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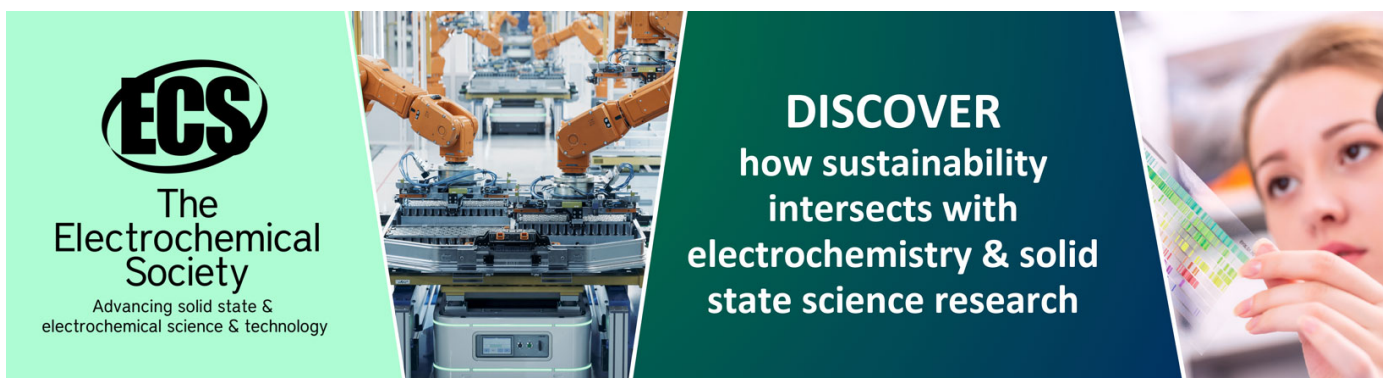
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Research on Nuclear Facilities Decommissioning Funds for China

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Abstract. Nuclear facility decommissioning technology is difficult, long processing time, requires considerable capital investment, the impact of nuclear power in the future sustainable development is enormous. However, China has not yet established a sound economic policy and system of decommissioning nuclear facilities, the world can learn from less experience, the issues of nuclear facility decommissioning funds need in-depth study. This paper analyzes the management status of decommissioning fund, retirement fund collection and management mode in major nuclear power countries around the world, and studies the management status of retirement funds in China, summarizes the outstanding problems in decommissioning funds in China, and puts forward relevant suggestions, the establishment of civilian nuclear facilities decommissioning fund, as soon as possible to develop civilian nuclear facilities decommissioning fund management approach, accelerate the estimation of the minimum guaranteed value of special funds for retirement, to promote the establishment of early public scientific research nuclear facilities retirement funds.

Keywords: Nuclear Facility; Decommissioning Funds; Research

1. Introduction

Decommissioning of nuclear facilities has a huge impact on the sustainable development of nuclear power in the future. It is a huge systematic project and requires considerable capital investment [1,2]. The decommissioning cost of nuclear facilities is a long time after the closure of related facilities. Therefore, it is the first choice for all countries in the world to do the retirement fund reserve ahead of schedule. The [3] (Chairman Decree No. sixth) of the law of the People's Republic of China on the prevention and control of radioactive pollution proposes that the decommissioning expenses of nuclear facilities should be withheld and included in the investment estimate or the production cost. The measures for the extraction and management of the decommissioning expenses of nuclear facilities shall be stipulated by the financial department of the State Council and the competent department of pricing, together with the administrative department of environmental protection and the competent department of nuclear facilities of the state council. As China's nuclear energy construction and operation have formed the enterprise operation, according to "who pollutes who governance" the basic principle, nuclear facilities decommissioning funds should be undertaken by nuclear power enterprises. But the economic management in our country at present is not perfect, the lack of effective financial system, it is difficult to avoid business risk and financial risk of nuclear power enterprises in the future, need to reference to international experience, in-depth study of the nuclear power plant decommissioning fund management mode, establish and perfect the policy system and the



decommissioning of nuclear facilities.

2. Overview of Decommissioning Management of Foreign Nuclear Power Plants

Almost all of the nuclear power plants in France belong to state-owned enterprises or owned by the majority of the state owned companies. Decommissioning of nuclear power plants is under the supervision of the French Atomic Energy Commission (CEA) and the national radioactive waste management agency (ANDRA). Unlike other countries, France does not have a dedicated funding agency, which is funded by waste producers. French electric power company (EDF) has established a relatively complete decommissioning reserve for nuclear power plants. For PWR nuclear power plant EDF, according to the initial investment of 15% from the retired fees, part of the funds retained by EDF in its interior, and is responsible for the management of funds, but should be examined and approved by the Ministry of Finance on behalf of the. After 2002, France introduced the provisions of the present value of the reserve fund to reassess the decommissioning reserve for the nuclear power plant. The present value of the reserve fund is used to estimate the present value of the reserve fund in the calculation, so as to ensure that the provision can be used at the time of provision. The present value conversion is not mandatory in France, but since 2005, the present value conversion must be carried out, and the present value is converted according to the present value rate of 2.5% (according to the actual situation will fluctuate).

British military nuclear facilities decommissioning is managed by the Department of Defense (MOD), the decommissioning of civilian nuclear facilities is governed by the nuclear decommissioning authority (NDA), and the entire decommissioning process is supervised by the health and Safety Agency (HSE) and the environmental protection agency. NDA is a public institution, not affiliated with government departments, funded by the UK Department of Commerce, enterprise and system reform. Its strategy, plan and budget are approved by the Ministry of Commerce, enterprise and system reform. NDA through the management and operation contract signed with the owner of the company, to fulfill the retirement responsibility. The owner company implements the retirement work according to the work plan formulated jointly with NDA, and the actual cost of the work is paid by the NDA, and the owner uses his own employees or subcontractors to complete the decommissioning work. There are two sources of NDA costs, part funded by the UK Department of Commerce, enterprise and system reform, and part of the business revenue, including operating income and fuel processing revenues paid by owner firms.

The United States Department of energy (DOE) is responsible for the decommissioning of military nuclear facilities in the United States, the decommissioning of civilian nuclear facilities is managed by the American Nuclear Safety Agency (NRC), and the entire decommissioning process is supervised by the Department of environmental protection (EPA). The United States does not have a decommissioning fund for nuclear power plants, but requires nuclear power plant operators to reserve deposits that can be used for retirement.

3. Management Model of Decommissioning Fund for Nuclear Power Plant

According to preliminary estimates, decommissioning of nuclear power plants has increased the cost of nuclear power, with an increase of about 2% to 5% [4]. Due to the differences of economic system, accounting system and traditional practices, the management mode and mode of decommissioning fund for nuclear power plants adopted by different countries are different. Some countries set up a system to collect retired capital, some countries require the electric power company to set up the retirement fund. But no matter what kind of situation, the country needs to introduce specific retirement fund management measures.

3.1. Ways of Collecting Funds

There are four ways to collect decommissioning funds for nuclear power plants: (1) Prepayment. Before the operation of power plants began to pay the expenses for retirement funds in a separate account, the provisions shall not be used for other purposes. (2) External payment method. The

payment from customers' electricity charges to extract a certain percentage, after years of accumulation, set up a fund to invest in or into a free power company controlled by the special commission of decommissioning funds dominated trust fund. (3) Internal reserve mode. Similar to external payments, electricity is extracted from electricity bills, but electricity companies can use this fund to borrow money for investment or for other purposes. (4) Margin, letter of credit or insurance. It is purchased by the electric power company, and when the electric power company fails to repay the debt, the payment of the retirement fee is guaranteed.

3.2. Management Style

On the whole, the retirement funds in the world can be divided into two levels and three types in the management style. Two levels of fund management. One is whether it is incorporated into the national budget. The two is whether it is relatively independent of enterprise finance. Where the management of funds is not independent of the enterprise's finance, it belongs to the reserve provided by the enterprise in order to fulfill its future obligations. Where the management of funds is relatively independent of enterprise finance, even if it is not in the category of national budget management, it is often regarded as the name of "fund".

Three types of fund management [5]. The first is internal reserves. So far, the French EDF's funds required for decommissioning of its nuclear power plants are managed by the enterprise's internal reserves, and the relevant responsibilities and capital delivery are dealt with by commercial contracts. According to the interpretation of the French financial sector, because the French nuclear size, if the huge retirement funds into national fund management, is bound to set up special investment company, the French administrative authorities on balance, gave up this plan. The second is to set up a separate account that is independent of the assets of an enterprise. The most typical representative is the United States nuclear power plant decommissioning fund management system. The federal regulations in the United States have regulations on the amount of retirement funds, the types of effective financial instruments, the independence of funds, the principle of capital investment, and the use of funds. According to the US system, the American Nuclear Regulatory Commission (NRC) oversees the decommissioning fund for nuclear power plants, but the tariff rates are regulated by the Federal Energy Regulatory commission. The third is the establishment of a national nuclear waste fund that does not fall into the national budget category. The typical representatives are the national nuclear waste fund of Sweden and Finland. The fund defines the ownership of capital very clearly. Key features include the fund management system operation: prediction of different charges based on four nuclear plants according to the different rates of pay, and have different share of the fund's assets; nuclear power plants have the statutory right to return the funds from the fund for future retirement expenditure. Clear legal ownership of the fund is inherent characteristic of Swedish fund management system [6].

3.3. Maintain Value and Avoid Financial Risk

The common problems faced by different types of funds are to increase the value of investment and avoid the risk of investment. Nuclear power plant decommissioning fund management, on the one hand to prevent risks from the management system, in order to protect the nuclear power plants have sufficient funds to fulfill future nuclear responsibility; on the other hand to allow these funds from their situation to find suitable investment channels, in order to reduce the cost and improve the competitiveness of nuclear power nuclear power.

The Swedish retired do not total funds, funds were initially placed in the "risk of bank" (the Swedish central bank) account, then put them from the internal to the state reserve fund as a financial guarantee mechanism by government bonds, because this new funding system can ensure the lower unit electricity fund extraction amount. The new nuclear waste fund committee can invest the fund's money through the Treasury office, so it can get a fixed return at a market rate for a fairly long period of time. At the same time, the commission can also use the opportunity of interest liberalization to increase returns through the reinvestment of different interest periods.

The decommissioning fund of the United States nuclear power plant is managed by the enterprise fund, but the federal regulations stipulate that the funds must be separated from the holder's assets and trust the third party to manage the money. In the standard review plan, the Moodie rating of the trust company is required to be at least "BBB". The Bank of New York in May 2006, a survey report "to prepare for change"-closed nuclear decommissioning trust investment method pointed out in the [7], U.S. nuclear decommissioning trust investment strategy has been stressed from the review of each investment financial qualifications, and emphasized the diversity of investment, and specifically pointed out that the power companies pursue investment returns for the typical tax 6-7%.

The decommissioning reserve of the French nuclear power plant is managed by the internal fund of the enterprise [8]. From the EDF financial annual report, the annual extraction amount of the reserves allocated to the generation cost is calculated according to the nominal discount rate of 5%, that is, EDF takes all the reserves from the extraction to the use of the nominal annual return of 5% to increase the value of the obligations, in order to reduce the burden on consumers, or to improve their market competitiveness. The reserve for decommissioning of nuclear facilities in France is the capital which is not used at present and will be used for the future, and its total amount increases year by year. In the past EDF reserve does not establish a special account, but use the money to buy foreign power companies and expand foreign market share, EDF has reached a considerable scale in English, German, Spanish, Italian, Brazilian, Argentine and other countries of the mergers and acquisitions and market share, which on the one hand by the European Parliament external pressure, another also that the French government departments to worry about safety investment. Therefore, the new law passed by France in 2006 requires EDF to establish a special account, and gradually establish "mortgage" special assets". According to the Bank of Paris disclosed that the current EDF "special assets" composition is: 45% stocks, 55% bonds. That is to say, the French government requires EDF to gradually change the form of reserve investment from overseas self-expansion to the form of investment in financial markets. The new trend that France requires nuclear power plants to invest in value added through financial markets is, to some extent, similar to that of the United States, but there are differences. The United States requires that the retirement fund be independent of the enterprise finance and entrust the third party (trust) to manage the money; France does not require the three reserve to be independent of the enterprise finance, nor does it require the entrusting third party to manage the money.

3.4. And the Relationship of Enterprise Financial System

Under the mechanism of external fund management, the enterprise provides the necessary funds for the external retirement fund according to the regulations, and the enterprise does not reflect its retirement nuclear responsibility in the accounts. In retirement funds according to the mechanism of internal fund management, according to international accounting standards, the responsibility to the future retirement provision form reflected in the balance sheet, in the calculation of the allowance while allowing the use of "net present value method". Time in the nuclear power plant is completed, all the discounted future retirement responsibility as a provision in the balance sheet to confirm (the debt side); at the same time, the future retirement funds as the book value of nuclear power plant (capital asset side).

4. Nuclear Facilities Decommissioning Fund Management Status in China

The initial purpose of China's nuclear energy development is for national defense and military needs. Therefore, the state undertakes the responsibility of all decommissioning of nuclear facilities. This kind of funds is provided by the central government in full support. With the rapid development of society and economy, the construction and operation of nuclear energy have been operated in an enterprise, and the civil nuclear fuel cycle facilities and public welfare research facilities are also increasing.

According to statistics, China has three nuclear power generating units and power generation in 1990s, Qinshan a 300 thousand kilowatts of nuclear power units has been running for nearly 20 years,

the design life of 30 years, the Dayawan nuclear power station two sets of 1 million kilowatts of nuclear power units has been running for nearly 18 years, the other in the operation of nuclear power plants are concentrated in the grid time after 2002 design life is 40 years. If the life extension of nuclear power plant is not considered, Qinshan Phase I and Dayawan nuclear power station will retire in 2021 and 2033, and about 10 nuclear power units will be retired in about 2042~2050 years. It is foreseeable that the decommissioning of nuclear power plants will be a long and arduous project in the future.

Decommissioning of nuclear power plants not only lasts a long time, but also consumes a lot of money. The International Atomic Energy Agency (IAEA) stipulates that the three stage of decommissioning is recognized by the international community. It takes about 40~60 years, or even hundreds of years. According to preliminary estimates, the cost of decommissioning of large nuclear power plant is about 10%~20% of its infrastructure investment, according to the current cost (the two generation, three generation), a million kilowatt pressurized water reactor nuclear power plant decommissioning need at least 3 billion Yuan, if not immediately retired, in addition to considering retirement itself, but also to ensure the safety of maintenance during storage service facilities and equipment operation and maintenance costs.

At present, in the decommissioning of nuclear facilities, all civil nuclear facilities have no corresponding economic policy and management measures. Financing is an unavoidable problem in retirement plan, and it is also a key issue in decommissioning. There must be sufficient funds for retirement in the future. The nuclear power plants in China have different technical routes and many reactors, and the decommissioning costs of different reactors are different. Therefore, the specific extraction methods should be studied in detail. In addition, the relevant issues such as the division of responsibilities during decommissioning of nuclear power plants are not clear, so it is necessary to establish decommissioning fund for nuclear power plants and study the relevant management methods.

In addition, the construction and management of public research facilities scattered in the nuclear industry, education, science and technology, health and other government departments or local, in the early construction did not fully consider the responsibility and funding problems in decommissioning of nuclear facilities, resulting in a number of civilian nuclear facilities has reached early life cannot implement funding channels, unable to implement nuclear facilities decommissioning, increase the risk of nuclear safety[9,10].

The future, nuclear power will be more widely used in all walks of life, retired economic policy and management means, if not as soon as possible to establish and perfect, will not be conducive to the healthy and steady development of nuclear energy, the country is difficult to circumvent the financial risk, the risk of nuclear safety, environmental risk and social risk.

5. Thoughts and Suggestions on the Management of Retired Funds in China

Establishment of decommissioning fund for civilian nuclear facilities. In view of the fact that decommissioning of nuclear facilities is closely related to national nuclear safety and environmental safety, considering the lag, long-term and arduous nature of decommissioning of nuclear facilities, it is suggested that the decommissioning fund for civilian nuclear facilities be established as soon as possible, all civil nuclear facilities are included in the management of decommissioning funds.

Administrative measures for the decommissioning of civilian nuclear facilities as soon as possible. According to the 2003 enactment of the "People's Republic of China radioactive pollution prevention and control law" put forward to extract and manage the expenses for retirement of nuclear facilities, by the competent departments of Finance and the State Council jointly with the competent price departments, nuclear facilities administrative regulations for environmental protection under the State Council set. Therefore, the relevant departments should implement the responsibility as soon as possible and formulate the provision, management and use of the decommissioning fund for civilian nuclear facilities.

A Study on the Estimation of the Minimum Guaranteed Value of Special Funds for Retirement. It is recommended that the Ministry of Finance, in conjunction with the competent authorities of nuclear

industry, nuclear power authorities and nuclear safety supervision departments, and with the participation of enterprises, learn from the international experience and carry out the research work of various types of decommissioning cost estimation, and constantly updated and improved.

To Promote the Establishment of Early Public Scientific Research Funding for Nuclear Facilities Decommissioning. The construction and management of the early public scientific research nuclear facilities shall be the national behavior. The decommissioning funds of such facilities shall be borne by the state. Considering that the early public scientific research nuclear facilities scattered in the nuclear industry, education, science and technology, health and other government departments or places, And the retirement of nuclear facilities should not be scattered management, it is recommended that the state in the central government to set up such facilities for the retirement of special funds, special funds by the Ministry of Finance, nuclear safety supervision departments in conjunction with the relevant departments to manage and implement.

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