



PROGRESS OF CHINA'S NUCLEAR POWER PROGRAMME

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Abstract

From a long-term point of view, nuclear power is the only solution for the shortage of energy resource. Nuclear power development strategy has been specified in China according to national condition. The electricity development of nuclear power optimizes the national energy structure and ensure the power supply, particularly in east China. China's first self-designed and self-constructed nuclear power plant--Qinshan Nuclear Power Plant (300MWe PWR) is now well under commercial operation. China is willing to cooperate with IAEA, other countries and regions in the field of nuclear energy for peaceful use on basis of mutual benefit.

1. Status of Nuclear Power Development

The idea of developing nuclear power in China has long been conceived. It was pointed out in the 12-Year-Outline for Atomic Energy Development Program put forward by the central government in 1955 that "Nuclear power which ushers in a new era in the history of power development, has brilliant prospects. An integrated power supply system shall be taken shape in China within the coming 10 years, which includes primarily comprehensive exploitation of rivers and development of thermal and hydroelectric power as well as use of nuclear power depending on the practical conditions". On February 8, 1970, hearing the report on a shortage of electricity in Shanghai given by the municipality, the late Premier ZHOU Enlai said: "From a long-term point of view, nuclear power is the only solution for the shortage of electricity in Shanghai and East China". China's first nuclear power plant project was therefore named "728 Project". From then on, the prelude to develop nuclear power was drawn in China.

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China is a large and developing country. In recent years, the gross national product is increased by about 9% per year. Lack of electricity arose in many regions, specially in southeast China. Because 80% of coal resource is in north China, 70% of hydroelectric resource is in Southwest China, and the developed east, northeast & south China only possess about 15% of nation's energy resource. However 50% of train and one third of water freight transport capability have been used for transport of coal. So in response to economic growing demand, perhaps the only way is to build a group of nuclear power plants in east China. (See Fig.1)

The first concrete was poured on March 20, 1985 for China's first self-designed and self-constructed nuclear power plant--Qinshan Nuclear Power Plant (300MWe PWR). And it was connected to the grid and started to generate electricity on December 15, 1991 under the joint efforts of all the builders, and reached full power operation in July 1992. It had entered the period of high-power trial operation then. On the First of April 1994, Qinhsan 300MW NPP got into commercial operation. First cycle operation was finished in Oct. 1994. After refueling and necessary maintenance, the Qinshan plant restarted and connected to grid for second cycle operation in Jan. 1995. It is expected that the plant load factor would reach about 84% in 1995.

The successful construction of Qinshan NPP, which results from both making full use of our achievements in science and technology over the past 30 years and absorbing the advanced experience of other countries thanks to the opening policy, is an another significant breakthrough in peaceful use of nuclear energy and nuclear technology. It marks an end of no nuclear power in China's mainland and initiation of a new stage in peaceful use of nuclear energy and nuclear technology.

Daya Bay NPP (2 x 900MWe PWRs) has been one of the largest joint venture projects since China started the reform and opening policy. For the Unit 1, the first concrete was

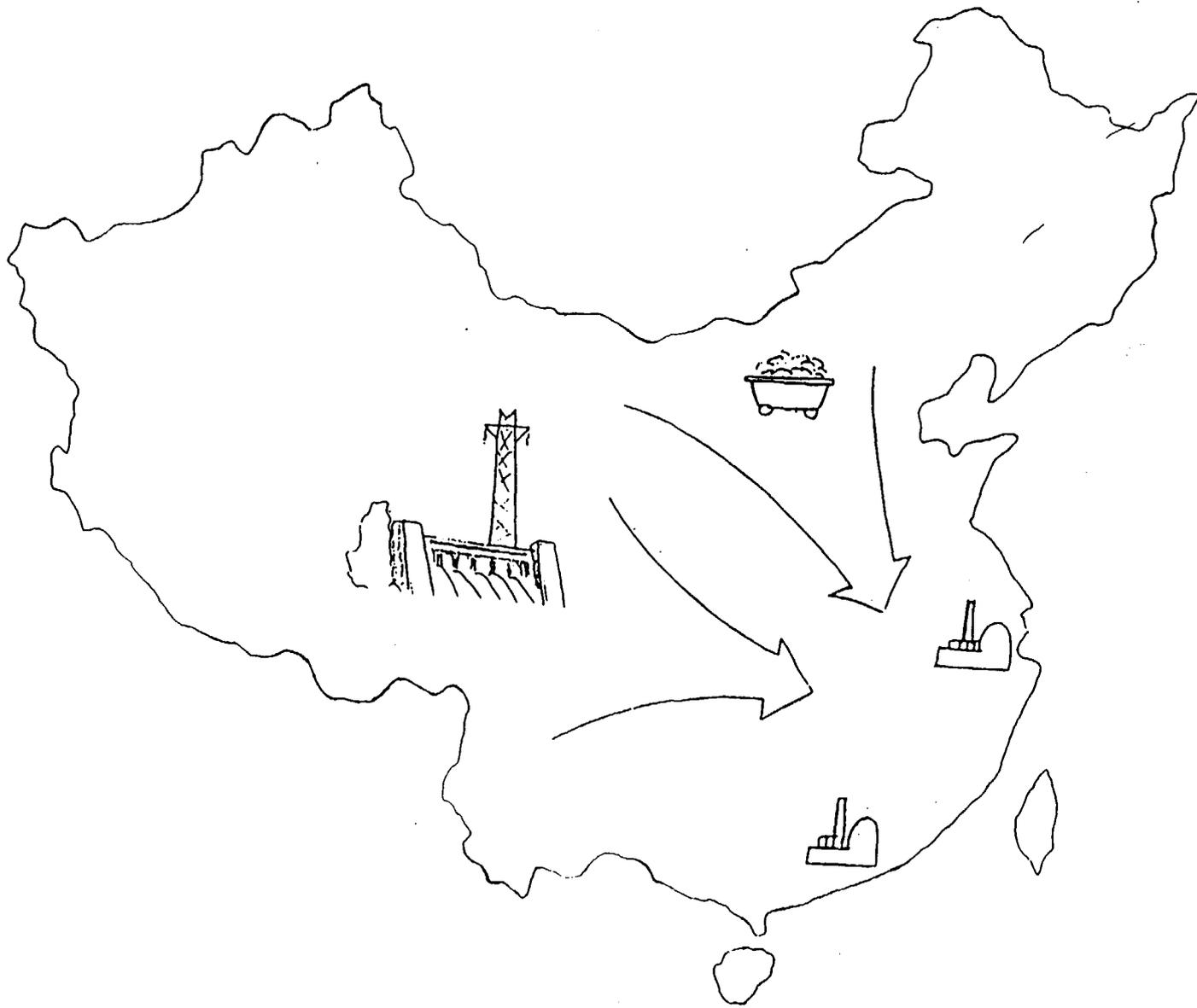


Fig 1 Energy Resource in China

poured on August 7, 1987, and connection to the grid and generation of electricity, initiated on August 31, 1993, and commercial operation reached in Feb. 1994; For the Unit 2, the first concrete was poured on April 7, 1988, and commercial operation reached on May 6, 1995. Both unit had finished first cycle and refueling and is now on second cycle operation.

The construction and operation of the Daya Bay NPP plays a major role in learning the foreign advanced techniques and management experience and in improving China's construction and management of nuclear power plant.

The second phase of Qinshan NPP Project (2 x 600MWe NPPs) has been placed on the National Plan as one of the major items. The review of the preliminary design was fulfilled in November 1992. It is scheduled that the connection to the grid and generation of electricity shall be initiated by the end of 2000, and for the Unit 2, one year after.

The recommendation for the second phase of the Guangdong NPP Project (2 x 900 MWe PWR Units) was approved and preparations are underway.

The feasibility study on construction of nuclear power plant is actively carried out in Liaoning Province and in the southeast coastal provinces such as Shandong, Jiangsu, Zhejiang, which are well developed in economy but short of coal and power resources.

2. Nuclear Power Program and Policy

In January 1984, China joined in the IAEA and acts as a designated member of the Board of Governors, taking an active part in activities of international nuclear cooperation. In November 1988, China concluded an agreement with the IAEA to voluntarily place some of its civilian nuclear facilities under the Agency's safeguards; and has accepted Agency's inspectors to inspect the nuclear

facilities in China. In January 1989, China acceded to Convention on the Physical Protection of Nuclear Material. In March 1992, China acceded to the Treaty of the Non-Proliferation of Nuclear Weapons. In February 1993, China gave the Agency a pledge to report on its import and export of nuclear material, which means China's support to the efforts made by the international community in non-proliferation of nuclear weapons.

Since 1990s, China has entered a period of rapid development of national economy, thus presenting a new challenge to the existing energy industry which can hardly meet the needs of the economic development. As estimated, there is a shortage of conventional energy resources amount to 0.1 - 0.2 billion tons of standard coal by 2000 and 1.2 billion tons of standard coal by 2050. The situation of energy shortage is more serious in southeast coastal areas with fairly developed economy, therefore, alternative energy resources must be developed as early as possible so as to mitigate this gap.

30 years of experience in developing nuclear power in the world can fully witness that nuclear power possesses safe, clean, and economical features. The electricity development of nuclear power is the only way to optimize the national energy structure and ensure the power supply. In order to fit in with the objective needs of economic development, the general principle of developing nuclear power is "Developing mainly the thermal and hydroelectric power while the nuclear power as and auxiliary"; for the southeast coastal areas, the principle is "Developing the thermal, hydroelectric, and nuclear power in the light of local conditions". At the same time, nuclear power development strategy has been specified, taking into account the national conditions.

In technology, we shall conscientiously sum up the experience in construction and operation of Qinshan NPP and Daya Bay NPP. Through the construction of Qinshan NPP, we have mastered the techniques in design and construction of

nuclear power plant with 300 MWe scale. 70 percent or more of the equipment used in the Plant were manufactured in China. Now China's nuclear power construction is climbing to a new level.

The construction and operation of the Qinshan NPP has heightened our confidence in developing nuclear power and demonstrated the superiority of nuclear power as new energy resources. As a result, several provinces and municipalities have made applications for constructing nuclear power plant. The safety and reliability of nuclear power are much concerned by the public. The principle of "Safety First and Quality First" is consistently followed throughout the construction of nuclear power in China and specific measures are adopted accordingly:

- An authoritative organization for independent implementation of safety supervision to civilian nuclear facilities - China National Nuclear Safety Administration (NNSA) was established in 1984. on the basis of the IAEA NUSS documents, the NNSA has enacted and promulgated four nuclear safety codes relating to design, siting, operations, and quality assurance, and a series of standards and guidelines. As a competent body of nuclear safety, the CNNSC has also promulgated a series of administrative rules relating to operation and radiological safety control, etc. and at the same time, it possesses a complete quality assurance system and special organizations and personnel to deal with research work and management for nuclear safety, and international cooperation in this field.
- From the very beginning of development of nuclear power, all the constructors are always instructed to have a strong sense in safety and quality, and also to have high professional morality to the State and the people.
- During design, construction, and operation of the nuclear power plant, the IAEA experts are invited to

carry out safety review. And our work will be improved according to their comments.

- The operators of nuclear power plant shall be strictly trained and further trained. They are allowed to take their posts, only when they have obtained their licenses.

These measures will basically ensure the safety and reliability of nuclear power plants in China.

3. International Cooperation and Peaceful Use of Nuclear Energy

Promoting the peaceful use of nuclear energy throughout the world for the benefit of mankind is one of the objectives set forth in the Statute of the IAEA. One of the major tasks in China's nuclear industry is extensively developing international cooperation to promote peaceful use of nuclear energy and nuclear techniques.

Since 1980s, under the guidance of the reforming and opening policy, China has developed extensive cooperation with many countries. In the course of design and construction of the Qinshan NPP, advisory opinions were acquired from foreign experts and some of the major equipment, were imported. Daya Bay NPP is constructed by joint venture with HongKong, importing foreign equipment and technology. The principle of "Relying mainly on our own efforts while cooperating with foreign countries" shall be followed in construction of the second phase of Qinshan Project. In manufacture of nuclear fuel assemblies, foreign technology shall be introduced to backfit the existing production line, etc. The cooperation inevitably benefits us to fully control of nuclear power technology and further promote the development of nuclear power construction.

In 1990s, the width and depth in international cooperation shall be greatly increased. Some of the untouched

cooperative scope and forms before are now open for discussion, including construction of nuclear power plant by joint investment and joint development of new-type reactors and spent fuel reprocessing technology for power reactors. Though PWR is selected as major type of NPP, the other type of NPP are to be considered for sake of increasing nuclear power supply capacity. A plan to build a CANDU type NPP is under consideration. The active cooperation between CNNC and AECL is being taken for building PHWR NPP on Qinshan site in China. Under the circumstances the nuclear power industry will be developed steadily, which shall undoubtedly provide a broad prospect for cooperation in the field of nuclear technology.

While introducing foreign investment, equipment, and technology, improving its technique level and construction capability in nuclear power development, China is ready to play an active role in the world market for the sake of promoting peaceful use of nuclear energy and nuclear technology in the world. Now China's nuclear industry, developed on the basis of self-reliance, is in a position to export nuclear power plant and research reactors. China's technology and experience fairly meet the needs of the developing countries; following the principle of "Equality, mutual benefit and common development", China is willing to cooperate with other countries and regions in the field of nuclear energy and nuclear technology for peaceful purposes.

China has concluded inter-governmental agreements with 12 countries on the cooperation of peaceful use of nuclear energy, and has established relations of exchange and cooperation with many countries and regions. On the basis of independence, self-reliance, equality, and mutual benefit, China wishes to carry out active cooperation with foreign countries in science and technology, economy and trade, and continue to make its due contributions to the prosperity and development of nuclear undertakings in the world.