Country Report for Japan
Human Resource Development Looking over Future Deployment of Nuclear Power in Japan

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1. Japan's policy for nuclear energy and future plan

1.1 Status of Nuclear Power Plants in Japan

In Japan, there are nine major electric power companies, which operate commercial light water reactors, and one company which is a producer and wholesaler of electricity from nuclear power. As of the end of 2006, there were 55 nuclear power plants operating in Japan, which are including 32 BWRs and 23 PWRs[1)]. The total licensed generating capacity is 49,580 MWe, by which was generated about one third of Japan's total electricity in fiscal 2005. Two commercial light water power plants and one prototype fast breeding power reactor are under construction. Furthermore, 4 plants are under safety review by the licensing authority and another 7 plants are planned.

1.2 Framework for Nuclear Energy Policy in Japan

In 2005, the Atomic Energy Commission decided a Framework for Nuclear Energy Policy[2)] for the research, development and utilization of nuclear science and engineering, in which are included a basic idea for promoting nuclear power generation for a stable energy supply, a measure against global warning, and the application of radiation technologies in the areas of science, industry, agriculture and medicine.

Important action plans about the nuclear power application are categorized according to the action term in the framework as the followings;

The short-term actions are those aiming at using existing assets as long as practicable, of which the life may be expected more than about 60years. They include activities for maintaining the public confidence in the safety management of existing plants and related facilities, improving the performance of existing plants, promoting the use of Pu recovered from the spent fuels in LWR, and making progress of site finding for geological disposal of vitrified high-level wastes. The mid-term actions are those to prepare advanced LWRs for replacement of retiring plants, as significant existing plants are retired in 10-30years. The long-term actions are those related to the development of innovative nuclear energy systems which can be competitive with other technology in the future market in terms of social acceptability as well as safety, economy and environmental protection, including nuclear science and technology research as fusion and ADS (Accelerator Driven System). One of the major projects in the category is the development of fast breeder reactor and its fuel cycle systems, which could be commercially available in 2050s by satisfying the requirements of the safety, reliability, and economy.

By implementing these actions, the Atomic Energy Commission expects that the nuclear power

shares steadily about 50 to 60GWe which is equal to 30 to 40 % of the total electricity generation.

1.3 Japan's Nuclear Energy National Plan

The METI (Ministry of Economy, Trading & Industry) deliberated concrete actions[3] for achieving the basic goals of the framework for nuclear energy policy, and proposed a policy plan composed of 10 categories:

1. Building new nuclear power plants in a liberalized electricity market.
2. Appropriate use of existing nuclear power plants with assuring safety as a key prerequisite.
3. Deploying strategy for acquiring natural resources.
4. Promoting nuclear fuel cycle and strategically reinforcing of nuclear industries.
5. Early commercialization of FBR cycle.
6. Assuring ample technical and human resources to support the next generation nuclear power.
7. Supporting for international development of Japan's nuclear industry.
8. Positive involvement in creating an international framework to uphold both non-proliferation and the expansion of nuclear power generation.
9. Building trust between government and local communities through detailed communication.
10 Reinforcement of measures for radioactive waste disposal

A lot of nuclear power plants in Japan had been constructed in the '70s and '80s, and the construction rate has fallen off sharply since the 1990s. While, a significant number of existing reactor have to be replaced from the mid of 2020s. In addition, worldwide deployment of nuclear power plant is also predicted for getting over the climate change and energy security. With considering the situations, one of the most concerned issues is the human resource. Thus, the issue of human resource is mentioned in this plan, and a new budget was assigned to promote the development of human resources in universities and colleges by the MEXT and MITI in FY2007.

2. Human Resource Development for Nuclear Power in Japan

Figure shows the number of persons belonging to each sector relevant to nuclear energy application. The HRD has been implemented according to the needs and missions in each sector with mutual- interaction and collaboration.

2.1 Education and Training for Operating Staff in Electricity Utilities

In Japan, education and training to maintain and improve the operating stuff capabilities are conducted by the dispatch of staff to training facilities and in-house education at each electricity utility. A nuclear power plant is operated through shifts consisting of trained operators who generally comprises a person responsible for shift chief, shift sub-chiefs, operators and assistant operators.

Operating staff had been trained in the training facilities of US manufactures before 1973. After that, the Nuclear Power Training Center Ltd.(NTC) and BWR Operator Training Center (BTC) were founded to serve comprehensive education and training in Japan, where provided introductory training courses, retraining courses, teamwork training courses and other additional courses according to the level of staff competence. As of the end of FY2006, 31,199 individuals and 10,999 teams have been trained and returned to their proper jobs[4]. Besides, in each electricity utility, OJT (on-the job training) is also enforced concerning accident simulation operation drills and case studies of accidents.

Operators first receive introductory education about nuclear power through in-house training of the

electricity utility and are dispatched to the field as trainees where they learn field knowledge through inspections and other practices. They are then assigned to the field where they learn basic knowledge and techniques about electricity, turbine and nuclear reactors. They are dispatched to primary training or other courses at an operational training center, where they attend lectures and simulator-aided training about the basic principles and techniques necessary for reactor operation. After they have gained practical experience as assistant operators, they are assigned as operators of electricity, turbine and nuclear reactor. After being assigned as operators, they are again dispatched to an operation training center to attend a retraining course consisting mainly of simulator-aided training. A group of the shift is dispatched to an operation training center as a unit to receive simulator-aided training in the teamwork training course to check their teamwork as a shift and to improve their skills.

2.2 Training in Research Institute

The Japan Atomic Energy Agency (JAEA) has a mission of HRD on nuclear technology since a nuclear technology education center(NuTEC) was founded as a reactor and radiation school in 1957 in the Japan Atomic Energy Research Institute (JAERI). As of September 2007, the number of graduated persons is about 108,000. Among them, 2,500 foreign people, mainly from Asian countries are included.

Presently, the NuTEC is organizing a plural kind of domestic training, international training, and collaboration training with universities. For domestic courses, NuTEC provides three training courses for beginners, engineers, and officers. In the training courses for nuclear engineers, participants from nuclear power plants, nuclear facilities and research institutes, are able to acquire comprehensive knowledge of nuclear engineering, nuclear fuel engineering, radiation management and related regulations and laws through lectures, laboratory exercises and facility visits.

The NuTEC has organized several kinds of international courses so far, which are UNESCO Isotope Training Course, International Atomic Energy Safety Technology Training Project, Joint Training Course (JTC), Instructor Training Program (ITP) and Safeguards Training Course mainly for Asian countries. Here, the ITP and JTC are in a pair course. Namely, the ITP is a program for developing the teaching ability and techniques of instructors, in which the instructors are trained for a few months at the NuTEC. The ITP started bilaterally with Indonesia from 1996, Thailand from 1996 and Vietnam from 2001. Following the ITP, the JTC courses have been organized in Indonesia from 1997, Thailand from 1998 and Vietnam from 2001, where local instructors, who are trained in the NuTEC, organize a domestic training course in each country with assistance by NuTEC staff. Finally, it is expected that each country can organize training course for own country independently on Japan.

In JAEA, nuclear emergency assistance & training center(NEAT) and international nuclear information and training center on FBR are also available.

3. Issues in Human Resource Development in Japan

3.1 Concerns and measure about HRD

The most important element of human resource is the activity of universities. The number of students, however, decreased greatly with the drop of construction rate of nuclear power reactors, resulting to about half of the peak as shown in this figure. Besides, a lot of engineers who have

engaged in the construction and operation in the ‘70s and ‘80s are about to retire in 10 years. The situation on HRD has been seriously concerned.

Fortunately, a couple of new courses on nuclear energy have recently established in several universities. In addition, a project by the MEXT and METI started to support the HRD on nuclear energy in universities and colleges in 2007. The project is covering comprehensively the issues for HRD, such as (1) nuclear energy training support program including invitation of instructors from industries, (2)funding to basic technology fields underlying such as material corrosion, welding technology, fluid dynamics, and so on, where research activity and specialists are lacking in recent years, (3) sponsorship for students to have opportunities to experience firsthand the realities and appeal of nuclear industry and research laboratories, (4) support of the basic facilities for research and education, and (5)developments of core curriculum.

This funding system is very valuable for universities, because basic and fundamental nuclear researches are able to continue using existing research facilities such as critical assemblies and hot-laboratories, and students are able to learn nuclear science & technology using real facilities. Triggering the funding, a standing committee composed of government, university, and private company was organized to discuss the issues on human resources to minimize imbalance between demand and supply sides. The framework is very important, since human resource is a long period issue.

4. Concluding remarks

(1) In Japan, nuclear energy is an essential energy source. Therefore, HRD for nuclear energy application has been continued by universities, industries and JAEA.

(2) Human resource is a unique and fundamental force for supporting nuclear power application in not only developing also developed countries.

(3) Japan, so far, has led the collaboration and cooperation for the HRD in FNCA member countries.

(4) In FNCA member countries, Korea, China, and Japan have power reactors. A couple of countries are planning to construct power reactors in near future. Other countries may have power reactors in future.

(5) It is very important to have a framework to share each experience and mutual collaboration for HRD.

Japan will do the best effort for HRD in FNCA member countries.

Reference

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