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Aktuelle Chronik

Konferenzen und Informationen

Rezensionen und Neuere Literatur

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JAPAN'S NUCLEAR POLICY

Kinya Niiseki

It is perhaps the most significant paradox in the modern Japanese history that the only country which has experienced the holocausts of the atomic bombs should be the country with the urgent need to develop and utilize nuclear energy.

Japan is an extreme example of an industrially advanced country which has a relatively large population without any meaningful indigenous energy resources. That is to say, Japan is entirely dependent on energy imports from foreign countries to sustain its highly developed national economy.

In the 1960s Japan's energy intensive industries were so rapidly expanded that the annual rate of increase of energy consumption was nearly twice the world's average in the same period. At that time Japan's energy policy was based on the assumption that abundant and cheap energy resources were always available. However, the oil crisis in 1973 revealed that the situation of the world energy market will become more and more unstable. Ever since Japan has come to grips in real earnest with the energy problem.

At present 88% of Japan's primary energy requirements come from abroad, of which imported oil and coal account for 73% and 12% respectively. Since exploration and development of oil resources will continue, the world's oil supply will not fall short of demand radically in the very near future. However, as the world currently depends on oil for the supply of more than half of its energy requirements, uncertainties in energy supply will inevitably persist.

The aim of energy strategy is to make sure that the country's economic, political and social activities are adequately covered by the supply of energy on a long-term basis. The assurance of sufficient energy supply is vital for the prosperity of the country. The rapidly increasing oil costs in recent years have forced many countries to look for alternative energy sources. However, in weighing various options open to a country, it has to take into consideration above all the domestic availability of energy resources.

Since Japan has very little coal left in the country, we consider that nuclear energy is the most promising substitute for oil. There is a growing awareness in the country that unless nuclear power generation capacity is expanded, the attainment of economic growth and high-level employment would become difficult. Now it is the declared policy of the Japanese government to continue its support for the further development of nuclear energy. Reduction of Japan's excessive dependence on imported fossil energy is an imperative. Should Japan maintain its character as an industrially advanced country, there is no other choice than nuclear energy.

It is almost twenty years since a demonstration reactor of the Atomic Energy Research Institute, the first nuclear power reactor in Japan, succeeded in the transmission of electric power in 1963. And the use of nuclear energy in electric power generation in Japan was expanded rapidly during the past years. Today Japan has 21 nuclear power plants with the generating capacity of 14,950 MW, namely 13.3% of the country's gross power generation. This has made Japan the world's second largest nuclear power generating country after the United States.

We are resolved to pursue vigorously the development and utilization of nuclear power in the future. According to a Cabinet decision of the Japanese government in November 1980, Japan's nuclear power development target is 51,000 - 53,000 MW in 1990, accounting for 22% of the country's total energy supply. This national program for nuclear energy development, although scaled down in recent years, is still one of the most ambitious programs in the world.

The greatest restriction to the accelerated development and utilization of nuclear energy is finding sites for nuclear power plants.

Japan's territory is 370,000 km² of which only 20% can be used by 110 million people. Besides, Japan is known for its frequent earthquakes of significant magnitude. Therefore, we need most deliberate considerations to select sites for nuclear power plants. The site conditions and the possible impact on the public health and safety should be very carefully assessed. The Nuclear Power Engineering Center has just completed construction of housing for the world's largest earthquake simulation system on Shikoku Island. This system is designed to test the seismic resistance of nuclear power plant components, featuring a vibration table which eventually will hold up to 1,000 tons of equipment.

As I already mentioned, the Japanese people are in general agreement with the necessity of nuclear power as an important energy source. However, when it comes actually to the question of siting a nuclear power plant, then the utility company concerned encounters difficulties in acquiring a proper site because of the opposition of local residents involved. The main reason for the lack of support by the public is the concern about safety. In other words, the Japanese people's concern about nuclear power plants has not eased in spite of the increased recognition of the country's serious energy situation. This is a typical case of ambivalence of approving nuclear energy in general and of opposing the siting of a nuclear power station next-door.

Given the historical background, it is quite natural that the Japanese people show a rather allergic reaction to everything nuclear. Since nuclear power plants are normally located on the sea coast, fishermen's cooperatives use to oppose the installation of nuclear facilities on the ground it would affect their fishing. The difficulties we had and still have with the ill-fated nuclear ship "Mutsu" are quite indicative of the emotional character of the anti-nuclear movement in Japan. The Three Mile Island accident in the United States has provided unfortunately additional ammunition to those who challenge the wisdom of using nuclear power.

To dispel such unwarranted fear, the Japanese government in cooperation with scientific and industrial circles must disseminate more knowledge about the development of nuclear energy and create a better climate for the realization of our nuclear energy program.

Moreover, to encourage the public acceptance of a given site, the circumstances peculiar to the local community must be carefully considered and adequate measures must be taken to enlist its benevolent cooperation.

The Ministry of International Trade and Industry which is responsible for the overall control of electric power stations has decided to hold public hearings prior to the selection of sites for nuclear power plants. Furthermore, the Electric Power Plant Adjacent Arrangement Law provides that the construction of nuclear power plants might improve the well-being of local residents and as a result might obtain better understanding and cooperation from them. For example, a tax on electricity was introduced in 1974. Revenues from this tax are administered by the Electric Power Development Acceleration Measures Special Account and are defrayed to

assist the smooth acquisiton of sites for nuclear power plants. The subsidy to accelerate acquisition of power plant sites is granted to local public organizations to be used to improve public facilities in the area adjacent to the site. Moreover, the government is now planning to cut down the electricity fee for the consumers living near nuclear power plants in response to their complaints that they do not reap benefits from the proximity. Enterprises in those communities that have nuclear power plants in the neighborhood will also pay less for the electricity they consume. In addition the government agencies concerned are planning to create "regional development subsidies" for energy producing prefectures whose nuclear power output exceeds consumption considerably. And to obtain the funds for this, they will try to raise the electricity source development tax mentioned.

The development and utilization of nuclear energy is indispensable for the maintenance of people's living standard. However, it is needless to say that it should be carried out assuring protection of public health and safety.

Japan has been promoting the development of nuclear energy in strict conformity with the Atomic Energy Basic Law which was enacted on January 1, 1956. This law provides among other things that research, development and utilization of nuclear energy should be limited to peaceful purposes and be performed under safety control and democratic management. In 1978 this law has been amended on the recommendation of the Prime Minister's Advisory Committee on reorganizing the administrative arrangements for the development of nuclear energy. This amendment was designed mainly to separate the responsibility for safety regulation from those of the governmental organizations involved in promotion of nuclear energy. It has made the responsibilities of different organizations concerned clear by establishing the Nuclear Safety Commission independent from the Atomic Energy Commission. One of the most important tasks of the new Commission is to recheck safety examination reports submitted by the competent administrative organization. And the Prime Minister is requested to pay due consideration to the decisions made by the Nuclear Safety Commission.

To obtain understanding of the people on the safety of nuclear facilities, it is necessary for the government not only to examine their safety in strict fairness but also to reflect public opinion in the project through dialogues between utility companies and local residents. Therefore, the Nuclear

Safety Commission also has decided to hold public hearings when commercial power plants or other important nuclear facilities are to be constructed.

A lot of lessons have been learned from the Three Mile Island accident. However, the detailed findings obtained from investigations of the accident revealed that the decisive factor in the accident was inherent matters in design, maintenance and operation of the TMI 2 station. We believe that the rationality of the principal concept of nuclear safety based on defence-in-depth was demonstrated in the accident. The nuclear power plants should be so designed, constructed and operated that no design-based event or human error would cause any serious radiological impact on the off-site population. The safety of nuclear power plants should be achieved by high quality in design and construction as well as by dependable operation. The emergency planning is a supplementary safety measure as precaution against the eventual occurrence of an accident. Therefore, such approach as being taken in the United States following the TMI accident which emphasizes the need for a fixed distance, population density and distribution is not reasonable and convincing. An ideal solution to the problem could be found in trading off the site conditions and design, construction, maintenance and operation features.

Fortunately no serious event which could result in releasing a significant amount of radioactive materials has occurred yet in Japan over the last 110 reactor years, although it has experienced such troubles as stress-corrosion cracking or steam-generator-tube leak in the earlier stage of development. We are now convinced that the commercial use of nuclear power reactors has already overcome technical difficulties in the initial period and is entering into a new era of development which should be established by promoting the standardization of light water reactors with improvements in design, construction and operation. Efforts have been made in recent years to build up our own technology for light water reactors which is currently the mainstay in generating nuclear power. Further accumulation of indigenous technology is needed for economic reasons as well as for improving safety, so that technical troubles could be fixed promptly and effectively. Thus, we are trying to standardize light water reactors to be used in the country in order to increase their reliability and at the same time to reduce risks of radiation exposure. In other words, we are planning to introduce safe and dependable "Japanized" light water reactors. Our aim is to establish a new type of reac-

tor with the design best suited to Japanese conditions. For example, remote and automatic inspecting or repairing systems is being developed and the container will be widened in order to facilitate both inspection and maintenance.

In the long run, the basic strategy of nuclear power development in Japan is to proceed from light water reactors to fast breeder reactors, with advanced thermal reactors for the interim stage. The long-term Plan for the Development of Nuclear Power which was decided by the Atomic Energy Commission in 1978 presents a vision of nuclear power development in Japan and highlights necessary measures to be taken in the following decade. Above all an early commercial application of fast breeder reactor will pay large dividends to Japan, because it will contribute to lessen Japan's reliance on imported nuclear fuel. For a resourceless country like Japan the fast breeder reactor is not only a question of economics. It represents the only practical means to decrease its energy dependence to a tolerable level. It is a matter of national security.

If uranium is used only in light water reactors in a once-through mode, uranium resources of the world might be exhausted in the future. A light water reactor uses a few percent of uranium, but a fast breeder reactor can utilize more than sixty percent of uranium, thus reducing its consumption. Besides, fast breeder reactors can be operated without enrichment of uranium. Therefore, it is most important for Japan to develop as quickly as possible fast breeder reactors. We have no alternative but to deploy fast breeders in large scale in the future in order to increase nuclear power generation over a long period. The prosperity of our nuclear industry depends, therefore, not only on the expansion and improvement of light water reactors but also on prospects for timely commercialization of advanced reactors. Japan has no uranium on its territory and is not prepared to substitute dependence on one imported energy source for another. This explains the importance attached to the development of advanced reactors and fuel cycle capability using our homegrown technology. This is fundamental in Japan's nuclear power development and utilization program. Thus, the development of advanced power reactors has long been one of the principal aims of our endeavor for the development of nuclear energy. The research and development work of fast breeder reactors and advanced thermal reactors has been carried out by the Power Reactor and Nuclear Fuel Development Cooperation (PNC), a government-sponsored organization, since 1967.

As for the fast breeder reactor, an experimental reactor called JOYO has reached criticality in 1977 and attained its goal of generating 75 MW of thermal power in 1979. Now the experiences obtained from the successful operation of JOYO are being incorporated into the design of a 300 MW prototype reactor MONJU and its construction started in the fiscal year 1981. The Atomic Energy Commission has yet to come up with a schedule for a commercial fast breeder project, but conceptual design work will be carried out while the construction of MONJU goes on at Tsuruga, Fukui Prefecture. Thus, Japan is approaching its ultimate goal of acquiring and accumulating its own technology for fast breeder reactors.

In the near term, however, it is necessary to reduce the amount of natural and enriched uranium to be consumed for the generation of electric power by recycling plutonium in light water reactors while trying to utilize advanced thermal reactor as a plutonium burner.

The PNC has successfully developed the Advanced Thermal Reactor (ATR) which will serve as an intermediate reactor in the transitional period from light water reactors to fast breeder reactors. A prototype of ATR named FUGEN has reached criticality in 1978. After attaining the level of operation at the rated capacity of 165 MW in 1979 it is now operating on what amounts to a commercial basis. The Atomic Energy Commission, encouraged by such performance of FUGEN, has decided to establish a special committee to check the design of a 600 MW demonstration ATR. We hope that ATR will bridge the gap until the fast breeder reactor becomes available for full commercial use.

In our view, if nuclear energy is to play a key role as an energy source in Japan, utilization of potential energy of uranium, namely plutonium, must be made possible. ATR is a heavy water reactor which can be operated by using uranium mixed with plutonium for the purpose of effective use of nuclear fuel. This home-grown advanced reactor reflects our desire to make best use of energy available. We are making efforts to develop ATR and FBR in parallel for the purpose of paving the way for the full use of plutonium.

Another important factor in the nuclear policy of Japan is the establishment of a nuclear fuel cycle. For this purpose the PNC has been trying to develop necessary technologies.

As for reprocessing of spent fuel from light water reactors, the Tokai Reprocessing Facility with a capacity of 0.7 ton/

day started up its operation in 1977. Now preparations are underway, in the private sector, for the construction of a commercial reprocessing plant to meet Japan's prospective needs of plutonium. The Law for the Regulation of Nuclear Reactors has been amended in the meantime to provide for the construction of commercial reprocessing plants. In March 1980 the Japan Nuclear Fuel Service Co. Ltd. was established. It is engaged in preparations for the construction of a reprocessing plant with the annual capacity of 1,200 tons.

For Japan in particular, an effective reprocessing and recycling system will greatly contribute to reduce the pressure on scarce uranium resources, and we have gone, as already mentioned, a long way in our commitment to the development of advanced reactors which can utilize plutonium as fuel.
Thus, the need for reprocessing is based on the long-term requirement to conserve energy resources. The energy potential of uranium must be fully exploited. For this purpose plutonium present in spent fuel must be recovered and recycled. We can not afford the luxury of using uranium in a once-through mode and throwing away the residual value of spent fuel. For providing plutonium which will be needed for advanced reactors, reprocessing capability must be further expanded on an appropriate time scale. For us, reprocessing and recycling is more than just an option.

At present, the enrichment of uranium is commissioned to foreign facilities. Japanese electric utility companies have concluded long-term contracts with the USDOE and the French EURODIF for enrichment services to meet their requirements by 1990. However, such a total dependence on foreign services calls for urgent development of enrichment technology and the early establishment of enrichment plants in the country for the sake of assuring stable supply of enriched uranium in the future.

The PNC has been developing enrichment technology based on gas centrifuge method similar to that being developed by URENCO. A pilot enrichment plant started up its operation in 1978 and attained the full through-put rate of over 50 tons-swu/year in 1981. We are now convinced that the PNC has successfully developed centrifuge machines with a technical performance competitive with those developed by URENCO, although we are still behind with regard to the scale of the plant. Currently a demonstration enrichment plant with a capacity of 250 tons-swu/year is being designed. It is hoped that this plant would serve as a prototype that will prove the feasibility of constructing larger commercial plants in the 1990s. However, for the commercialization of uranium enrichment, not only further development of reliable centrifuge machines with high velocity is necessary, but also such matters as arrangements for manufacturing the machines in mass production, design optimization of the plant complex and responsibility for economic risks must be settled. For examining such related problems the Atomic Energy Commission has recently established a special committee. In short, we must take positive measures to build up a capacity sufficient to cover at least one third of our future requirements with a view to lessen Japan's reliance on foreign enrichment services and to strengthen the base of our nuclear industries.

Needless to say that both the reprocessing and the enrichment are sensitive technologies which could eventually lead to the production of atomic weapons. Therefore, particular care should be taken from the standpoint of non-proliferation and it is essential to have effective safeguards to prevent the dissemination of nuclear arms.

Japan was the first country to accept international inspection by the International Atomic Energy Agency (IAEA). Ever since it has actively cooperated with the IAEA in the field of safeguards. Japan has concluded a safeguards agreement subsequent to its participation in the Non-Proliferation Treaty. Japan is now engaging itself in real earnest with the development of safeguards techniques which are applicable to the reprocessing and the enrichment facilities. As generally recognized, it is not so difficult to apply safeguards measures to small scale reprocessing or enrichment facilities, but, since safeguards on large scale facilities have not yet been practically applied in any country, it is necessary to improve safeguards techniques to be applied to commercial plants in the future. For example, Japan has been cooperating with the IAEA, the United States and France to improve safeguards techniques using the Tokai Reprocessing Facility under the project called TASTEX (Tokai Advanced Safeguards Technology Exercise). We are prepared to continue our efforts further in the framework of IAEA safeguards cooperation program. As for the enrichment, research and development efforts to improve safeguards are being made jointly among countries concerned. I believe that for non-proliferation purposes it will be rewarding for countries involved to conduct such

research and development work in cooperation with the IAEA.

An extremely important problem related to reprocessing is plutonium management. As I mentioned earlier, Japan has a plan to use a large amount of plutonium in advanced reactors. But plutonium should be controlled most strictly in order to prevent its misuse. For this purpose, an international system to control excess plutonium must be devised. Studies are already underway within the IAEA on the concept of the International Plutonium Storage (IPS) with the participation of experts from a number of countries including Japan. It seems that the best way is to establish the storage at the same site where a reprocessing facility is located, if we take into consideration difficulties in the transportation of plutonium. However, in order for this concept to be given a concrete form so that it may really contribute to the ultimate goal of non-proliferation, it is absolutely necessary to ensure that the results of the studies are acceptable to the countries involved and, above all, will not impede peaceful uses of nuclear energy.

Japan takes a great pride in having renounced the possession and use of atomic weapons, being painfully aware of the most disastrous consequences of their employment after its own tragic experiences in World War II. On the other hand, Japan considers as its legitimate right to determine its economic and political future by decreasing as much as possible its dependence on the supply of energy sources which are indispensable for sustaining its highly industrialized society.

In concluding, I should like to emphasize that energy security and nuclear non-proliferation are inseparable like the right and left wheels of a car. If their balance is lost, it will become very difficult to operate the car of development of nuclear energy for peaceful purposes.