

Nuclear Power Infrastructure Development Program: Korean Education Program

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1. Introduction

Many countries have decided nuclear power for next energy resources as one of the long-term energy supply options. IAEA projected nuclear power expansion up to 2030 reaching between 447 GWe and 691 GWe compared to 370 GWe and 2660 TWh at the end of 2006. Both low and high projection is accompanied with new nuclear power plant constructions respectively 178 and 357, about 11 units per year, and most new construction is in North America, the Far East, Eastern Europe, the Middle East, and Southeast Asia. [1] During the last forty years, thirty three countries have established commercial nuclear power programs but only some of them have developed comprehensive and large scale peaceful nuclear power infrastructure. [2]

Although various cooperation and guidance program of nuclear power infrastructure, developing appropriate environment and infrastructure of nuclear power plant is still challenging problems for developing countries launching nuclear power program. With increasing the demand of safety and safeguard from international society, creating appropriate infrastructure becomes essential requirements in national nuclear power program. In the viewpoint of developing countries, without sufficient explanation and proper guidance, infrastructure could be seen only as another barrier in its nuclear power program. The importance of infrastructure development would be obscured by ostensible business and infrastructure program can result in increasing entering barriers to peaceful nuclear power application field without benefits to developing countries and international community. To avoid this situation by providing enough explanation and realistic case example and cooperate with the countries wanting to establish comprehensive nuclear power infrastructure in the peaceful applications, we are creating the education program of infrastructure development with basic guidelines of the IAEA infrastructure series and Korean experiences from least developed country to advanced country with nuclear power.

2. Evolution of Korean Nuclear Power Program

Major nuclear power countries historically established the first nuclear power plant with its strong industrial and financial infrastructure. However, most of newcomers in peaceful nuclear applications is developing countries newly endeavoring to establish industrial and economic infrastructure, technological

capability and social stability. Because of significantly different starting points, development experiences of major nuclear power countries do not correspond to present problems for newcomers which can drive unacceptable plans resulting in failure of national nuclear power program with inappropriate examples.

Unlike other nuclear power countries, the Republic of Korea launched her first nuclear power plant program after Korean War's Ceasefire Agreement in 1953 under devastated social, economic, and industrial conditions which have greater relevance to today's developing countries. In 1954, the Per Capita Gross National Products (GNP) of Korea was \$ 70, about 0.35% of that in 2007 and the total electricity generation capacity was only 127,000kW, about 0.2% of that in 2005. [1] Despite of these barren conditions, Korea has emerged from a developing country to one of major nuclear power technology holders during the past 50 years of unprecedented growth in economy and democracy. Prospective Korea electric infrastructure evolved fast and successfully, leading to 516 times larger generating capacity between 1953 and 2006 (i.e., from 127MW to 65,514MW). [3] With extreme difficulties encompassed in the early Korean experiences, valuable lessons and critical information, applicable and acceptable experience, can be provided to developing countries through this education program.

3. IAEA's Infrastructure Program

IAEA is establishing basic principles and fundamental guideline for nuclear power infrastructure development. IAEA's milestones document published in 2007 specially aimed at providing comprehensive recognition and identification of national commitments and obligations with infrastructure development milestones consisting of nineteen issues and three phases. Nineteen issues are national position, nuclear safety, management, funding and financing, legislative framework, safeguards, regulatory framework, radiation protection, electrical grid, human resources development, stakeholder involvement, site and supporting facilities, environmental protection, emergency planning, security and physical protection, nuclear fuel cycle, radioactive waste, industrial involvement, and procurement. Three phases are covering from national decision stage to launch nuclear power program to operating the first nuclear power plant. [4] In addition to milestones document, evaluation methodology for national infrastructure status and NEPIO concept documents published for

supporting the milestones documents. In the summary conditions of milestone documents, 218 conditions in three phase and nineteen issues are required for comprehensive infrastructure development of the first nuclear power plant and this complexity establishes difficulties for deciding national goal of nuclear power program and creating long and intermediate plans.

4. Korean Education Program

For supplementing and supporting IAEA's program and developing countries' peaceful applications, we are creating education program for peaceful nuclear power infrastructure development combining with IAEA's infrastructure guideline and the last 50 years Korean experience on nuclear power. This course is providing not only long and intermediate goals but reasons and approaches from issues of national energy, importance of nuclear power in economic development to 19 issues recommended by the IAEA. To effective lectures with synergy effects between each issue, 19 issues are compressed into 8 sessions by grouping relevant subjects as indicated in Table I.

Table I: Detailed Course Outline

Session	Detailed Subjects	Hours
Session I Course Introduction	Opening Session	1.0
	Course Introduction	1.0
	Milestones of NP program	1.0
Session II National Position	Korean Energy Policy, national commitment and communications	1.0
	NP and Economic Growth	1.0
	Issues on Energy and Environment	1.0
Session III Safeguards Security and Physical Protection	Nuclear Safeguard & Security and Physical Protection	1.0
Session IV Human Resources Development	Human Resources Planning and Development	2.0
Session V Nuclear Safety & Radiation Protection & Emergency Planningz Legislative and Regulatory Framework	Nuclear Safety Policy Overview	1.0
	Nuclear Regulatory and Legislative Framework	1.0
	Licensing of NPP	1.0
Session VI Management Fundfing and Financing Industrial Involvement Procurement Stakeholder Involvement	Nuclear Power Project Management	2.0
	Financing of Nuclear Power Plant Project	1.0
	Korean Localization Policy and Experiences	1.0
Session VII Site and Supporting Facilities Electrical Grid Environmental Protection	Site Evaluation	2.0
	Electrical Grid and Distribution System	1.0
Session VIII Nuclear Fuel Cycle Radioactive Waste	Front End Nuclear Fuel Cycle	1.0
	Radioactive Waste Management	2.0
Session IX Nuclear Technology and Technical Cooperation	Global Technology Trends	1.0
	NP Technology Option	1.0
	International Cooperation	1.0
Session X Wrap up and Closing		1.0

All issues are provided with the implications of national development and sustainable nuclear energy vision; Proliferation-resistance, Environmental-friendliness, Accident-tolerance, Continuity, and Economy (PEACE). Audiences of this course are decision makers and energy planners in the government, utilities, regulatory body and research institute and the public opinion leaders who leading countries' energy program. As teaching materials, in addition to KAERI's Nuclear Power Project published 2001, we developed "Lessons Learned from the Development of Korean Nuclear Power Programme" summarized and analyzed Korean nuclear power history according to IAEA's milestones document structure. Essential lessons and historical experiences and strategies in each issue are provided in this document focusing on early activities of nuclear power program. [1, 5]

Considering harmonization and cooperation of previous nuclear education program, this course would be used specified course for high level decision makers of national energy program and general introduction before attending more advanced and specialized courses already provided by other Korean nuclear institutes such as KAERI, KHNP, KINS, KINAC and other organizations.

5. Conclusion

Nuclear power development requires considerable time and huge amounts of funding for developing essential infrastructure and accumulating diverse knowledge and experience. For reducing inherent difficulties, this education program could provide general guideline and useful example for developing nuclear infrastructure. This program also accelerates international collaborations between Korea and other countries. In 2009, this course will be applied to potential country joining in peaceful nuclear applications.

Acknowledgement

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