies concerning the research, development and utilization of nuclear energy for the next ten years, with due consideration to the results of the policy evaluation of the concerned administrative bodies mentioned above and to the public opinions on the evaluation results; and explain the outcomes of policy evolution to the people.

We consider it rational that the private sector has already conducted business risk management to minimize the damage from the occurrence of unexpected events in business. In light of the public nature of nuclear energy-related business and from the perspective of seeking robust efficiency with the public's trust by securing stable management, we expect the private sector to enhance such evaluation activities including those related to safety assurance so as to implement business risk management adequately. Particularly, we expect that the private sector will continue to improve and enhance the nature of activities for establishing an excellent organizational culture and those leading toward a mutual understanding with the people, by performing appropriate and adequate evaluations, including external evaluation.

Annex

Annex-1 Members of the Atomic Energy Commission

Members of the Atomic Energy Commission

5 members, since January 2004

KONDO, Shunsuke	Chairman
SAITO, Shinzo	Vice-Chairman
KIMOTO, Noriko	Commissioner
MACHI, Sueo	Commissioner
MAEDA, Hajimu	Commissioner

Annex-2 Setting up of the New Nuclear Policy-Planning Council

Establishment of a Long-Term Plan for Research, Development and Utilization of Nuclear Energy

June 15, 2004

Decision by the Atomic Energy Commission

1. Start on establishment of a new nuclear policy plan

According to the Atomic Energy Basic Law, the research, development and utilization of nuclear science and engineering in Japan, are, strictly limiting all activities to peaceful purposes and placing the greatest importance on safety, performed autonomously under democratic management, and the results therefrom should be made to public voluntarily to contribute to international cooperation.

The Atomic Energy Commission (AEC) has formulated Long-Term Plans for Research, Development and Utilization of Nuclear Energy (hereinafter referred to as Long-term Plans). The AEC has evaluated and revised Long-term Plans approximately every five years, based on the progress of the plans and changes in social conditions, and has formulated Long-term Plans nine times since it formulated the first Long-term Plan in 1956. The current Long-term Plan was formulated in November 2000, and it will be five years in November of the next year.

Although the research, development and utilization of nuclear science and engineering in Japan have been carried out in some areas as steadily as were expected, there has been some delay observed mainly in the nuclear fuel cycle business. Furthermore, the following new conditions have been emerging; progress of liberalization of the electricity market; establishment of the Basic Energy Plan based on the Basic Law on Energy Policy; enhancement of a quality management system in nuclear safety regulation systems and corporate activities; the integration of the Japan Atomic Energy Research Institute and Japan Nuclear Cycle Development Institute; emerging necessity of new efforts for developing human resources, and further enhancement of efforts for nuclear non-proliferation and physical protection, etc..

Under these circumstances, the AEC has hosted “public hearings on the Long-Term Plan” 15 times since January 2004 to gather a wide range of opinions from the public. The AEC hosted “The 7th Conference for Public Participation and Decision Making – as an opportunity to express opinions on the Long-Term Plan” to listen to proposals and opinions from various quarters with regard to establishment of a new plan. As a result, the AEC decided to initiate efforts to compile a new policy plan within 2005, paying due consideration to the fact that it is the first plan to be established since the AEC was transferred to the Cabinet Office as a part of the Government reorganization in 2001.

2. The process of the review

(1) Setting up of the New Nuclear Policy-Planning Council

(a) The New Nuclear Policy-Planning Council will be set up in the AEC to investigate and discuss necessary matters and establish a new nuclear policy plan. The members of the council are described in the annex. In order to reflect the wide range of public opinions on the discussion, the AEC selected the council members from various sectors of society, such as local governments, leading experts, citizens/NGOs, operating entities, and research institutes, considerately taking a balance in the areas of expertise, gender, and regions, and ensuring diversity of opinions on nuclear science and engineering. The members of the AEC are also included in the council.

(b) In order to facilitate investigation and discussion, subcommittees are set up in the New Nuclear Policy-Planning Council, where necessary, to organize issues. The members of subcommittees are selected by the AEC.

(c) The New Nuclear Policy-Planning Council and subcommittees should be dissolved when investigation and discussion are completed.

(2) The process of discussion

(a) The New Nuclear Policy-Planning Council and subcommittees should be all open to the public, and their proceedings should be made and disclosed to the public immediately after conferences, with the exception of the cases where the chairman of the New Nuclear Policy-Planning Council or subcommittees decides it appropriate not to disclose it to the public.

(b) The chairman of the AEC chairs the New Nuclear Policy-Planning Council.

(c) A wide range of public opinions should be gathered by invitation or the Conference for Public Participation and Decision Making, and be reflected in discussions. Leading experts in special fields should be summoned to the conferences, where necessary, for their opinions.

(Reference: Supplementary explanation)

1. Requirements for establishment of a new nuclear policy plan

In establishing a new nuclear policy plan, it is important to evaluate the current plan and clarify the basic principles, purposes, and responsible implementing bodies of research, development and utilization of nuclear science and engineering. It is important to verify the validity of the policies by quantitatively examining them as much as possible.

As for policies related to utilization of nuclear power as energy, in particular, it is required to clarify short-term, mid-term, and long-term roles that each of the administrative departments, R&D organizations, universities, and the private sector should play, and the basic concepts of government regulation/guidance policies necessary to achieve them.

Furthermore, as for policies related to utilization of radiation and nuclear reaction, it is important to clarify how to cope with short-term, mid-term, and long-term problems, ranging from development to utilization in the industry of radiation generators that can be used as a prominent tool of R&D, and the basic concepts related to responsible implementing bodies.

In this way, a new nuclear policy plan should present the basic framework of the government policies from the short-term, mid-term, and long-term point of view, reviewing the government's internal and external activities related to research, development and utilization of nuclear science and engineering.

2. Possible viewpoints of discussions in establishment of a new nuclear policy plan

- Positioning of nuclear power generation in the energy supply
- Desirable harmony between the public/society and nuclear energy; including safety assurance and public hearing and publicity projects, etc.
- Desirable roles of the government and the private sector necessary for utilizing nuclear power generation as a one of principal power sources, and rational nuclear fuel cycle system necessary for this
- Desirable R&D related to utilization of nuclear energy including fast breeder reactor and its fuel cycle technology
- Various development of nuclear science and technology using radiation and nuclear reaction, aiming for improvement of welfare of society and the living standard of people and advancement of science and technology
- International joint activities to effectively and efficiently promote research, development and utilization of nuclear science and engineering, and bilateral and multilateral cooperation from the perspective of pursuing mutual benefits
- Contribution to harmony between international society and nuclear energy

Members of the New Nuclear Policy-Planning Council

32 members, as of September, 2005

KONDO, Shunsuke(Chairman)	Chairman, The Atomic Energy Commission
BAN, Hideyuki	Co-director and Secretary General, Citizen's Nuclear Information Center
CHINO, Keiko	Chief Editorial Writer, The Sankei Shimbun
FUJI, Yohsaku (assigned until the 23rd Council)	President and Director, The Kansai Electric Power Co., Inc.
HASHIMOTO, Masaru	Governor, Ibaraki Prefecture
IKAWA, Yojiro	Editorial Writer, Tokyo Head Office, The Yomiuri Shimbun
INOUE, Chiiko	Commentator on Life Information
KANDA, Keiji	Professor Emeritus, Kyoto University Director, Japan Energy Policy Institute
KATSUMATA, Tsunehisa	Chairman, The Federation of Electric Power Companies (President, The Tokyo Electric Power Co.,Inc.)
KAWASE, Kazuharu	Mayor, Tsuruga City (Chairman, All Japan Council of Local Governments with Atomic Power Stations)
KIMOTO, Noriko	Commissioner, The Atomic Energy Commission
KOJIMA, Shinpei	President, University of Fukui
KUSAMA, Tomoko	President, Oita University of Nursing and Health Sciences
MACHI, Sueo	Commissioner, The Atomic Energy Commission
MAEDA, Hajimu	Commissioner, The Atomic Energy Commission
MATSUO, Shingo (assigned since the 24th Council)	President, Kyushu Electric Power Co., Inc.
NAKANISHI, Tomoko	Professor, Graduate School of Agricultural & Life Sciences, The University of Tokyo
NIWANO, Masao	Supreme Advisor, Nuclear Energy Steering Committee, The Japan Electrical Manufacturer's Association (Executive Officer, Corporate Executive Vice President, Toshiba Corporation)
OKAMOTO, Yukio	Foreign Policy Commentator
OKAZAKI, Toshio	President, Japan Atomic Energy Research Institute
SAITO, Shinzo	Vice-Chairman, the Atomic Energy Commission

SASAKI, Hiroshi	Professor, The University of the Air
SASAOKA, Yoshikazu	Honorary Adviser, The Federation of Electric Power Related Industry Worker's Unions of Japan
SUENAGA, Yoichi	Director, the Institute of the Global Studies, Aomori University
SUMITA, Hiroko	Lawyer Specially Appointed Professor, Dokkyo University
TANAKA, Satoru	Professor, Graduate School of Engineering, The University of Tokyo
TONOZUKA, Yuichi	President, Japan Nuclear Cycle Development Institute
UCHIYAMA, Yohji	Professor, Department of Risk Engineering, Faculty of Systems and Information Engineering, University of Tsukuba
WAKE, Yoko	Professor, Faculty of Business and Commerce, Keio University
WATANABE, Teruyo	Board member, Japanese Consumer's Co-operative Union
YAMAJI, Kenji	Professor, Graduate School of Engineering, The University of Tokyo
YAMANA, Hajimu	Professor, Research Reactor Institute, Kyoto University
YOSHIOKA, Hitoshi	Professor, Graduate School of Social and Cultural Studies, Kyushu University

Annex-3 Setting up of the Technical Subcommittee

Setting up of the Technical Subcommittee of the New Nuclear Policy-Planning Council

July 29, 2004

1. Purpose

The Subcommittee will inspect specialized technical matters pointed by the New Nuclear Policy-Planning Council, as a preparation for comprehensive evaluation of the nuclear fuel cycle to be conducted by the New Nuclear Policy-Planning Council.

2. Organization

The Subcommittee consists of several members of the New Nuclear Policy-Planning Council (see the annex).

The chairman of the New Nuclear Policy-Planning Council can join in the proceedings.

Experts of the Japan Nuclear Cycle Development Institute and the Japan Atomic Energy Research Institute who have specialized knowledge with regard to technical inspection can participate as a member of the secretariat and can make remarks at the chairman's request.

3. Matters to Study

The following matters should be studied according to the directions of the New Nuclear Policy-Planning Council.

(a) Organization of concepts such as direct disposal methods, etc.
(b) Confirmation of the past estimations of economic viability
(c) Organization of assumptions and methods of cost estimation
(d) Cost estimations of basic fuel cycle scenarios assumed by the New Nuclear Policy-Planning Council
(e) Other specialized technical matters

4. Schedule

The first Subcommittee will be held at the beginning of August, 2004. After that, the Subcommittee will be held one to three times a month, and the results should be reported appropriately to the New Nuclear Policy-Planning Council.

5. Others

The Subcommittee will be dissolved when the inspection on committed matters is completed and the result is reported to the New Nuclear Policy-Planning Council.

Members of the Technical Subcommittee

8 members, as of October, 2004

UCHIYAMA, Yohji (Chairman)	Professor, Department of Risk Engineering, Faculty of Systems and Information Engineering, University of Tsukuba
BAN, Hideyuki	Co-director and Secretary General, Citizen's Nuclear Information Center
FUJI, Yohsaku	Chairman, The Federation of Electric Power Companies
SATAKE, Makoto (Acting)	Managing Director, The Tokyo Electric Power Co., Inc.
SASAKI, Hiroshi	Professor, The University of the Air
TANAKA, Satoru	Professor, Graduate School of Engineering, The University of Tokyo
YAMAJI, Kenji	Professor, Graduate School of Engineering, The University of Tokyo
YAMANA, Hajimu	Professor, Research Reactor Institute, Kyoto University
WAKE, Yoko	Professor, Faculty of Business and Commerce, Keio University

Annex-4 Setting up of the Working Group on International Issues

Setting up of the Working Group on International Issues of the New Nuclear Policy-Planning Council

February 1, 2005
Decision by the Atomic Energy Commission

1. Intention

The AEC sets up the Working Group on International Issues in the New Nuclear Policy-Planning Council, to conduct a specialized review on international issues related to nuclear energy and to contribute to establishment of a new nuclear policy plan.

2. Organization

The organization of the Working Group is described in the annex.

The chairman of the New Nuclear Policy-Planning Council and the members of the AEC can join in the proceedings.

Experts of the Japan Nuclear Cycle Development Institute and the Japan Atomic Energy Research Institute who have specialized knowledge with regard to international issues can participate as a member of the secretariat and can make remarks at the chairman's request.

3. Matters to inspect

(a) Desirable international development for strengthening of nuclear non-proliferation regime
(b) Desirable international cooperation with regard to research, development and utilization of nuclear science and engineering
(c) Desirable international development with regard to research, development and utilization of nuclear science and engineering

4. Schedule

The first meeting will be held in February, 2005. After that, the meetings will be held nearly once a month, and the results should be reported to the New Nuclear Policy-Planning Council during April, 2005.

5. Others

The Working Group will be dissolved when the review is completed and the result is reported to the New Nuclear Policy-Planning Council.

Members of the Working Group on International Issues

12 members, as of April, 2005

NAITO, Kaoru (Chairman)	Senior Executive Director, Nuclear Material Control Center
CHINO, Keiko	Editorial Writer, The Sankei Shimbun
FUJI, Yohsaku	Chairman, The Federation of Electric Power Companies
TAKEKURO, Ichiro (Acting)	Managing Director, The Tokyo Electric Power Co., Inc.
KANDA, Keiji	Professor Emeritus, Kyoto University Director, Japan Energy Policy Institute
KUROSAWA, Mitsuru	Professor, Osaka School of International Public Policy, Osaka University
NIWANO, Masao	Chairman, Nuclear Energy Steering Committee, The Japan Electrical Manufacturer's Association
SAITO, Shozo (Acting)	Vice Chairman, Nuclear Energy Steering Committee, The Japan Electrical Manufacturer's Association (Vice President and Executive Officer, Hitachi, Ltd.)
OKAZAKI, Toshio	President, Japan Atomic Energy Research Institute
WAKABAYASHI, Toshio(Acting)	Director, Office of International Affairs, Japan Atomic Energy Research Institute
TAKEUCHI Hiroshi (Acting)	Director, Office of International Affairs, Japan Atomic Energy Research Institute
SUDO, Tatsuya	Director, Center for the Promotion of Disarmament and Non-Proliferation, Japan Institute of International Affairs
SUZUKI, Tatsujiro	Senior Research Scientist, Socio-economic Research Center, Central Research Institute of Electric Power Industry
TAKUMA, Masao	Executive Vice Chairman, Japan Atomic Industrial Forum, Inc.
YAMANA, Hajimu	Professor, Research Reactor Institute, Kyoto University
ENDO, Tetsuya (Adviser)	Special Assistant to the Minister for Foreign Affairs