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Current Status of Korean Nuclear Industry and Major Policy Issues for Nuclear Development

Moon-Hyun Chun
Korea Advanced Institute of Science and Technology

Chang Hyun Chung
Seoul National University

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한국원자력 산업의 현황과 원자력 개발을 위한 주요 정책상의 문제점

전 문 헌
한국과학기술원

정 창 현
서울대학교

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Abstract

A brief overview of the current status of Korean nuclear power development is first presented. The necessity of nuclear energy in Korea is then clarified. After presentation of these overview, the major issues of the Korean nuclear industry, such as the major obstacles for nuclear power development and the most weak areas of the Korean nuclear industry, are identified and discussed. Finally, as a conclusion, actions to be taken by the government and the nuclear industry in conjunction with increased nuclear power generation in Korea are presented.

요 약

먼저, 우리 나라의 원자력 개발현황에 대한 개요를 제시한 후, 우리 나라의 경우 원자력 에너지가 왜 필요한가를 분명하게 설명하였다. 이러한, 주요 현황을 제시한 다음, 원자력 개발 상의 제약 요인과 한국원자력산업의 가장 취약한 분야등의 우리나라 원자력 산업의 주요 문제점들을 파악하여 이 문제점들에 대하여 논의하였다. 끝으로 결론적으로는 우리 나라에서 원자력 발전의 증가와 관련하여 정부와 원자력 산업이 각각 취해야 할 제반조치들을 제시하였다.

1. Introduction

It is very impressive that, on the one hand, in many countries in both Europe and Asia that had gone nuclear the amount of electricity supplied by nuclear power plants varies from 20 to as much as 50%. What is also impressive

is that at the end of 1984 there were, throughout the world, 528 units of nuclear power reactors in operation, under construction, or on order whose total capacity is about 404,997 MWe(1). On the other hand, it is very shocking that, in Sweden, a parliamentary decision has banned any further construction of nuclear power plants and nuclear power is scheduled to be phased out completely by the year the 2010(2). What is also bothering us is that, in the United States, the cessation of domestic orders in 1978, together with the suspension or cancellation of about 100 plants, equates to a nonexisting domestic market for nuclear power plants.

What is particularly striking is that these reductions took place against the background of a fivefold rise of oil prices. Even in Korea, there has been some reduction in the number of new nuclear power reactors to be added in the next 15 years according to the current nuclear power development program. And naturally we ask ourselves the following question (3):

"Considering the impressive safety records, technical reliability, superior performance records, and the economic advantages of nuclear power, what are the major reasons for its present reductions in nuclear power programmes and what has gone wrong for nuclear power?"

There are many reasons for this condition. Some are institutional, some neopolitical, some financial, some are due to lower load growth forecasts (4). In addition, there are two general reasons why nuclear energy has faced with present difficulties (3) : One is that the consequence of a slow-down or halt in the planning and construction of nuclear power stations are not immediately felt. The difficulties will only show up six to ten years from now in the form of lack of electrical energy for which the electric utilities and government policy planners will then be held responsible. Another reason why nuclear energy has become a scapegoat in industrial countries, in particular, lies in the conscious or unconscious associates in most people's minds between the peaceful uses of nuclear energy and nuclear weapons.

Then, what are the unique problems and the real issues which will govern the future development of nuclear energy in Korea? And what should be done by the government and the Korean nuclear industry to cope with the present difficulties and to achieve a self-reliant nuclear industry? These issues will now be addressed in the following discussions.

2. Current Status of Nuclear Power Development in Korea

Electricity is one of the key elements for economic development and its stable supply at reasonable price is one of the most important objectives of the long-term economic development plan. Since Korea is lacking domestic energy resources, the top priority of the energy policy has been to develop a non-petroleum power generation system and seek a diversification of fuel for power generation. In addition, as an alternative energy source to oil, Korea has initiated an ambitious nuclear power development program along with the conventional coal-burning plants in the early 1970.

As a result, the nuclear power generation has become one of the most important and stable sources of energy in Korea today. Last year alone, 11.8 billion KWH of electricity was generated by the nuclear power and this amounts to about 22% of the country's total electricity generation of 53.8 billion KWH. When the 11.8 billion KWH of electricity is converted into an equivalent amount of oil, it becomes 1.8 million bbls of oil which, in turn, is equal to about 10% of the annual oil consumption in Korea.

Therefore, this is the amount of oil that is saved by the nuclear power.

Currently, 3 nuclear power reactors (capacity : 1,916MW) are in operation, 6 reactors (capacity : 5,700MW) are now under construction, and two more reactors are scheduled to be added by 1996. When all of these projects are completed in 1996, the nuclear power will provide about 42.5% of the country's electricity (For more detailed information, see Tables 1, 2, 3, and 4).

3. The Necessity of Nuclear Energy in Korea

First, let us consider our present energy resources in Korea. In fact, we have very limited options in the ways that we can produce electricity in Korea: while reserves of recoverable coal is only 640 million tons, it will be all used up within 30 years according to the government estimate. We lack both coal and hydroelectric power as can be observed in Table 2 (for the year of 1984). Korea has been mainly depending on imported foreign coal, oil, and gas. Neither solar nor wind energy is sufficiently developed to produce large amounts of electric power. Nuclear fusion is likely to remain a hopeful dream for the remainder of the 20th century. Scientists have yet to achieve a self-sustaining fusion reaction in the laboratory.

Now, let us then consider the demand side of electric power in Korea. The average GNP growth rate of the last 20 years (between 1962 and 1982) is about 7.3% per year. On the other hand, the average growth rate of the total energy consumption for the same period, in Korea, is about 10.6% per year, whereas the average growth rate of electric power consumption is about 17.7% per year. Thus, Korea's energy needs are bound to increase at a faster rate than the GNP growth rate if the current economic growth continues.

In other words, we have very limited amount of domestic energy resources. Other sources of energy alone will simply not meet future power demands in Korea. Not only that, oil is too valuable as an aircraft and automobile fuel and as a raw material for petrochemicals to be used to generate electric power. Natural gas is better used as a heating fuel. Therefore, it is inevitable that Korea has to depend on the increased use of nuclear power in addition to the imported coal and oil.

Thus, considering our current and future energy demand and the available energy resources one can conclude as follows: the demand for electric power will increase as the current economic growth continues. Since our domestic energy resources are so limited that Korea has to depend on the increased use of nuclear power in addition to the imported coal and oil.

4. Major Obstacles for Nuclear Power Development in Korea

Up to this point, we have briefly reviewed the "current status of nuclear power development" and tried to convince why we need to increase the use of nuclear energy in Korea. With this background, let us now examine the major obstacles and real issues which will determine the future destiny of nuclear power industry in Korea. Some of these issues are directly related to (1) economic, (2) social, and (3) technical areas.

(1) Increase of Both Nuclear Construction Costs and Foreign Debt:

This issue is concerned with the economic competitiveness of the nuclear power and the economic policy of the Korean government. Without going into a complex comparative analysis of electricity generating costs which depend on the ground rules chosen, the follo-

Table 1. List of Korean Nuclear Power Plants (1) (As of Dec. 31, 1984)

Nuclear Power Reactor (Location)	Net MWe	Reactor Type	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor	Construction Stage	Commercial Operation	
								Original Schedule	Actual or Expected
Korea Nuclear 1 (Kori)	556	PWR	W	GEC	Gilbert	W	100	Dec., 1975	April, 1978
Korea Nuclear 2 (Kori)	605	PWR	W	GEC	Gilbert	W	100	Feb., 1983	July, 1983
Korea Nuclear 3 (Wolsung)	629	PHWR	AECL	Parsons	Canatom/ AECL	AECL	100	Jan., 1982	April, 1983
Korea Nuclear 5 (Kori)	895	PWR	W	GEC	Bechtel	Hyundai	96.4	Sept., 1984	June, 1985
Korea Nuclear 6 (Kori)	895	PWR	W	GEC	Bechtel	Hyundai	88.5	Sept., 1985	March, 1986
Korea Nuclear 7 (YoungKwang-Kun)	900	PWR	W	W	Bechtel	Hyundai	81.9	Mar., 1986	Dec., 1986
Korea Nuclear 8 (YoungKwang-Kun)	900	PWR	W	W	Bechtel	Hyundai	7.6	Mar., 1987	Sept., 1987
Korea Nuclear 9 (UlJin-Kun)	943	PWR	Fra	Alsthom	Fra/ Alsthom	DongAh/ KHIC	37.1	Dec., 1987	Sept., 1988
Korea Nuclear 10 (UlJin-Kun)	943	PWR	Fra	Alsthom	Fra/ Alsthom	DongAh/ KHIC	30.6	Dec., 1988	Sept., 1989

Abbreviations used in this table:
W=Westinghouse Electric Corp. (U.S.)
AECL=Atomic Energy of Canada Ltd.
Fra=Framatome : Societe Franco—Americaine de Constructions Atomiques SA(France)
GEC=General Electric Co. (UK)
Alsthom=Ste Generale de Constructions Electriques et Mechaniques (France)
KHIC=Korean Heavy Industries and Construction Company

Table 2. Breakdown of Power Generation Capacity and Share by Sources (5)

Year / Resources	1984		1986		1991		1996		2001	
	MW	%	MW	%	MW	%	MW	%	MW	%
Petroleum	7,202	50.8	4,820	26.7	4,788	21.5	3,559	11.8	3,151	7.8
Nuclear Power	1,916	13.5	4,766	26.3	7,616	34.2	9,416	31.3	13,016	32.1
Coal	3,170	22.3	3,730	20.6	4,530	20.3	9,705	32.3	15,320	37.7
Hydroelectric	1,202	8.5	2,217	12.3	2,784	12.5	3,384	11.3	5,365	13.2
Gas	700	4.9	2,550	14.1	2,550	11.5	4,000	13.3	3,750	9.2
TOTAL	14,190	100	18,083	100	22,268	100	30,064	100	40,602	100

wing major points can be made.

The construction cost of nuclear power plants has been increasing every year. In the early 1970s, there was little difference in the construction costs of nuclear and coal-burning plants: Nuclear plants cost $200 per Kilowatt to build, coal plants around $175. But nuclear consruction prices quickly began climbing. By the late 1970s, nuclear plants cost $700 per Kw, compared with $500 for coal plants. Now, with post-TMI requirements pushing the price of nuclear construction even higher, a nuclear plant costs $1,500 per Kw, whereas a coal-fired plant with state-of-the-art pollution-control equipment can be built for around $1,200 per Kw.

In spite of the sharp increases in the invest-

Table 3. Breakdown of Electric Power Output and Share by Sources (5)

Year / Resources	1984		1986		1991		1996		2001	
	GWH	%	GWH	%	GWH	%	GWH	%	GWH	%
Petroleum	29,237	54.4	21,018	32.4	18,142	18.8	12,275	8.9	12,501	6.6
Nuclear Power	10,774	20.1	21,698	33.4	47,335	48.9	58,701	42.5	82,559	43.4
Coal	11,189	20.8	16,934	26.1	19,678	20.3	44,347	32.2	76,584	40.3
Hydroelectric	2,524	4.7	3,001	4.6	4,060	4.2	4,236	3.1	5,075	2.6
Gas	—	—	2,239	3.5	7,580	7.8	18,382	13.3	13,515	7.1
TOTAL	53,724	100	64,890	100	96,795	100	137,941	100	190,234	100

Table 4. Long-Term Nuclear Power Development Plan (5)

	1984	1986	1991	1996	2001
Capacity of Nuclear (MWe)	1,916	4,766	7,616	9,416	13,016
Electric Power Output (GWH)	10,774	21,698	47,335	58,701	82,559
Nuclear Share of Total Output	20.1	33.4	48.9	42.5	43.4
Number of Reactors	3	6	9	11	15

Table 5. Comparison of Electricity Generating Costs Between Nuclear and Coal
(Unit ¢/KWH) (5.6)

Cost / Country	Nuclear Power	Coal-Fired Plant	Ratio of Costs: Coal/Nuclear	Remarks
Korea	3.31	3.77	1.14	Ref. 6
U.S.A.	6.67	5.41	0.81	Based on the
Canada	3.36	3.81	1.13	Midwest Areas
Japan	4.04	5.03	1.25	
France	2.69	4.02	1.49	
West Germany	4.22	5.53	1.31	
Italy	2.90	3.77	1.30	

Reference: OECD Report (April, 1984)

ment costs of nuclear stations which have occurred over the last few years, mostly caused by increasingly numerous and stringent environmental standards, nuclear plants in the 1000 MWe range have achieved a substantial competitive advantage over coal fired plants as can be observed in Table 5.

(2) Impact of Nuclear Power on the Environment and Growing Public Fears About Nuclear Safety:

These are nod only social issues but also technical issues. With regard to the impact of nuclear power on the environment, it has, in many respects, become a victim of its own thoroughness. No other source of energy, indeed no industrial technology, has even been the subject of such comprehensive and detailed analyses of its environmental effects (3). The results of the reactor safety study, WASH-1400 in particular, have led to two major conclusions (7) :

a. The possible consequences of potential reactor accidents are predicted to be no larger, and in many cases much smaller, than those of non-nuclear accidents.
b. The likelihood of reactor accidents is much smaller than that of many non-nuclear accidents having similar consequences. All non-nuclear accidents examined in this

study, including fires, explosions, toxic chemical releases, dam failures, airplane crashes, earthquakes, hurricanes and tornadoes, are much more likely to occur and can have consequences comparable to, or larger than those of nuclear accidents.

More specifically, when the nuclear reactor accident risks predicted for the 100 plants expected to be operating(in the U.S.A.) by about 1980 are compared with risks from other man-caused and natural events to which society is generally exposed the following results are obtained.:

a. Non-nuclear events are about 10,000 times more likely to produce large numbers of fatalities than nuclear plants.
b. Nuclear plants are about 1000 times less likely to cause comparable large dollar value accidents than other sources.

However, these favorable conclusions do not in any way imply that no work remains to be done on the ecological effcsts of nuclear power.

Up to now, nuclear opposition movements have not grown among private citizens in Korea. However, as the number of nuclear power reactors is increased, the number of opponents and critics of nuclear power in Korea may also grow sooner or later, unless the fears of the general public that nuclear plants are releasing mysterious and unseen radiation that will maim generations to come or may somehow explode can be removed entirely. The industry must be more sensitive to public concerns about safety.

(3) Two Major Unresolved Technical Issues:

In addition to the above potential and real issues for nuclear power development, there are two major unresolved technical issues which call for an immediate government action.

The first issue is the closing of the nuclear fuel cycle, especially with regard to the storage and ultimate disposal of radioactive wastes. Korea, as one of developing countries, is still primarily concerned with how to gain access to modern technologies on the best term and how to develop its own technologies required for radioactive waste disposal. As of yet, there is no permanent repository for nuclear wastes.

The primary responsibility of the radioactive waste disposal and its management is given to the Korean Nuclear Fuel Company. Two feasibility studies, one for the construction of processing and a permanent repository site for low-and mid-level radioactive wastes, and the other for using an interim storage for spent fuels, are supposed to be carried out within this year. The final plan and the implementation of the radioactive waste disposal policy will be dependent on the outcome of the feasibility studies.

The second and the less urgent technical issue is the decommisioning of nuclear installations. Until now, because the industry is so relatively new, demolishing an old nuclear plant has never been attempted on a commercial scale. Instead, decommissioned reactors have typically been put into "safe containment": sealed and left to stand in protected isolation.

So far, a few small noncommercial reactors have successfully been dismantled in other countries. But with more and more aging larger plants being taken out of service, we have to prepare proper dismantling processes at least within the next 15 years.

5. The Most weak Areas of The Korean Nuclear Industry

The first step to solve the present difficulties of nuclear industry and to build a viable self-reliant nuclear industry in Korea is to identify the most weak areas of the nuclear industry and then find ways to eliminate the problem areas through a long-term national planning and give a priority for the solution from the

national policy standpoint.

With this purpose in mind, let us look at the list of the most weak areas already identified by the Korean nuclear industry and the government.

(1) Infrastructure of Nuclear Industry

Nuclear power generation is a multi-technological industry and it requires a substantial technological infrastructure and long term commitment on the part of the industry as well as the government. However, mainly because the nuclear industry is relatively new in Korea, it has immature and weak infrastructures compared with other industries.

Since the first three nuclear power reactors (Kori No. 1, No. 2, and Wolsung) were built according to the so-called turn-key contract method, most of the work were done by foreign technologies. Consequently, the localization rates of equipments and materials used in Kori No. 1, Kori No. 2, and Wolsung were only 8%, 12.8%, and 14%, respectively (5).

As we have built more nuclear power plants, there have been significant improvements in the capabilities of domestic nuclear industries. In the case of the Kori Unit No. 9 and No. 10, the localization rate of equipments and materials is about 40%, whereas that of the architect engineering is about 46% (5). The construction technology, on the other hand, has become completely self-reliant since the construction of Kori No. 5 and No. 6.

With all this improvement in localization, however, the dependency on both foreign capital and foreign technologies in the construction of a nuclear power plant is still relatively large compared with the other industries in Korea.

(2) Managerial Capabilities for a Large Scale Project

In spite of the fact that the Korean nuclear industry had only a limited amount of experience and expertise in international contract and managing a grand scale project, industry analysts agree that all the nuclear projects had been well conceived and efficiently controlled such that a significent amount of construction time had been reduced in comparison with other countries.

However, there is a general consensus that we have only a limited number of skilled managers who have both sufficient experience and expertise in international contracts, planning, coordinating, and managing a large scale project such as the nuclear power plant construction. Eventually, this will become a negative factor in the nuclear industry and this will be contributing to increased construction costs unless proper measures are taken at this early stage.

(3) A Low Plant Capacity Factor

The annual cost of operating a nuclear power plant is obtained by summing the contributions from the three main cetegories: (1) capital (or plant investment), (2) operation and maintenance, and (3) fuel. Capital costs constitute a major fraction of the cost of generating electricity in a nuclear plant, operation and maintenance costs are small, and fuel costs contribute roughly 12% to the total in Korea. The cost per kilowatt-hour of electricity is thus not greatly dependent on the fuel cost.

Since the capital (investment) costs have to be paid regardless of whether the plant is generating electricity or not, the capacity factor has an important bearing on the unit energy cost. Idle reactor periods therefore constitute a penalty, almost directly proportional to the annual capital cost. It is important, therefore, to maintain a high plant capacity factor to reduce costs. However, the plant capacity factor of the three nuclear power plants currently under operation is only about 65%(5). Thus, there is a plenty of room for making improvements over the present level of the plant capacity factor through such measures as more rigorous preventive

maintenance, reduction of the idle reactor periods for repairs, and preventing from the occurrence of major accidents.

(4) Independent Codes and Standards for Nuclear Industry

All the equipments and materials for nuclear power plant should be designed, manufactured, installed, and tested according to the various applicable codes and standards. For the purpose of licensing and nuclear regulatory activities in connection with the construction and operation of the nuclear power plants in Korea, our government has been mainly following the codes and standards of the United States such as ASME Codes, the code of federal regulation (i.e., 10CFR 50) etc.

As a result of lacking our own codes and standards for nuclear industry, there have been many confusions and difficulties to build a systematic technological infrastructure for nuclear development. This is another important area that requires an immediate action to develop our own codes and standards that satisfy our own needs by both Korean nuclear industry and the government.

6. Measures to be Taken by the Government and the Nuclear Industry in Conjunction With Increased Nuclear Power Generations in Korea

In the foregoing discussions, we have reviewed the present status of the Korean nuclear power development and we have shown why we need to increase the use of nuclear energy in Korea. Also, we have examined the major obstacles as well as the real issues for nuclear power development in Korea. In addition, we have discussed about the most weak areas of the Korean nuclear industry identified by the Korean nuclear community.

Now then, finally let us see what measures are already undertaken and what else should be done by both the nuclear industry and the government in conjunction with increased nuclear power generations in Korea.

(1) Promotion to Establish a Self-Reliant Technology

All the necessary industrial, scientific, and economic policy measures should be undertaken by the government for the Korean nuclear industry to insure the safety in nuclear power generations and to enhance the economic competitiveness of the nuclear energy. Furthermore, in order to expand the current nuclear industry into a self-reliant exporting industry, clear goals must be defined at this stage. The major goals for localization of nuclear industry defined by the government are shown in Table 6 (5).

Since the nuclear power technology is a multi-disciplinary industry it requires close cooperations between all the participating industries, research and development organizations, and the government. Therefore, in order to promote and to establish a self-reliant technology for nuclear power generation in Korea, a proper division of work between the participating organizations is highly desirable. According

Table 6. Major Goals for Localization of Nuclear Technologies to Establish a Self-Reliant Nuclear Industry (5)

Items for Localization	Localization Rate(%) and Target Year	
	1984(Current Year)	By the latter half of 1990
Production of Major Equipment and Material	60%	90%
Design and Engineering	70%	90%
Construction	99%	100%

Table 7. Division of Work Between Domestic Nuclear Industries (5)

Organizations	Major Responsibilities
Korea Electric Power Corporation (KEPCO)	Overall Project Management
Korea Power Engineering Co. (KOPEC)	Architect Engineering Service
Korean Heavy Industries and Construction Company (KHIC)	Component Design, Manufacturing, and Installation
Korea Nuclear Fuel Co.	Fuel Manufacturing
Korea Advanced Energy Research Institute (KAERI)	NSSS and Fuel Design
Domestic Construction Industries	Civil and Construction Work

to the recent agreement between the nuclear industries and the government, the major responsibilities defined for each organization are as shown in Table 7 (5).

(2) Current Efforts for the Standardization of Nuclear Power Plants

Following the lead of such countries as France and Canada, which have adopted standardized reactor designs, Korean nuclear industry is going to develop a standardized nuclear power plant based on the experience obtained from the construction of the Korean nuclear reactor unit No. 11 and No. 12, in particular. The standardized reactor design will be used beginning from the nuclear reactor unit No. 13.

The standardization activities with regard to the production of equipments and materials, the construction, the operation, and the maintenance procedures etc. will also be initiated at the same time. Since the design project of the standardized nuclear power plant is so broad and multidisciplinary that the whole project will be divided into four major areas (5): (1) inte grated design of a standardized nuclear power plant, (2) design and manufacture of the equipments, (3) the reactor core and the nuclear reactor vessel designs, and (4) the nuclear fuel assembly. These responsibilities will be properly distributed to each organization that has the capability to carry out the given mission.

The blueprints of the standardized nuclear power plant would allow modifications made on one plant to be copied at others in the series. The expected results of the standardization of the nuclear power plant in Korea are as follows (5):

1) The length of time required to build a nuclear power plant can be reduced by about 12 months.
2) The construction costs of a nuclear power plant can be reduced by up to 15%.
3) The foreign capital required for the construction of a nuclear power plant can be reduced from the current level of 35% of the total costs to the level of 10%.
4) The overall localization rate of the nuclear power generation can be raised from the current level of 57% to 80%.
5) The nuclear power technologies and the infrastructure of the Korean nuclear industries can be upgraded so that the present domestic nuclear industries can be transformed into a viable exporting industries.

(3) To Achieve a High Plant Capacity Factor

The economic competitiveness of the nuclear power generation depends largely on the reduction of construction costs and maintaining a high plant capacity factor. Therefore, one of the main objectives of the nuclear industry is to raise the current level of 65% to the level of 75% by 1990. In order to achieve this objective, the following actions are recommended to be taken by the power utilities, in particular:

1) Strengthening of preventive maintenance system and specialization of maintenance and repair personnel.

2) Securing and continuously upgrading reactor operators, maintenance personnel, and superintendent operators on a long-term basis by expanding the current training centers for reactor operation and maintenance.
3) Extension of the current refueling cycle of 12 months to possibly 18 months by using nuclear fuels that allow longer fuel cycles.

(4) Upgrading of the Regulatory Systems for Nuclear Safery

Following recommendations are made here to be taken by the government:

1) The licensing procedure for nuclear power plants should be reevaluated and simplified so that there is no duplication or excessive regulation. And eventually, the primary responsibilities of the normal and routine activities for nuclear safety should be transferred to the utilities. The role of the government, on the other hand, should be supervision and guidance of the activities of the utility.
2) Foreign regulatory codes and standards for nuclear safety should be selectively adopted after a close reexamination from the standpoint of practicality and cost-effectiveness. Eventually these codes and standards should be modified to be suitable to the Korean nuclear industries as well as the Korean society.
3) A simplified licensing procedure for the standardized nuclear power plant should also be prepared to promote the current standardization activities.

(5) Efficient Project Management

To improve the efficiency of the overall project management for nuclear power plant construction, the following actions are recommended to be taken by the nuclear industry:

1) "An overall project management center" should be established at the construction site, and the project management system should be modified in such a way that everything can become site-oriented.
2) A proper process and cost control system should be developed so that eventually all the controls can be computerized.
3) A project management evaluation system should be introduced so that all the results of the evaluation of previous projects can be effectively reflected in the next projects.

(6) Radioactive Waste Disposal Policy

With respect to the problem of radioactive waste disposal, the following recommendations are made to the government:

1) An organization that has the exclusive rights to oversee the radioactive waste management should be established within this year(1985), and proper regulatory codes and standards for radioactive waste disposal should be prepared.
2) A permanent repository site for low-and mid-level radioactive wastes should be constructed by 1990, and at the same time, the final plan for interim storage of high-level radioactive wastes should be made.
3) In addition, in order to develop the technologies required for radioactive waste disposal, a joint research program with other major industrial countries should be developed. In this effort, the emphasis should be first on developing the technologies that will maximize the less expensive in-pool storage and second on chosing the least expensive from among several ex-pool storage technologies.

(7) Coordination of the Nuclear Power Development Policy

Following recommendations are made to the government in particular:

1) A committee for the coordination of nuclear power development policy should be managed in such a way that a close cooperation between the nuclear related organizations can be realized.

2) A clear and proper division of responsibi lities between the government organizations should be reestablished for the more efficient handling of the overall policies for the long-term nuclear power development in Korea.

7. Conclusion

To summarize, the major issues of the Korean nuclear industry, such as the obstacles for nuclear power development and weak areas of the Korean nuclear industry, are identified and discussed. In addition, actions to be taken by the government and the nuclear industry in conjuction with increased nuclear power generation in Korea are presented.

Currently, Korean nuclear industry and the government have taken a number of steps to buildup a nuclear industry that will become eventually self-reliant and exporting industry by 1990, although, for a while, Korea has to rely on LWR technology imported mainly from the United States. Included in this effort is the investment in standard designs of nuclear power plant.

Nuclear is one of the Korea's most important source of safe, economical, and reliable energy. Therefore, the nuclear energy shoucd be continuously promoted as Korea's semi-domestic energy sources and as a main alternative energy source to oil from the viewpoint of stable energy supply, economy, and capability of providing in large quantity.

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