Challenges and Opportunities in Launching New Nuclear Power Programs in Developing Countries

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1. INTRODUCTION

As a consequence of the 1st and 2nd oil shock during the 1970's, nuclear power generation was considered as the most economical energy source. After that, new nuclear power programs began showing a downward trend due to public opinion against nuclear power as a result of large-scale accidents such as the Three Mile Island accident of 1979, the Chernobyl nuclear disaster, and anti-nuclear power generation movements by environmental organizations.

However, according to a recent IAEA report, 300 more nuclear power plants will be constructed worldwide by 2030. In the case of the U.S.A., the construction permits for 26 new nuclear power plants have been filed from 2007. It is considered the green light for "The Golden Years of Nuclear Energy."

There are various requirements for the development of a country, and among them one of the most important elements is securing economical and good quality energy sources. Securing economical energy sources concerns mankind itself, setting aside matters of individual countries. Especially for developing countries striving for economic development, securing stable and economical energy sources is on their top priority list in order to realize sustainable economic development. Contrary to the fact that developed countries such as the U.S.A, England, Germany, France, Russia, Japan and Korea have advanced nuclear technology, developing countries are heavily dependent on energy sources with unstable supply, high prices, and great environmental pollution such as coal and oil.

In 1959 when the national per capita income was between 70 and 80 dollars, the Korea Atomic Energy Research Institute was opened and within 50 years Korea has become the world's 6th largest nuclear power generating country.

I will suggest solutions to the problems of introducing new nuclear power programs in developing countries with the basis of Korea's experience on exemplary nuclear power programs development.

2. DISCOURSE

2.1. The role of IAEA for countries who intend to launch new nuclear programs

IAEA and developed countries with nuclear energy need to help solve common challenges faced by developing countries who intend to launch new nuclear programs. It is required that the entire international community work together to conserve the environment and to control pollution. In addition, it is a duty of IAEA and developed countries to increase and ensure the peaceful use of nuclear energy.

First, IAEA and developed countries in nuclear energy should provide technologies and human power

training programs needed for introducing new nuclear programs in developing countries.

Though most developing countries have aspirations to get nuclear energy related technologies, it is very hard for them to realize their desire without help from IAEA and developed countries simply because they do not have enough resources. So, IAEA and developed countries with nuclear energy need to provide training programs to human resources; and they need to give free access to a nuclear reactor for research.

By diffusing nuclear technology from developed countries, developing countries can minimize the time and mistakes of their own technology development in launching new nuclear power programs. Also, an economic effect can be promoted through nuclear energy technology transfer and facility export. IAEA also needs to diversify attendance at its training programs; from primarily European and American countries to Asian countries which have a strong need for those programs. Support for the nuclear related department at universities should go side by side with improving interest in the nuclear power generation area for gifted students.

Second, IAEA and developed countries with nuclear energy should support financial resources to the developing countries.

The most challenging problem faced by developing countries is raising financial resources to launch new nuclear power programs. Financial embarrassment makes it difficult for those countries to secure investment capital, to accumulate nuclear related technologies, and to educate their human resources.

The role of IAEA supporting financial resources to the developing countries should be intensified to promote the peaceful use of nuclear energy. Financial resources can be supplied by countries or companies which provide nuclear power facilities to developing countries. Additionally, IAEA needs to consider making provisions of compulsory clauses to provide financial support during the certification processes of nuclear facility design and manufacturing.

Third, IAEA should develop and deliver nuclear reactors appropriate to the needs of developing countries with adequate reactor type and capacity.

Considering the electric power grids and the capacity of each developing country, IAEA needs to develop small and medium capacity nuclear reactors. Also, IAEA should develop standardized multi-purpose (power generation, steam supply, water conversion, etc.) nuclear reactors corresponding to the needs of each country. The SMART (System-Integrated Modular Advanced Reactor) model, a small and medium capacity nuclear reactor which is under development with the target year of completion in 2011 by the Republic of Korea and certified by IAEA, can be a solution for the development of the multi-purpose nuclear reactor in this size range.

Finally, technological gaps among countries should be reduced in a way to motivate participation of developing countries in the international joint projects on nuclear energy.

One of the universal common features of technological industries is forming a barrier due to technological gaps. It is almost impossible for newcomers to reverse the technology gap which was led by existing players. Especially in the area of architecture, engineering and construction of nuclear power generation facilities, which is a huge integrated science/technology which includes nuclear physics, machinery, chemistry, radiation and information technology, new players are left out in the cold.

To induce developing countries to invest on the long-term research and development projects, including the 4th generation nuclear reactor development program, radioactive waste and spent fuel disposal, the participation of developing countries on these projects is encouraged.

Through these measures, IAEA can achieve not only its organizational goal, the peaceful use of

nuclear energy, but also establish a base for “Low Carbon Green Growth” and support sustainable progress of the developing countries.

2.2. ROK’s exemplary model can be applied to other developing countries

The Republic of Korea with its 5,000 years of history has been called a country of morning calm. Contrary to its beautiful natural beauty, however, ROK lacks of natural resources. Besides that, ROK was one of the poorest countries in the world devastated by the Korean war and divided by North and South in the 1950s.

But look now. Just 50 years later ROK has become the world’s 13th most powerful economy, introducing free economy and market system, taking rank with developed countries in the world even in the areas of sports and culture. The morning calm country became a morning rush country. Behind the driving forces was nuclear power generation, and I would like to share ROK’s success story and my experiences in establishing an infrastructure of nuclear energy with the other member states.

First, there was a strong leadership for nuclear power generation. It was 1956 when ROK first opened it eyes to nuclear power generation. Dr. Walker Lee Cisler who was the chairman of the American Nuclear Society once told Mr. Seungman LEE, President of ROK at that time, that 1 kg of Uranium, the size of a golf ball, can generate energy equivalent to 9,000 drums of oil and 3,000 tons of coal. And if ROK which lacks of natural resources invests in nuclear power generation it will achieve electricity generated from nuclear power after 20 years.

With that vision in 1959 when poverty was so common that everybody was having a difficult time, ROK began to construct the Korea Atomic Energy Research Institute and nuclear reactor with a huge amount of money. A strong leadership of President Seungman Lee, who sent 230 gifted people to America and England for nuclear power generation study, President Junghee Park, who constructed the first nuclear power plant, Gori 1 and continued to support nuclear power plant construction even in the atmosphere of war between North and South Korea in 1973, and President Doohwan Jun, who developed OPR-1000, Korean standardized nuclear reactor and domestically fabricating nuclear fuel in 1982 all made this possible.

Second, overcoming the hardship. When Korea’s first nuclear power plant, Gori 1 started, the conflict between North and South Korea was intensified domestically and during the construction a second oil shock broke out. It was united will power from Korean people who overcame these hardships for a better future. For countries who want to launch new nuclear power programs, it is so difficult to have a quality guarantee policy whereby reliability and safety of nuclear power is the ultimate goal.

To overcome this we hired highly skilled American experts and contractors to help satisfy the regulations. We had problems in supply and demand for operators and managing staff when we had a succession of nuclear power plants. To overcome this we asked people who studies overseas to come back to Korea and train staff at the fire power station with simulation techniques, and we sent gifted people to overseas training for nuclear power plant operation and maintenance. For better and more secure personnel management, we established the Nuclear Power Education Institute in 1978.

Third, we had luck in nuclear power generation. Our first fortunate choice was to select PWR(Pressurized Water Reactor) over GCR(Gas Cooled Reactor) for our first nuclear power plant Reactor type, Gori 1. At first GCR type was decided for Gori 1 but after many twists and turns PWR type was decided upon. And this was very lucky because right after that GCR type had serious problems and all projects were cancelled. If we had chosen GCR type for our first nuclear power plant, the biggest national project in the history of ROK would have gone failed miserably.

We also had luck with capacity choice. At first Gori 1 was planned to be constructed as a small scale reactor because our national electricity demand was only 2 million kW. But Mr. Ruri Krynn, an economic analyst of IAEA, advised us that the Korean economy was growing very fast so we

shouldn't establish the capacity of a nuclear power plant with that standard.

So the original capacity of 150,000 KW was increased into 587,000 KW which was a fortuitous decision. ROK which was starting up its economic development at that time could get cheap electricity from nuclear power generation which translated into securing competitive power in the international community because trade products could be manufactured inexpensively. This led ROK to be the world's 13th economic powerful country.

Furthermore, OPR-1000, Korea's standardized nuclear plant, was able to be developed due to the innovative technology transfer from GE right after the Three Mile Island accident. Now there are 12 OPR-1000 nuclear power reactors under operation or construction. If one constructs and operates 6 nuclear power plants of one type consecutively, almost perfect management and control exists regarding that type. In this regard ROK can export OPR-1000 to countries who want to launch nuclear power programs.

3. CONCLUSION

For the past 50 years, Republic of Korea (ROK) has been expanding the peaceful use of nuclear energy. The year 2009 is a meaningful year when we celebrate the 50th anniversary of nuclear power generation in Korea. As I already mentioned, in 50 years ROK has become the world's 6th largest nuclear power generating country supplying 40% of electricity from nuclear power generation. Nuclear power generating electricity played a pivotal role in economic development in Korea.

The Korean government with its strong willpower has been exerting tireless efforts in improving the sustainability of nuclear power generation with the cooperation of industry-academia-research. By realizing a low carbon green growth policy through strengthening safety management, and exporting Korean standardized nuclear power plant overseas, the share of nuclear power generation will increase from its present 40% to 60% in 2030.

Contrary to the EU and other developed countries in nuclear energy that are facing difficulties of an aging population of engineering staff, mergers and abolition of nuclear related companies, and shutdown of nuclear power related departments at universities, ROK has continuously accumulated design skills, manufacturing, maintenance and operation of nuclear energy. ROK also has the know-how how to improve people's receptiveness to nuclear energy.

The ROK can be a good model for developing countries, especially in Central and Southeast Asia, which intend to launch their own new nuclear power programs.

It is expected that we will have "The Golden Years of Nuclear Energy" propelled by a recent global economic recession and new, low carbon green growth policies in the world. With the efficient integration and convergence of IAEA's support program for developing countries and ROK's experience in launching and developing nuclear power programs, our system can be effectively applied to other developing countries and for the further mutual prosperity of mankind. We are eagerly looking forward to working with developing countries who want to launch new nuclear power programs.