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Nuclear Energy and Environment of China

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1. China needs to develop nuclear energy actively

The discovery of nuclear energy is one of the greatest achievements of human civilization in the 20th century. In 1991, 420 nuclear power stations of 26 countries or regions were in operation, producing 2 trillion and 20 billion KWh of electricity, and making up 16.6% of the world's total electricity generated. This was an increase 2.7% of 1972.[1]

It is considered by International Atomic Energy Agency (IAEA) that from the view of stability both in supply and fuel price alteration, nuclear power is obviously beneficial compared with other fossil fuels, if it is not indispensable to imported uranium source. Taking a million KW level nuclear power station (PWR) for example. The yearly use of fuel is 27 tons of low enriched uranium, which could be transported by several trucks only, if the equipment utilization ratio is 75%. But the yearly fuel use for a coal power station of same level is 2.6 million tons of coal, which needs to be transported 5 times per day by a cargo train with a 1400-tons capacity. And for a oil power station of same level, its yearly use is 2 million tons of oil, the amount of which equals the capacity of 10 super tankers.

It has to be mentioned that if the operating nuclear power stations were substituted by coal power station, the world CO_2 emission would go up 7%, which is about 0.53 billion tons (as carbon).

If the existing ability of nuclear power construction is brought to its full potentials, and nuclear power stations of 40 millions KW are put into operation each year between 2000 and 2010, the world will be able to reduce 30% of its CO_2 emission, about 1.27 billion tons[1].

According to Japanese MITI, the nuclear energy revenue and expenditure ratio are high. If the expenditure is 1, the revenue should be 20. Another estimation by Japanese Economy Institute showed that staking exhausted CO_2 from coal power as 100, that of nuclear power is 4, oil power is 78 and natural gas power is 67, providing the fuel producing process is included[2].

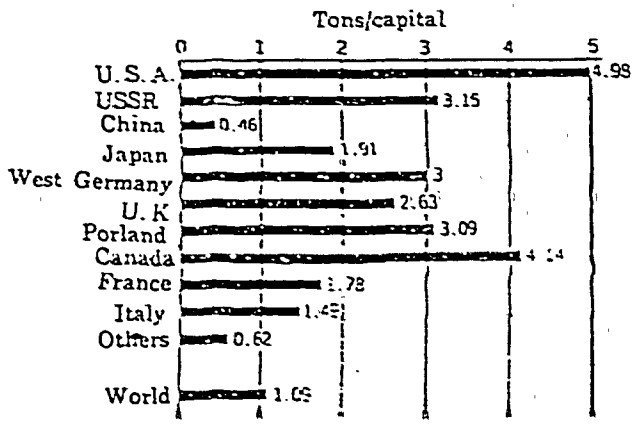

Fig. 1 Exhausted CO_2 each person in different countries (1985)

As a developing country, China has very low energy consumption. (Fig. 1). The total energy consumption of the country is 685.7 MOTE, including 117.9 of oil, 13.4 of natural gas, 543.8 of coal and 10.6 of water energy. In order to suit the need of 8% of economic increase ratio, energy supply has to be developed greatly. But it is restricted by both energy producing ability (the construction of coal mine, oil and natural gas field) and transportation ability (railway, highway, and pipeline etc.) (Table 1).

Table 1 · Chinese Energy Reserves and Production (by End of 1991)

	Coal (ton)	Crude oil (barrel)	Natural gas
Reserves	$114{,}500\times10^8$	24×10^9	10^{12} m^3
Production	$100{,}700\times10^6$	2.81×10^6/d	13.4 MTOE
Minable years	114	22.6	67.3

In addition, because of the limitation of fossil fuel resources and environmental capacity, the inevitability of population increase and the rising average energy consumption, to develop nuclear energy which has high revenue and expenditure ratio and low environmental load must be a correct chose (Fig. 2). After 1992's Earth Summit in Brazil, the policy of saving energy and improving energy structure, which included developing nuclear power, was proposed in China's Priority Activities for Sustainable Development. The first nuclear power station in Chinese mainland--Qinshan Nuclear Power Station has been put in operation since 1992, the second one--Daya Bay Nuclear Power Station was well prepared and it will generate electricity before long.

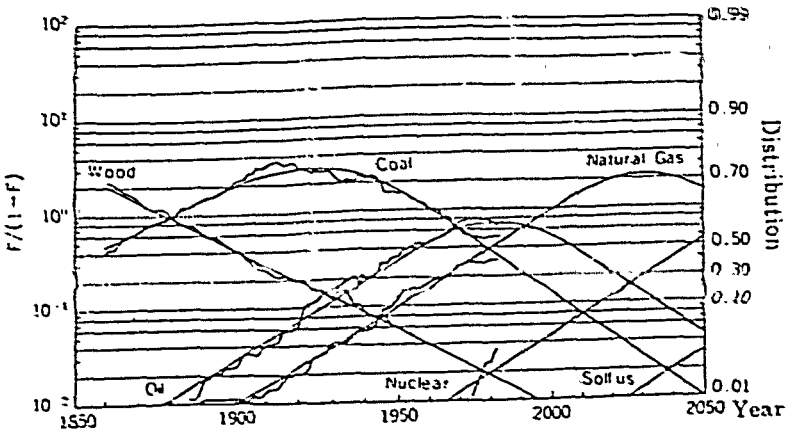

Fig. 2 The distribution of energy source used.

2. China pays attention to the radiation environment management

Chinese nuclear industry and nuclear technology application have had a history of more than 30 years. The government has paid great attention to radiation environment management since the beginning.

Before the national environmental protection institution was founded in 1973, the management was done by radiation safety institution of enterprises. At that time, both the Ministry of Nuclear Industry and a number of universities carried out strict management over the radiation environment.

In August 1973, the first National Environmental protection Conference was held in Beijing. Right before the conference, the related ministries were organized by the preparatory office of the conference to work out "Radiation Protection Regulations (draft)". which was discussed and revised during the meeting, and then it was approved as National Standard (GB-J8-74).

The Environment Protection Law of the People's Republic of China was issued in 1979. According to the law, an environmental protection administration under the State Council was founded and authorized to carry out the management of environmental pollution elements including radioactive materials.

Environmental Protection Bureau was founded in 1982 which belonged to the Ministry of Urban and Rural Construction and Environmental Protection at the time. In October of the same year, the State Council made it clearer that "the Bureau is responsible for national radioactive waste management". After that, the bureau began to do two things immediately. One is the investigation of the national environmental natural radioactivity level. It took 8 years, involving more 300 people, collecting and analyzing about 13,000 soil samples and 6000 water samples, measuring terrestrial radiation dose rates at about

8800 grid points (grid size is 25 x 25 km). As a result, the current level, distribution and pattern of environmental natural radioactivity have been fully ascertained in China, of which the value averaged over the whole country of terrestrial gamma radiation dose rate has been reported to UNSCEAR as the typical value of China data. The other is the construction of provincial urban radioactive waste storehouse. By June of 1993, 21 provinces, autonomous regions and cities have, one after another, had their radioactive waste storehouse in operation, while some other storehouse are still in construction or preparation.

Since 1984, National Environmental Protection Agency (NEPA) has actively formulated regulations, more than 30 regulations and standards were formulated. The major ones are "Urban Radioactive Waste Management Rule", "Environmental Protection Management for Nuclear Power Station Capital Construction", "the Content and Format of Nuclear Power Station's Environmental Impact Assessment (EIA)", "Radiation Environment Management Rules" etc.

3. The role of China NEPA in nuclear energy and the environment[3]

As early as in 1982, Mr. Qu Geping, director of NEPA at the time, declared the policy of nuclear power is one of " active support and strict demand". This showed the supportive attitude of the NEPA to nuclear power. At the same time, there is enforced management through administrative, legislative, economic, technical and educative measures to ensure the safety.

3.1 administrative measure

It has been made clear that NEPA takes charge of the management over the radiation environment throughout the country, that the management system is to be carried out at two levels: national and provincial, and that EIA license and assessment procedures for nuclear installations and projects with radiation, and the system of "three simultaneousness" i.e. environmental protection facilities must be designed, constructed and put into operation together with the projects, which is newly constructed, renovated or expanded, must be implemented strictly and examined carefully before approval. To satisfy the EIA license and assessment, NEPA invited some authoritative experts and professors to form some expert groups and a high level expert committee. They played very good role in the finished EIA license and assessment of 50 projects.

3.2 Legislative measure

As mentioned above, NEPA, together with other related ministries, has made more than 30 regulations and standards related to radiation environment management. And now "Law on Nuclear Pollution Control" is being scripted and "Radioactivity Projection Regulation" is being revised. NEAP has formulated also a series of environmental policies related to nuclear waste management, such as "Policy on Disposal of Low and Intermediate Level Radioactive Waste in Nuclear Installation" etc.

3.3 Economic measure

By learning from foreign experiences, China will adopt the principle of "the polluter pays" for the nuclear waste management, in order to include the cost of the treatment and disposal in the electricity fee.

3.4 Technical measure

Although IAEA did not think that additional technical breakthrough for nuclear waste safety management is needed, although China has carried out research and development for years, and has also the advantage of vast territory, the management is still a high-tech and high sensitivity task after all. NEPA actively support related ministries and institutions to carry out necessary R and D.

3.5 Educative measure

It is essential to carry out public education, in order to help the public and local authorities understand the nuclear energy in nuclear waste management. We should help them (including leaders of different level and decision makers) truly understand the necessity of nuclear energy utilization, the inevitability of waste producing and safety of the technology of disposal, so that they will support the development of nuclear energy.

References

[1] Japanese Journal of Atomic Industry, Vol. 38, No. 9, 1992, P4;
[2] Japanese Journal of Atomic Industry, Vol. 38, No. 12, 1992, P3;
[3] Chinese Journal of Nuclear Science and Engineering, Vol. 11, No. 4, 1991, P.363