

Tentative Translation

White Paper on Nuclear Energy 2007 (Summary)

March 2008

Japan Atomic Energy Commission

Chapter 1: Overview

— For Research, Development and Utilization of Nuclear Energy to Contribute to the International Community —

1. The Trend of Nuclear Energy Utilization at home and abroad in 2007

(1) Heightening expectations for the utilization of nuclear energy in the international community

The Intergovernmental Panel on Climate Change (IPCC) concluded in its Fourth Assessment Report (AR4) released in 2007 that warming of the global climate system is unequivocal, and that most of the observed increase in global mean temperature since the mid-20th century is very likely due to the increase in global atmospheric concentration of anthropogenic greenhouse-gases. The AR4 then projected various impacts associated with projected increase in average temperatures on water resources, ecosystems, food, coasts and human health, and presented several stabilization levels for the atmospheric concentrations of greenhouse-gases that should be achieved with mitigation efforts to reduce, delay and avoid such impacts. It stated that the most stringent level (stabilizing at 445–490 ppm CO₂-eq) could limit global mean temperature increases to 2.0 - 2.4°C above pre-industrial, requiring emissions to peak within 10 years and to be around 50% of the 2000 level by 2050.

It is stated in the G8 Summit Heiligendamm declaration entitled “Growth and Responsibility in the World Economy” published in June 2007 that the head of the States will seriously consider the decisions made by the EU, Canada and Japan, which include at least a halving of global emissions of greenhouse-gases by 2050, in setting a global goal for greenhouse-gas emission reductions, and commit themselves to achieving these goals as well as invite the major emerging economies to join them in this endeavor.

Although it will be extremely demanding for humans to halve global greenhouse-gas emissions by around 2050 while each country pursues economic development, it is a challenge to which we must rise. In order to achieve this, in addition to thorough efforts in energy conservation, it will be necessary to introduce rapid and drastic innovations in the global energy system, taking urgent measures to develop, deploy and promote technologies with high efficiency and low carbon intensity in the areas of energy supply and usage.

The IPCC’s AR4 provides examples of mitigation technology in the energy supply sector, such as the use of renewable energy and nuclear energy, which produces very limited greenhouse gas emissions in its life-cycle, as well as improvement in the efficiency of energy supply and distribution, a fuel shift from coal to natural gas, and the use of CO₂ capture and storage technology.

To illustrate the magnitude and urgency of the challenge, the International Energy Agency (IEA) made an estimate of a combination of measures that would achieve the stabilization of atmospheric

concentration of greenhouse-gases at the lowest level mentioned above, in the “World Energy Outlook 2007”. The estimate includes restraint of growth in the use of conventional fossil energy as well as rapid expansion in the use of renewable energy, nuclear energy and CO₂ capture and storage (CCS) technology for fossil energy uses, in addition to significant energy conservation and energy efficiency improvement. (Fig. 1)

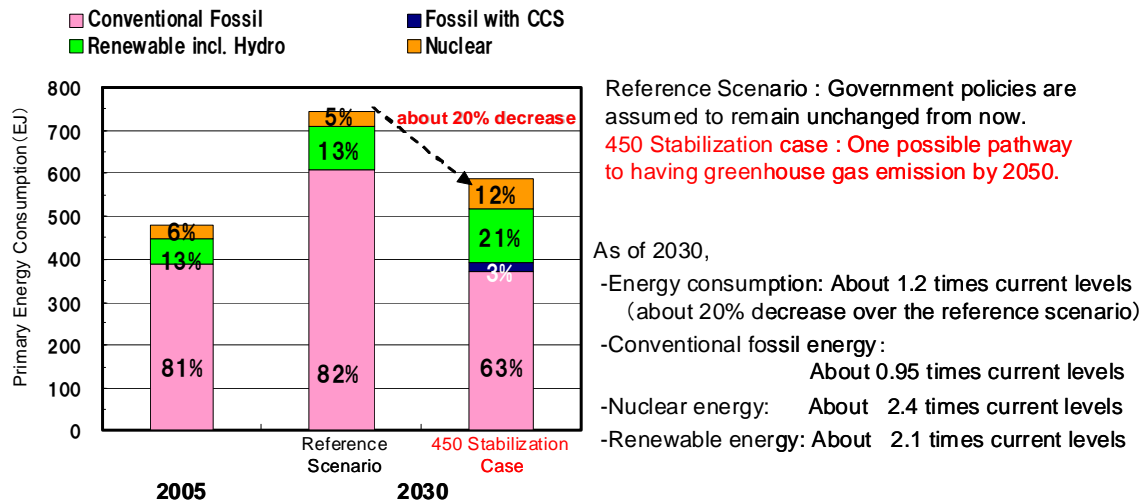


Fig. 1 Calculations of world primary energy consumption

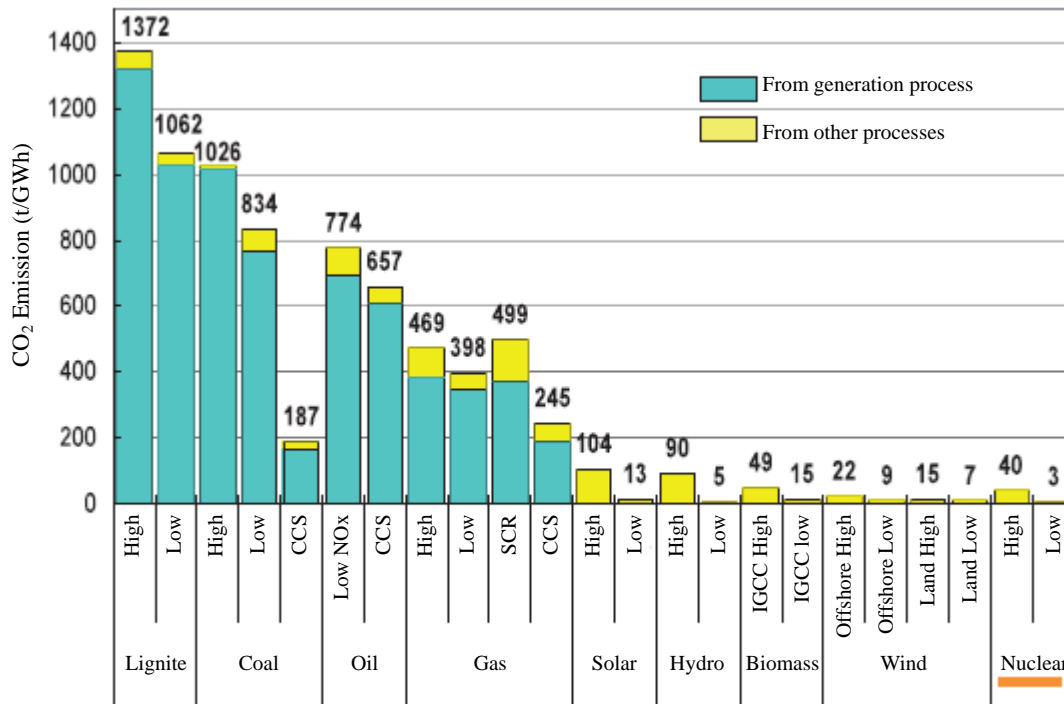
Source: World Energy Outlook 2007

It is becoming widely accepted in various regions and countries of the world that nuclear energy utilization is an effective measure against global warming. In March 2007, the European Council stated that it would fully respect Member States' choice of energy mix, and that it would note the Commission's assessment of the contribution of nuclear energy in meeting the growing concerns about safety of energy supply and CO₂ emissions reductions, while ensuring that nuclear safety and security are paramount in the decision-making process. In the UK, the Government concluded that nuclear energy and other low-carbon energy sources should be used as future energy sources, through a more than year-long dialogue with the public on the utilization of nuclear energy.

Globally speaking, CO₂ emissions in power generation sector are larger than other sectors, and are increasing at a fast rate. This means that demands for fossil fuels are escalating in the sector. In fact, fossil fuel prices remain high and international competition for natural resources is becoming increasingly fierce. The fast-growing wind and solar power also suggests that power generation sectors have a large potential for introducing new technologies. In these circumstances, nuclear power has been consistently producing about 16% of the world's electricity since 1986. As of 2006, there are 435 reactors in operation in 30 countries, with a total capacity of about 370GWe. If nuclear power generation of this scale was replaced by fossil power generation, global CO₂ emissions would

increase by 1.1 billion tons (4% of the global emission as of 2005), even if LNG combined cycle power generation, which emits the least amount of greenhouse-gases among fossil fuel power plants, was used.

In addition, considerable expansion and new introduction of nuclear power generation are currently being planned and considered for the future in various parts of the world. The number of nuclear power plants planned and considered totals about 350 (approx. 330GWe). If all of these are realized, the total capacity of the world's nuclear power generation facilities will reach a level of 700GWe and they will reduce CO₂ emission of 2 billion tons per year (7% of the total global emissions in 2005) compared with the case of power generation by LNG combined cycle power plants of such capacity. Therefore it is quite reasonable to expect that nuclear energy will significantly contribute to the stabilization of atmospheric concentration of greenhouse gases at lower levels.



(tones of carbon dioxide equivalent per lifecycle for electricity generation of GWh)
 (High, low: highest or lowest result in the category)
 (CCS: Carbon dioxide Capture and Storage)

Fig. 2 Calculated lifecycle CO₂ emission from alternative electricity sources

Source: Comparison of Energy Systems Using Life Cycle Assessment, WEC, 2004

Recognizing that many countries have plans to build new nuclear power plants, the international community is actively cooperating to expand the peaceful use of nuclear energy, while ensuring nuclear nonproliferation, safety and security. The International Atomic Energy Agency (IAEA)

developed the document “Milestones for Nuclear Power Infrastructure Development” and has held annual workshops since 2006. In these workshops, countries with nuclear power plants, including Japan, as well as ten countries planning to introduce nuclear power, have discussed issues of infrastructure development, such as legal and regulatory frameworks, financial resources and funding mechanisms, and human resource development.

Countries with nuclear power plants and those planning to build them expressed their intention to join the Global Nuclear Energy Partnership (GNEP) proposed by the U.S. in February 2006, as part of the cooperation among countries that share an understanding of the need to globally expand the peaceful use of nuclear energy in increasing global energy demand, while ensuring nuclear safety and security. The meeting of Ministers from the GNEP partner countries in May and September 2007 discussed how to develop infrastructure, and service for the supply of nuclear fuel in the countries planning to introduce nuclear power, as well as how to cooperate in promoting the development and deployment of advanced nuclear fuel cycle technology, in order to improve the environment, make contributions to the development and prosperity of the world and the reduction of nuclear proliferation risks. As of February 2008, there are 21 GNEP partner countries, including Japan.

The Forum for Nuclear Cooperation in Asia (FNCA), which was established in 1990 as a framework for regional cooperation to promote the peaceful and safe use of nuclear technology and economic development in Asia, with ten participating countries – Japan, Bangladesh, China, Indonesia, Korea, Malaysia, the Philippines, Thailand, Vietnam and Australia –, has discussed about mainly non-nuclear power generation areas such as utilization of radiation since its establishment. In recent years, however, an increasing interest in nuclear power was shown and the discussion of issues related with the introduction of nuclear power were started and at the 8th FNCA Ministerial Level Meeting in December 2007, the “Forum for Nuclear Cooperation in Asia (FNCA) Joint Communiqué on the Peaceful Use of Nuclear Energy for Sustainable Development” was issued. The communiqué stated (1) that the introduction of nuclear power should be promoted as a measure for addressing global warming and nuclear power should be included into the Clean Development Mechanism (CDM); and (2) that it should be reaffirmed that the utilization of nuclear power should be promoted in a manner that ensures nonproliferation and nuclear safety and security, and efforts should be made to introduce nuclear power through regional cooperation. The communiqué is the world’s first regional joint communiqué issued to this effect.



Fig. 3 Mr. Kishida, Minister of State for Science and Technology Policy, addressing a speech at the FNCA Ministerial Level Meeting

(2) Enhancement of international efforts to ensure the peaceful use of nuclear energy

With an increasing global interest in the introduction of nuclear energy, enhanced efforts have been made by the international community to ensure nuclear nonproliferation, safety and security.

<Nonproliferation and safeguards>

In order to promote the peaceful use of nuclear energy and prevent the diversion of nuclear material from peaceful uses to nuclear weapons under the Nuclear Non-proliferation Treaty (NPT), the IAEA has concluded a safeguards agreement with Member States and has made safeguards in place. It has also been working to increase the number of Member States that accepts Additional Protocol.

Japan has accepted IAEA safeguards under the comprehensive safeguards agreement and the Additional Protocol, and has been working to ensure the transparency of nuclear activities including the use of plutonium. With a world-class nuclear industry and, as a country that has accepted IAEA safeguards, substantial knowledge about safeguards, Japan has made active contributions to strengthening and improving the efficiency of IAEA safeguards, including playing an active role in developing the Model Additional Protocol. Japan was the first nuclear power-generating country to sign the Additional Protocol in December 1999.

The IAEA Board meeting in June 2004 made a “conclusion” on Japan that there was no sign of diversion of safeguarded nuclear material and no sign of undeclared nuclear material and activities. In September 2004, integrated safeguards – which can make improvements in the efficiency of safeguards, such as reduction in the frequency of inspections – were implemented in Japan as the first

country with large-scale nuclear activities. Since then, Japan has received the same “conclusion” every year. Japan has made active efforts to make it possible to implement an internationally agreeable safeguards at the Rokkasho Reprocessing Plant scheduled to start full operation in 2008 and the Rokkasho MOX fuel fabrication facility to be constructed in the future. Japan has also made efforts for increasing the number of member States that accept the Additional Protocol, with the understanding that it is most realistic and effective in strengthening the international non-proliferation system for as many countries as possible to sign the Additional Protocol. As part of such efforts, Japan provided personnel and financial support to the regional seminar held in Vietnam in August 2007, in order to support efforts to promote the Additional Protocol in the region in cooperation with the IAEA.

The Nuclear Suppliers Group (NSG), whose purpose is to allow countries with the capability to supply nuclear-related material and technology to pursue policy coordination in nuclear export controls, has been actively discussing restrictions on the transfer of sensitive equipment, material and technology related to enrichment and reprocessing and making it a requirement for recipient countries to sign the IAEA Additional Protocol. At the NSG convention in South Africa in April 2007, issues such as efforts to strengthen the non-proliferation system and strengthening nuclear export controls were discussed. Also, a desirable relationship with India in connection with an agreement on commercial nuclear cooperation was discussed. The Permanent Mission of Japan to the International Organizations in Vienna serves as the secretariat for the NSG, and thus Japan has made active contributions to the NSG’s activities.

<Assurance of nuclear fuel supply>

In October 2003, IAEA Director General Mohammad ElBaradei proposed a new approach (Multilateral Nuclear Approaches: MNA) to achieving both non-proliferation and the peaceful use of nuclear energy. This prompted discussion on the mechanism to assure nuclear fuel supply, and in September 2006, a special event was held during the IAEA General Conference to discuss the assurance of nuclear fuel supply. Six enrichment countries, including the U.S. proposed to create a virtual fuel bank as a “safety net” to complement the current nuclear fuel market. In order to support the objectives of this Six-Country Initiative and to participate in and contribute to international discussion on the initiative, Japan proposed an IAEA Standby Arrangements System for Nuclear Fuel Supply. The purpose of the proposal is to create a system in the IAEA where each Member State registers all aspects of its current nuclear fuel supply capability, such as uranium enrichment, uranium ore, conversion, fuel fabrication and nuclear fuel stockpiling, so that the Director General can play an intermediary role to assure fuel supply in the case of supply disruption by political reasons. Russia proposed an “International Center for Nuclear Fuel Cycle Services.” At the IAEA Board meeting in June 2007, the Director General submitted a report on the assurance of nuclear fuel supply that

identified issues for discussion by comprehensively reviewing the proposals made by various countries. Currently, the IAEA secretariat is reviewing the Russian proposal to set up the International Center, the proposal of the Nuclear Threat Initiative (NTI), a NPO of the U.S. to have a stockpile of low-enrichment uranium and a proposal by the German Foreign Minister to establish a multilateral enrichment facility. Japan has been discussing how to develop a realistic system as soon as possible.

<Nuclear terrorism and security of nuclear materials and nuclear installations>

The terrorist attacks on the U.S. in September 2001 led the international community to claim that the threat of terrorist attacks against nuclear facilities, as well as the threat of terrorist attacks with “dirty bombs” using nuclear or radioactive materials that cannot be diverted to nuclear weapons, should be addressed in an urgent way. Consequently, in September 2003, the IAEA adopted the revised Code of conduct on the Safety and Security of Radioactive Sources. In July 2005, the Convention on the Physical Protection of Nuclear Material was revised, and in July 2007, the International Convention for the Suppression of Acts of Nuclear Terrorism became effective. In the Heiligendamm Statement on Non-Proliferation and the G8 Summit Statement on Counter Terrorism – Security in the Era of Globalization issued at the Heiligendamm G8 Summit in June last year, the G8 countries were requested to: expand participation in the Global Initiative to Combat Nuclear Terrorism initiated by the U.S. and Russia and involved in the further development of the initiative. The International Convention for the Suppression of Acts of Nuclear Terrorism and the revised Convention on the Physical Protection of Nuclear Material were concluded.

In accordance with conclusion of these treaties and plans, Japan has made efforts to strengthen measures to prevent both the theft of nuclear and radioactive materials and sabotage against nuclear facilities. Japan also established the “Criminal Radiation Emission Act” and signed the International Convention for the Suppression of Acts of Nuclear Terrorism in August 2007. Furthermore, Japan has urged the countries involved to sign the international convention as soon as possible. The Atomic Energy Commission determined the necessity of measures for the protection of nuclear materials that went beyond existing security measures and, currently is discussing relevant security measures to protect radioactive materials

<North Korean and Iranian nuclear issues>

Despite international efforts to ensure nuclear non-proliferation and nuclear security, international concerns about nuclear proliferation remain.

North Korea agreed to disable all existing nuclear facilities under the six-party talk agreement of October 2007, to completely disable the 5 MWe experimental reactor, reprocessing plant and nuclear fuel fabrication facility at Yongbyon by December 31 2007, and to provide a complete and correct declaration of all its nuclear programs. However, as of the end of 2007, the process of disabling the facilities has not been completed and the complete and correct declaration has not been submitted.

Iran did not follow the UN resolution and the IAEA Board resolution requiring it to suspend all of its uranium enrichment and reprocessing activities and heavy water reactor programs. Consequently, in March 2007, the UN Security Council unanimously adopted Resolution 1747, imposing new sanctions in connection with Iran's nuclear program.

Japan will request North Korea and Iran to follow the requirements of the agreements and resolutions, and will actively follow up on the North Korean and Iranian nuclear issues in cooperation with the international community.

<Nuclear safety>

In recent years, the world's nuclear facilities have been stably operated without any serious incidents involving a massive release of radioactive material. The international community has criteria in place for nuclear facility establishers primarily responsible for ensuring safety and their activities. Regulatory authorities have audited compliance with the criteria, ensured the transparency and openness of the activities, and expressed a strong interest in ensuring a safety culture that pays attention to and provides management resources for all safety-related issues, in a manner appropriate to the importance of the issues. The regulatory authorities also stress the importance of cultivating a safety culture to countries with plans to build nuclear facilities. The IAEA evaluated the nuclear facilities and regulatory systems of member states at their request, increased the opportunities for the parties involved to exchange opinions, and contributed to harmonizing approaches to ensuring safety. Moreover, the Multinational Design Evaluation Program (MDEP), an initiative based on multilateral safety regulations set up to share standards, criteria and safety goals, is currently underway. Under the MDEP, national regulatory authorities exchange information on the resources and knowledge acquired in the safety review process, to improve the effectiveness and efficiency of safety reviews of new types of nuclear reactors.

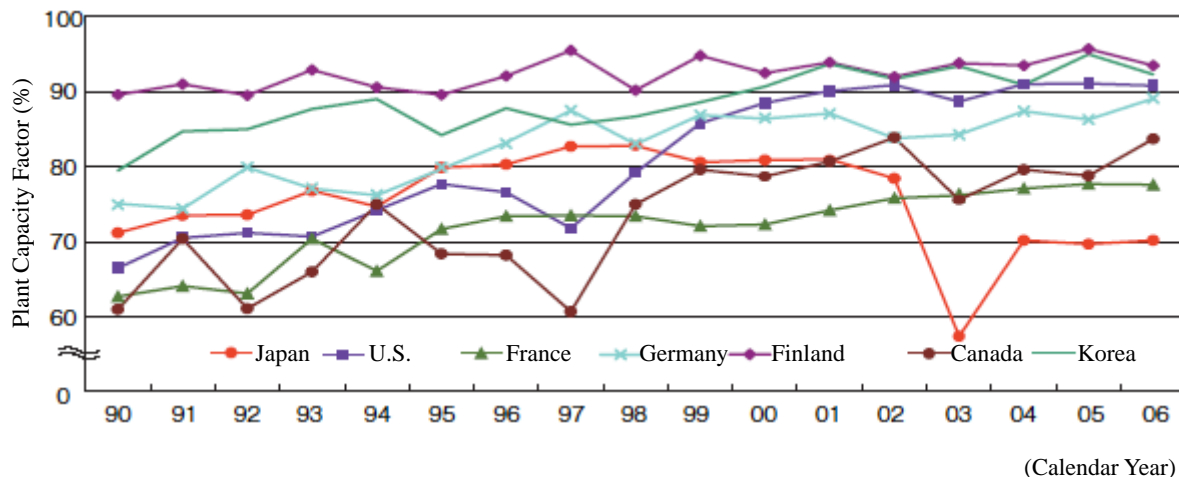


Fig. 4 Mr. Nakagawa, Vice-Minister of State for Science and Technology Policy, addressing a speech at the 51st IAEA General Conference

(3) Trends in research, development and utilization of nuclear energy in Japan

With an increasing global interest in the use of nuclear energy, as well as progress in the efforts to ensure nuclear non-proliferation, safety and security, Japan has steadily conducted activities in research, development and utilization of nuclear energy, according to basic concept specified in the Framework for Nuclear Energy Policy.

As for nuclear power, existing nuclear power plants generally continue to operate stably, and they supplied 30.5% of the Japanese electricity for general in 2006. Thus, nuclear power is playing a role as a core power source in electricity supply in Japan. In addition, the construction of new nuclear power plants is progressing steadily. However, due to the shutdowns of the Shika and Onagawa Nuclear Power Plants, caused by earthquakes that exceeded the design basis ground motion or due to prolonged repair work, the capacity factor dropped below 70% in 2006, which is very low compared to the capacity factor of 80% or more in the U.S. and Europe. The capacity factor in 2007 is expected to drop further due to the shutdown of Kashiwazaki-Kariwa Nuclear Power Plant due to the Niigataken Chuetsu-Oki Earthquake in July 2007. (Fig. 5)



Note: France shows a lower capacity factor than the U.S. and Germany due to its use of load-following operation since 1982 to allow the reactor power to be decreased with decreasing electricity demand.

Fig. 5 Year-to-year change in plant capacity factor in various countries

Source: 2007 Annual Report on Nuclear Facility Operation Management

Japan's basic policy of back-end of nuclear fuel cycle has been to reprocess spent fuel, to dispose of only non-recyclable fission products and transuranic element as high-level radioactive waste, and to effectively utilize collected plutonium and uranium, etc. As for the use of plutonium and uranium collected from reprocessing as MOX fuels in LWRs (Plu-thermal program), electric utilities announced in 1997 that they would start using MOX fuels in 16 to 18 light water reactors by 2010. Although the programs have been suspended since then due to the utilities' improper activities to

ensure safety, they have been recently making steady and continuous efforts to develop a mutual understanding with municipalities with nuclear power plants and with local residents. Consequently, Kyushu Electric Power, in March 2006, Shikoku Electric Power, in October 2006, and Chubu Electric Power, in February 2008, obtained prior agreements from the municipalities on the implementation of their Plu-thermal programs in Genkai Nuclear Power Plant Unit 3, Ikata Nuclear Power Plant Unit 3 and Hamaoka Nuclear Power Plant Unit 4, respectively. In January 2008, Kansai Electric Power resumed preparations to implement their program in Takahama Nuclear Power Plant Units 3 and 4. J-Power's program for Ohma Nuclear Power Plant and Chugoku Electric Power's program for Shimane Nuclear Power Plant Unit 2 are undergoing a safety review by the government. These events indicate that the Plu-thermal programs are about to move forward. The Rokkasho Reprocessing Plant, Japan's first commercial reprocessing plant and a core nuclear fuel cycle facility, is in the final stage of construction. A hot test using spent fuel is being performed, and moving toward full operation while solving initial problems.

The utilization of radiation in the areas of science and technology, industry and medicine is increasing, although there is a difference in the increase among these areas in terms of monetary value. (Table 1) Radiation continues to be used in industrial and radiation diagnostic applications, and the number of radiation therapy users continues to increase.

Table 1 Monetary value of the use of radiation and nuclear energy in 2005 and 1997

(Unit: 100M yen)

Area \ Year	2005	1997
	Value	Value
Industry	22,952	21,773
Agriculture	2,786	3,109
Medicine	15,379	12,464
Total for Radiation Use	41,117	37,346
Nuclear Power (Receiving End)	47,039	57,846
Nuclear Equipment (Exports)	371	67
Total for Energy Use	47,410	57,913

Source: Survey Report on the Monetary Value of the Utilization of Radiation made by the JAEA under contract with the Cabinet Office, December 2007

Steady progress has been made in research and development activities that contribute to the expansion of utilization of nuclear energy and radiation for the sustainable development of human society,: such activities include those to improve commercialized technologies, those to pursue sustainable nuclear energy technologies in the areas of new types of reactors, nuclear fuel cycle,

non-electric utilization of nuclear reactors and nuclear fusion those to identify promising technologies for commercialization, and those to achieve advanced radiation application technologies, as well as those in basic and interdisciplinary research and development activities. In 2007, particular progress was made in the kick-off of such activities in the projects of next-generation light water reactors, fast breeder reactor and its fuel cycle technologies (FBR cycle technologies), the International Thermonuclear Experimental Reactor (ITER), and Japan Proton Accelerator Research Complex (J-PARC). At the RI-Beam Factory, which is being developed in RIKEN, research is being conducted to identify the existence limits of radioisotopes of all the elements from hydrogen to uranium and expand the periodic table, including the discovery of new elements. The facility has potential to be used by researchers in diverse field. For example, a new species of plant was developed using the facility. In parallel with these activities, also initiated are measures for developing and securing the human resources for the future of nuclear energy.

In certain areas, however, Japanese nuclear community suffered setback. Some of the incident that occurred last year indicate that there is still room for improvement in the government's as well as utilities' efforts to develop a safety culture and managing business risk related with facility operation. .

In March 2007, electric utilities announced about the results of investigations into cover-up of falsification of data and events that should have been reported to the authorities, occurred over the past 20 years. No data falsification conflicting with laws had been reported since October 2003 when the application of the new inspection system started, but the fact that the cover-up had not been revealed resulted in shaking public confidence in the safety assurance systems of nuclear power plants. The Nuclear and Industrial Safety Agency (NISA) clarified the future countermeasures based on the deliberation of improvements from the viewpoints of facilitating information sharing and transparency in efforts to assure safety, as well as problems for higher effectiveness of the inspection system.

The Tokyo Electric Power Company's Kashiwazaki-Kariwa Nuclear Power Plant (Unit 1-7) experienced more significant vibration than assumed in design, due to the Niigataken Chuetsu-Okai Earthquake that occurred on July 2007. This resulted in successful operation of important safety-related functions, ranging from the automatic shutdown function to the function to lead a reactor to safe and stable shutdown conditions. On the other hand, the earthquake developed safety concerns among the public because of improper trouble shooting of fire and improper public relations activities immediately after the earthquake, in addition to the ground motion significantly exceeding than assumed in design. The Nuclear Safety Commission and the NISA requested utilities to conduct a seismic safety checks of nuclear power plants (back checks) earlier than planned in light of the new "Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities" established

by the Nuclear Safety Commission in 2006. In addition, they revised part of the “Regulatory Guide for Reviewing Fire Protection of Light Water Power Reactor Facilities”, investigated issues in private fire brigade, reporting system and information dissemination, and requested fundamental enhancement of the private fire brigade systems.

As for geological disposal of high-level radioactive waste (HLW), some local government considered applying to be a candidate for a survey to select preliminary study areas for HLW disposal facilities. However, there are no areas where preliminary study has been done now. At the moment, there is a delay in the site selection process. In order to improve the situation, the government and utilities decided to fundamentally strengthen activities to foster understanding that the construction of disposal facilities is beneficial to the general public, promoting mutual understanding with the public and with local government through dialogue. In addition, the administrative bodies revised the basic policies and plans for the geological disposal of HLW and began renewed efforts along with them.

(4) Atomic Energy Commission’s Round-table Conference on the Vision for Nuclear Energy Policy for Global Environmental Protection and Security of Energy Supply

Recognizing the aforementioned circumstances, the Atomic Energy Commission set up a “Round-table Conference on the Vision for Nuclear Energy Policy for Global Environmental Protection and Security of Energy Supply” (the Nuclear Energy Vision Conference) in June 2007 to discuss what should be done to halve global greenhouse-gas emissions by 2050. In March, 2008, the Conference made a report on specific activities based on the following recognition.

- In order to achieve a significant reduction in global greenhouse-gas emissions towards 2050 while ensuring secure supply of energy, the expansion of the peaceful use of nuclear energy is essential, along with the maximum implementation of other effective measures such as energy conservation, energy efficiency improvement and the use of renewable energy.
- Japan should take action from the perspective of further promoting the peaceful use of nuclear energy on global scale, while ensuring nuclear nonproliferation, safety and security.

2. Challenges to be tackled seriously

(1) Steady promotion of the utilization of nuclear energy in Japan

As described earlier, Japanese nuclear power faces challenges at the moment. If, in order to tackle these challenges, Japan makes extensive efforts to improve and enhance fundamental activities to support the utilization of nuclear energy while developing mutual understanding with the public, useful knowledge and lessons can be offered to the international community in its efforts to promote the utilization of nuclear energy. Therefore, the parties involved should address the following issues, among others, with the intention of promoting nuclear energy use in a manner that serves as a model for the international community.

<Thoroughness ensuring transparency of activities to ensure safety, and enhancement developing mutual understanding by public hearing and public information>

In order to promote the utilization of nuclear energy related to the siting of new nuclear power plant and radioactive waste disposal facilities, the government and utilities must make constant effort to communicate what they are doing and understand what the stakeholders concerns are, so as to build trust and credibility with the general public and communities with nuclear facilities as well as prefectural government involved, in particular. Under the current circumstances of nuclear energy utilization, the government and utilities should steadfastly continue their efforts in this respect, taking into account the importance of the following points in particular:

- 1) To improve the communication of information on the state of nuclear facilities in both normal and emergency situations, so as to communicate what the public want to know;
- 2) To further strengthen activities to provide the public opportunities to learn the basic facts of nuclear energy and radiation utilization and develop leaders who promote activities to raise the public understanding of them through mutual communication, considering the importance of nuclear energy as a measure against global warming and need for bringing about marked improvements in public understanding of them;
- 3) To assure the effective public involvement in the decision-making of nuclear energy policy and nuclear safety policy in particular, and explain the results of such decision-making to the public;
- 4) To increase the opportunity for and to improve the contents of exchange with prefectural and municipal governments across the country in order to facilitate mutual understanding of matters related with nuclear energy policy among them;

<Enhancement of risk management activities to reduce the impact of natural disasters and other risks>

Since nuclear power generation is expected to contribute to the stable supply of electricity, utilities, from the viewpoint of ensuring stable supply, should continuously pay attention to the operational experiences at home and abroad as well as the latest scientific knowledge of seismology and meteorology in order to minimize the possibility that the nuclear power generation is faced with an unexpected situation due to natural disaster, and if they find any information that cannot be ignored from the viewpoint of business risk management, they should immediately conduct modifications and so forth of facilities and equipments to reduce the risk to acceptable level. For this purpose, utilities should achieve improvement in the business risk management activities and the contents of periodic safety review in order to assure the timely implementation of the above-mentioned responses, taking into account that increases in the number of facilities of the same type and / or the degree of concentration of facilities will increase the influence of such disaster on power supply stability due to the common cause failure.

In addition, the government should pay attention to the operational experiences at home and abroad as well as the latest knowledge in various science fields, including seismology, nuclear engineering and industrial safety, and if they find any information that cannot be ignored, they should immediately reflect it in the regulation standards to reduce its negative influence, in order to avoid losing confidence in the safety regulation due to the late discovery of its influence and or delay in taking proper countermeasures to it.

<Implementation of activities to gain public understanding for the implementation of high-level radioactive waste disposal>

A sincere effort should be made to gain public understanding about the following matter, (1) geological disposal of high-level radioactive waste can be safely implemented; (2) the responsibility for developing the road map for constructing the disposal facility should be with the present generation, and should not be passed on to future generations; and (3) the public has responsibility to support the sustainable regional development of a municipality that accepts the disposal facility site from the viewpoint of equity of benefits, since the construction of the disposal facility for HLW will be beneficial to people;

<Improving utilization of existing plants by adopting measures for the improvement of plant capacity factor and measures against aging>

Efforts to make the utilization of nuclear energy more sophisticated contribute to improving the level of its nuclear technology, as well as serve as effective measure against global warming in a short time. The government and utilities should work steadily to improve the capacity factors and uprate

the rated power of existing nuclear power plants, to conduct research and development to enhance the aging management of nuclear power plants and extend their operating life to 80 years, and to build new plants at new sites and add new units to existing plants under conditions that ensure safety, while gaining broad public understanding.

<Steady promotion of the nuclear fuel cycle activities>

As the reprocessing of spent fuel and effective utilization of recovered plutonium and uranium improve such characteristics of nuclear power generation as excellent supply stability, nuclear fuel cycle activities has been promoted as the government's basic policy. Work should be steadily promoted to build nuclear fuel cycle service systems on the major premise of safety assurance.

(2) Enhancement of activities for the expansion of use of nuclear energy on a global scale as a measure against global warming

The Nuclear Energy Vision Conference's report states that Japan should take the following principal actions in order to achieve a significant reduction in global greenhouse-gas emissions towards 2050 while ensuring secure supply of energy.

<Building a global consensus that the expansion of the peaceful use of nuclear energy is an essential against warming>

Japan should actively propose the international community to agree to build a global consensus that the expansion of the peaceful use of nuclear energy, while ensuring nuclear nonproliferation, safety and security, is an essential measure against global warming, along with such measures as energy conservation, energy efficiency improvement and the use of renewable energy.

<Development of international frameworks for expansion of the peaceful use of nuclear energy>

Japan should actively propose the international community to agree, as well as to build a global consensus that expansion of the peaceful use of nuclear energy is essential against global warming, to do the following actions for developing international frameworks that enable to expand the peaceful use of nuclear energy.

- 1) To include nuclear energy into Clean Development Mechanism (CDM) and Joint Implementation (JI).
- 2) To consider the establishment of the schemes that can encourage investment in the construction of nuclear power plants and other related activities for countries trying to promote the peaceful use of nuclear energy while ensuring nuclear nonproliferation, safety and security.

- 3) To recognize the peaceful use of nuclear energy as an effective measure against global warming in the next framework for 2013 and beyond, after the first commitment period of the Kyoto Protocol expires.

<Reinforcement of international efforts to ensure nuclear nonproliferation, safety and security>

For ensuring nuclear nonproliferation, safety and security, which is the prerequisite of the peaceful use of nuclear energy, the related international approaches promoted by the International Atomic Energy Agency (IAEA) are extremely important. As it is essential to reinforce these international approaches along with the global expansion of the peaceful use of nuclear energy, Japan should actively contribute to them in cooperation with countries across the world. The specific activities to be promoted will be, among others, to;

- 1) Appeal the international community to strengthen the IAEA's human and financial resources, so that measures assigned to the IAEA by international treaties including the Nuclear Non-Proliferation Treaty (NPT) and the Convention on Nuclear Safety are implemented sufficiently.
- 2) Enhance cooperation towards further advancement of the activities of the IAEA and the Nuclear Energy Agency of Organization for Economic Co-operation and Development (OECD/NEA) in formulating relevant technical standards and recommendations, based on Japan's unique experience as only non-nuclear weapon state that is promoting large-scale nuclear energy use, employing advanced technology systems.
- 3) In order to prevent nuclear proliferation, continuously contribute to reinforcing the IAEA safeguards, actively supporting its effort to universalize the IAEA Additional Protocol as well as actively participating and contributing to multinational discussions about the development of nuclear fuel supply assurance mechanisms to reduce the growth of nuclear proliferation risks.

<Positive cooperation in the efforts of various countries to build and strengthen infrastructure for the promotion of the peaceful use of nuclear energy>

In order to provide the international community with the opportunity to utilize Japan's advanced energy and environmental technologies, Japan should actively cooperate with international institutions such as the IAEA as well as developed countries in supporting to build infrastructure for nuclear power utilization such as human resources, laws, regulations and the management of radioactive waste in countries considering the promotion of peaceful use of nuclear energy while

ensuring nuclear nonproliferation, safety and security. The specific activities are to;

- 1) Actively offer cooperation to the IAEA's support activities in this category, dispatching experts who can utilize knowledge cultivated in Japan's advanced infrastructure for the peaceful use of nuclear energy in such activities, and actively support independent activities to build infrastructure in countries, mainly those in neighboring Asian regions, that are considering introduction or expansion of the nuclear power generation capability, through bilateral and multilateral cooperation frameworks, including the Forum for Nuclear Cooperation in Asia (FNCA) .
- 2) Positively utilize financial and insurance systems and other means, so as to be able to make an effective contribution to the expansion of the peaceful use of nuclear energy in various countries, applying Japan's advanced technology bases for design, construction, and operation and maintenance of nuclear power plants.

(3) Strengthening of research and development activities to contribute to the global expansion of the peaceful use of nuclear energy.

The Nuclear Energy Vision Conference's report states that in order to contribute to the further expansion of the peaceful use of nuclear energy in the world, Japan should strengthen its research and development activities aiming to innovate the performance of nuclear energy technologies. In specific, the activities of research and development to be promoted are:

- 1) To develop, demonstrate and deploy innovative technologies for diversifying and advancing nuclear energy use, such as next-generation light water reactors with world-best safety and economy, small and mid-sized reactors with sizes, functions and economic competitiveness that can meet diverse needs, and hydrogen production technology using high-temperature gas reactors.
- 2) To implement research and development of fast reactors and its fuel cycle technology, aiming to achieve an advanced fuel cycle system that can make it possible for global community to utilize nuclear energy over a long time.
- 3) To implement research and development of nuclear fusion, with the aim of realizing a permanent energy supply technology in the future.

The report also states that in order to promote these research and development activities in effective and efficient ways, international cooperation should be even more actively pursued through multilateral frameworks such as the Generation IV International Forum (GIF), Global Nuclear Energy

Partnership (GNP), cooperative research and development frameworks of the IAEA and other international organizations and the ITER Project, as well as various bilateral frameworks for nuclear research and development cooperation.

(4) Enhancement of efforts to expand the utilization of radiation contributing to the development of society

In Japan, the utilization of radiation which has been utilized effectively in the areas of academia, medicine, industry and agriculture, is nearly equal to the utilization of nuclear energy in monetary value, and has significantly contributed to improving people's living standard. Furthermore, in the area of academia, research and development of quantum beam technology – which is applicable to a wide variety of fields and is consisted of mainly accelerator technology– has been established in conjunction with other related technology fields, and has produced world leading research results.

About utilization of radiation, Japan should take the following efforts, in order to promote research and development of radiation application technologies, to expand and diversify its utilization, and to contribute to improvement of the welfare of mankind and living standard of the people.

- 1) Where efforts to develop new application areas of radiation or to offer the opportunity to use radiation facilities in areas where radiation is not used are considered appropriate from the viewpoint of enhancing public interests, to support such efforts by implementation of systems and environment to enable to make large facilities accessible to outsiders.
- 2) To enhance mutual understanding of benefits and costs among those who introduce new radiation technologies, and those who use the technologies and any other parties involved.
- 3) To actively train experts in the area of radiation therapy, which have a shortage of experts because of the increasing number of users of radiation therapy.
- 4) To promote steadily quantum beam technology which forms the infrastructure for technology development, while performing checks and reviews as appropriate.
- 5) To promote efforts to store and dispose of radioactive wastes from radiation use properly.

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

- 2-1 Assurance of Safety
 - 1. Safety Measures
 - 2. Physical Protection Measures
- 2-2 Guarantee of Peaceful Uses
- 2-3 Treatment and Disposal of Radioactive wastes
- 2-4 Developing and Securing Human Resources
- 2-5 Coexistence of Nuclear Energy and People/Local community

Chapter 3: Steady promotion of Utilization of nuclear energy

- 3-1 Utilization of energy
 - 1. Nuclear Power Generation
 - 2. Nuclear Fuel Cycles
- 3-2 Utilization of Radiation

Chapter 4: Promotion of Research and Development of Nuclear Energy

Chapter 5: Promotion of International Approaches

- 5-1 International Cooperation
- 5-2 Maintaining and Strengthening the Nuclear Nonproliferation Regime
- 5-3 International Development of Nuclear Industry

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

Reference Materials

This section of the white paper contains organizational charts related to nuclear energy administration (as of the end of December 2007), details of decisions made by the Japan Atomic Energy Commission, nuclear energy-related budgetary information for fiscal 2007 and chronological tables.

Note: Some of the data included in this part in the case of the previous year's edition is available in the "relevant collection of data" on the Japan Atomic Energy Commission's website*, and the list of data available therein is appended to the end of this year's edition.

* White Paper page on the Atomic Energy Commission's website

<http://www.aec.go.jp/jicst/NC/about/hakusho/index.htm>