COMPETITIVENESS OF NUCLEAR POWER GENERATION

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ABSTRACT

In view of the various merits of nuclear power generation, Japanese electric utilities will continue to promote nuclear power generation. At the same time, however, it is essential to further enhance cost performance. Japanese electric utilities plan to reduce the cost of nuclear power generation, such as increasing the capacity factor, reducing operation and maintenance costs, and reducing construction costs. In Asia, nuclear power will also play an important role as a stable source of energy in the future. For those countries planning to newly introduce nuclear power, safety is the highest priority, and cost competitiveness is important. Moreover, financing will be an essential issue to be resolved. Japan is willing to support the establishment of nuclear power generation in Asia, through its experience and achievements. In doing this, support should not only be bilateral, but should include all nuclear nations around the Pacific rim in a multilateral support network.

INTRODUCTION

With the globalization of market economies and deregulation, the principle of competition and various systems for enhancing business efficiency have been introduced in Japan's electric power industry. With the aim of achieving high cost performance, Japanese electric utilities are making every effort to make their management systems competitive internationally by the year 2001. In view of the various merits of nuclear power generation, such as long-term stable fuel supply, safe operation record, high cost performance throughout plant operation and environmental friendliness, Japan will continue to promote nuclear power generation. At the same time, however, it is essential to further enhance cost performance as well as safety and reliability.

Energy security is considered an important issue for sustainable growth of the world economy. With safety and economic efficiency assured, nuclear power will play an important role as a viable energy option in the 21st century.

THE ROLE OF NUCLEAR POWER

Let me take a quick look at nuclear power generation.

Nuclear Power Should Play an Important Role in Energy Security for the 21st Century

World energy demand is expected to continue to grow in the future. The growth of Asian countries will push up world energy demand and increase Asia's dependence on external energy supplies. Consequently, the Middle East's share of the oil market will reach the level it had at the time of the oil crisis. This could gravely threaten global energy security.

For comprehensive security, there must be various energy options; assuring various energy options is our generation's responsibility to future. It is also essential that efficient use of resources and conservation of energy be promoted, while minimizing environmental impact.

Considering economic performance and supply reliability, renewable energy options, such as photovoltaic cell and wind power, are only expected to play supplemental roles rather than serve as mainstream energy sources. Therefore, nuclear power, would play an important role in the 21st century.

Nuclear Power Can Be Considered a Global Common Asset

Nuclear power already shows good operating performance as an energy option; it accounts for 7% of primary energy and 17% of electric power in the world.

Japan has developed nuclear power plants with a total capacity of 45 GW, supplying 34% of the country's electricity. This makes nuclear power as the nation's largest single source of electricity. During the last two years, the nuclear plant average capacity factor reached as high as over 80%, and it can be said that nuclear safety and reliability have been established as well. By the year 2010, 42% of Japan's electricity is expected to be provided by nuclear power.

Nuclear power is not exactly a domestic energy, as its fuel, uranium, is imported, however, the uranium supply is relatively stable and the risk of import stoppage is very low.

In addition, nuclear power plants do not emit carbon dioxide, and generate a small amount of radioactive waste, which can be easily separated and disposed of. Nuclear power is, therefore, the only major energy supply system which envelopes various factors of its external economy within itself.

Nuclear power is regarded as a technological energy, since it is produced mainly through technology. Hence, it can be considered a global common asset.

So, Japan, as a country with very few natural resources and a high level of technology, is obligated to ensure global energy security in the future through its active commitment to nuclear power development.

MEASURES FOR ENHANCING THE ECONOMIC PERFORMANCE OF NUCLEAR POWER GENERATION

In response to deregulation and the globalization of market economies, cost-competitiveness with other energy sources is also an important judgement criterion for electric power supply options. Japan's electric power companies plan to reduce the cost of nuclear power generation.

I would like to present three aspects of the cost reduction efforts of Japan s nuclear power generation.

The First Aspect is Directed at Achieving a Higher Capacity Factor

Since capital cost accounts for a major part of nuclear power generation cost and, fuel cost only for about 20%, using facilities as efficiently as possible is very effective in reducing power generation cost. Therefore, achieving a higher capacity factor is a key to reducing power generation cost.

Ways of improving the capacity factor include extended operation period, reduction of troubles and failures, and optimized periodic inspection outages. Japanese electric utilities are actively working on these measures.

With regard to operating period, the current Japanese regulation sets 12+1 months as the maximum interval between periodic inspection outages. The extended operation will not undermine operating safety, but will greatly improve economic efficiency.

Concerning troubles and failures, Japan s nuclear power plant unscheduled shutdown rate has been kept as low as 0.3 times per reactor year, mainly due to efforts to prevent the recurrence of troubles and mishaps, and to avoid human errors based on lessons learned from past experiences. Moreover, Japanese electric utilities have launched major preventive maintenance activities including steam generator replacement in

PWRs and reactor shroud replacement in BWRs, and have implemented periodic safety review of a nuclear power plant every 10 years.

As for periodic inspection outage, on condition that plant safety is assured, it is necessary to optimize by reexamining inspection and maintenance items and contents, and considering in-service performance evaluation. We believe that Japan has accumulated sufficient experience in operation and maintenance to begin implementing these streamlining efforts.

The Second Aspect is the Reduction of Operation and Maintenance Costs

This issue is closely related to the issue of optimized outages. Past experience and performance records make it possible to optimize the frequency and content of operation and maintenance activities. By doing so, we can rationalize the number of personnel and equipment involved in operation and maintenance. In this regard, it is important to make sure that past, more than enough, inspection and maintenance activities does not paradoxically lead to higher reliability records or that streamlined inspection and maintenance activities will not later require secondary measures.

The Third Aspect is the Reduction of Construction Costs

Japan plans to achieve this goal through “scale merit” , meaning that the larger the plant capacity becomes, the lower the plant construction cost per unit capacity will be. In addition, the rationalization and standardization of facilities must be promoted. Plant capacity, which started at 300 or 500 MWe, has gradually increased to 800 and 1100 MWe. The capacity of the latest model is at 1300 MWe, and there is a plan to build a 1500 MWe plant.

A nuclear power plant is a giant process industry consisting of a huge number of components and requires vast funding for construction. Thus, the reduction of construction costs will contribute to both the reduction of initial funding and operation costs. With an eye on safety, efforts have been undertaken to reduce construction cost through all possible means, such as the rationalization, simplification and standardization of facilities and the rationalization of construction methods.

NUCLEAR POWER IN ASIA

Let us now shift our view from Japan to the Pan Pacific region, especially Asia.

After growing rapidly, the Asian economy fell in the exchange and stock market crisis, and entered a period of depression triggered by the sudden drop of the Thai baht in 1997. It is very unlikely that the situation will remain as it is for a long period of time. Asia is expected to return to its path of growth within a few years.

Meanwhile, energy demand growth in Asia will lead to the region s higher dependence on energy imports, especially oil. This trend may further weaken Asia’s energy supply situation.

For stability in Asia, it is necessary to secure a stable energy supply. Considering the characteristics of nuclear power generation, it is believed that nuclear power will play an important role as a future energy option in Asia.

For nuclear power development in Asia, there are specific tasks which must be accomplished. They include assuring safety, ensuring nuclear non-proliferation, promoting cost competitiveness, and obtaining smooth financing

Assuring Safety is the Highest Priority for Nuclear Power Use

To achieve this objective, safety culture must be well established. Only after safety culture is founded, can the technological and social infrastructure necessary to introduce nuclear power be developed, based on which various safety institutions, such as laws, standards and guidelines, can be put in place.

Furthermore, global safety standards will make it easier for countries where nuclear power is newly developed to ensure safety with regard to institutions and facilities and for suppliers to guarantee fairness, rationality and safety.

Nuclear Non-proliferation is the Most Important for Nuclear Power Development

In order to restrict nuclear power to peaceful purposes, it is important to keep in mind that nuclear power can be easily diverted to military use, therefore, nuclear non-proliferation must be clearly ensured.

To do so, it is essential to ratify the Nuclear Non-Proliferation Treaty and to accept the IAEA full-scope safeguards. Acceptance of the safeguards must be a prerequisite for the supply of nuclear components, materials and fuels.

Cost Competitiveness is Essential in Choosing Nuclear Power as a Major Energy Option

It is necessary to promote design rationalization and standardization, and introduce or develop plants that can simultaneously realize safety and cost competitiveness.

In addition, efforts should be made to reduce not only construction cost, but also operation and maintenance costs, by reviewing the operation and maintenance experiences of advanced nuclear countries.

Financing Must be Resolved

In Japan, as well as other nuclear countries, the financing for the construction of nuclear power plants has been relatively easy because Japan's utility companies are fairly large and founded on a firm management basis. This is not always true for developing countries, which are newly planning to introduce nuclear power; it is highly possible that financing will obstruct the introduction of nuclear power in those countries.

Nuclear power plant construction requires huge sums of money, and new investment in nuclear power generation might be difficult if short-term recovery of investment is necessary.

There exist methods of financing new power plant construction, such as the Build, Operate and Transfer (BOT) method and the Build, Operate and Own (BOO) method, which are implemented for thermal power plants. In the BOT method, a foreign private enterprise finances the construction of a power plant, recovers the investment by operating the plant for a certain period of time, and then transfers the ownership of the facility to the host country. In the BOO method, a foreign private enterprise continues to own and operate the power plant even after construction. It takes 20 to 30 years to recover the investment. Therefore, a steady capital reversion mechanism is essential to success.

Moreover, investment in nuclear power involves with various difficult issues which must be resolved. These include the need to insure trans-national impact in the case of a nuclear power accident, and guarantee nuclear cooperation agreements, nuclear non-proliferation, safety standards, a liability insurance system, adequate fuel supply and radioactive waste management and disposal. Accordingly, carrying out a project by the BOT or BOO method involves considerable difficulty.

THE ROLE OF NUCLEAR COUNTRIES

In concluding my presentation, I would like to comment on the role of nuclear nations in light of the challenges to the introducing nuclear power in developing countries.

For Asia's sustainable development, energy security is indispensable; I think that nuclear power will be established as an important energy option and that nuclear countries must play an important role to develop nuclear power in Asia.

Yet, at the same time, it should be noted that there is a gap in the way of thinking between the nuclear countries and the countries which are planning to newly introduce nuclear power. Some of the countries that are planning to introduce nuclear power may give priority to cost competitiveness and financial viability, rather than to safety and nuclear non-proliferation;

To fill this gap and introduce safe and cost competitive nuclear power, it is important that nuclear countries should cooperate in four areas:

Providing Material and Equipment

It is necessary to provide nuclear-related material and equipment on the condition that safety and non-proliferation are ensured. To ensure safety, it is important to provide a set of hardware and software.

Providing Technology and Experience

The nuclear nations should play an active role in ensuring a smooth establishment of safe and economically-competitive nuclear power in Asia, based on their experience and accomplishments. Such support should include important fields such as the establishment of safety regulations and standards, and the training and education of personnel.

Providing Financial Support

Loans must comply with international guidelines since, it is believed, from the long-term perspective, excessive loans will not lead to positive results, either for supplier or host countries. Both sides should exercise self control in this regard.

Providing a Multilateral Support Network

Japan is willing to support the smooth establishment of safe and cost-competitive nuclear power generation in Asia, through its experience and achievements. In doing this, support should not only be bilateral, but should include all nuclear nations around the Pacific rim in a multilateral support network wherein each nation provides what it excels at, such as technology, experience, and funds.