The Design of Greenhouse Gas Emission Regulation System in China's Electricity Industry

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***Abstract*—The warming of the climate as a worldwide problem has attracted the attention of all countries. As a big country in greenhouse gas emissions, china needs to make more efforts to reduce greenhouse gas emissions, especially in the electricity industry, which as a key field of emission reduction needs to be paid more attention. This paper analyzes the current situation of greenhouse gas regulation in china's electricity industry and finds its problems and obstacles of development. This paper also designs a regulatory scheme which is adapt to the greenhouse gas emission in china's electricity industry from the perspective of regulatory indicators and regulatory bodies, and the aim of this paper is to provide theoretical guidance and policy suggestions for the practice of greenhouse gas emission controlling in china's electricity industry.**

***Index Terms*—greenhouse gas, regulation system, electricity industry, China**

I. Introduction

Today, the change of climate has become a major problem in the world, and the response of china to climate change has also attracted the world's attention. At the Copenhagen climate conference, the Chinese government has stressed that china is the country which makes the largest effort for energy conservation, new energy and renewable energy in recent years. At the Durban climate conference in South Africa, the Chinese government has made it clear that it will stick to its own efforts to reduce emissions. Facing the international pressure of reducing emissions and the requirement of domestic emission reduction, china also carry out related works in response to climate change actively, and taking a lot of positive and effective measures to control and reduce the greenhouse gas emissions.

The coal consumption of electricity industry as china's largest greenhouse gas emissions department, accounts for more than 50% of china's total coal consumption, and the contribution of co2 emissions is over 40%. The energy resource conditions of china determined that the power structure dominated by coal will not change for a long time, and the change of carbon emission in electricity industry has an important impact to complete the targets of national emission reduction. Therefore, it has a great practical significance to study and formulate the regulatory scheme and regulatory index system for greenhouse gas emission controlling in china's electricity industry.

In recent years, the study of carbon emission reduction by various scholars has been emerged; Dallas Burtrawstudied the potential emission reduction of CHG in the United States after the implementation of Clean Air Act [1]; Matthew Ranson analyzed the link between different systems of carbon trading and the impact on international carbon emission reduction [2]; Han Hao analyzes the impact of energy consumption on passenger vehicles and their impact on greenhouse gas emissions [3]; Peter m.larkson examined the changes in greenhouse gas Emissions under the European Union Carbon Emissions Trading Scheme [4]; Tao Wang designed a policy system of carbon emission reduction for China's construction industry from pricing policy in direct and indirect [5]; Detlef P.v an Vuuren proposes that the combination of energy efficiency and selection of sustainable products can effectively reduce man-made carbon emissions and the use of land [6]. Based on the research results of these scholars, this paper studies the current situation of greenhouse gas emission regulation in China's electricity industry so as to improve the effect of carbon emission reduction through the design of this system.

II. The Current Situation of Greenhouse Gas Emission Regulation in China's Electric Power Industry

China has advocated energy conservation and emissions reduction and the development of a low-carbon economy since the year of 2007, and had issued a number of documents, such as "Administrative Regulations on Pollution Discharge Fee Levy", "fossil-fuel power plant atmospheric pollutant emission standard" and "the eleventh five-year plan of controlling acid rain and sulfur dioxide pollution". The Chinese government has made the intensity of emission and contribution rate of sulfur dioxide showing a downward trend by gradually lowering the limit of pollutant emission, raising the standard for collection fee of sewage charges and expanding the scope of expropriation. China has also taken measures to control the emissions of greenhouse gas in the electricity industry in terms of regulatory systems, regulatory measures, construction of carbon market, accounting and so on.

A. The regulatory system

At present, the supervision of electricity industry's greenhouse gas which mainly relies on the previous environmental regulatory system has not formed an independent system. In order to prevent the power enterprises from unlimited emission of pollutants to the environment (including some greenhouse gases), the government will regulate the electricity industry according to some rules and restrict the emission of pollutants in electricity production.

In 2013, the environmental protection department issued the documents of "notice on strengthening the publicity of environmental supervision information on pollution sources" and "Public catalogue of environmental regulatory information for pollution sources (first batch)", it requires environmental protection departments at all levels to disclose information about environmental pollution sources according to the principle of "the people who get it should be public and the people who make it should be made public", and to refine the public content for eight categories of 31 items such as the basic

situation of major pollution sources, monitoring of pollution sources, total control of pollution, pollution prevention and controlling, the collection of pollution charges, supervision of law enforcement, administrative punishments and environmental emergency. The environment protection departments at all levels should strictly regulate the time for information public and standardize the way of information public, and set up a special information public column for pollution sources relying on government websites as an important platform for information disclosure, for a small number of county environmental protection departments truly have difficulties in construction of site, the environmental monitoring information of pollution sources within its jurisdiction shall be issued by the environmental protection department at the next higher level or by the website of the local people's government at the same level. At the same time, the internal division and responsibility should be clearly defined; the accountability assessment and supervision guidance should be strengthened. The system of electric environmental monitoring is shown in “Fig. 1”.

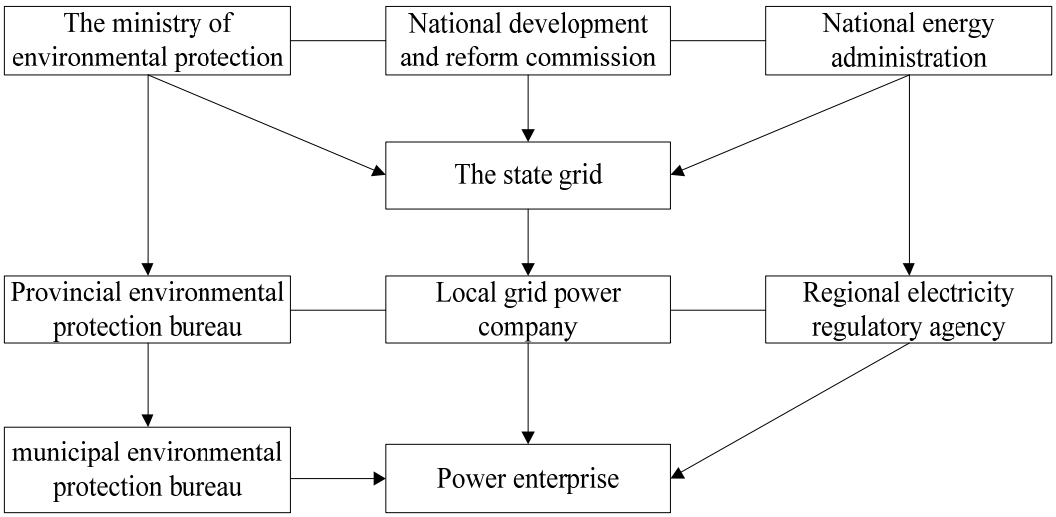

Figure 1. System of electric power environmental monitoring

B. The regulatory measures

As for the regulation of major greenhouse gases (CO2) in the power industry, there are no clear limits and detailed indicators in china, but two economic means are mainly adopted from the policy, it includes: (1) The quota system of renewable energy, it means that the national government requires the power generation enterprises or power grid enterprises to generate or buy electricity which come from renewable sources of energy in a legal form, its aim is to increase the share of renewable energy and reduce the proportion of electricity generated by conventional energy, so as to achieve green power, environmental protection, energy conservation and emission reduction; (2) Carbon emission trading system, it mainly make the party of the contract get the greenhouse gas emission reduction by paying the other parties trough setting up the quotas of carbon emissions in the electricity market and the trading of carbon in the electricity market, and the amount of emissions have been purchased will be used to slow down the greenhouse effect to achieve its emission-reduction targets, and finally, the effect of curbing carbon dioxide emissions in the entire electricity market will be achieved.

C. Carbon market and account of greenhouse gas

The 12th five-year plan has put forward that china will establish a national carbon emissions trading market gradually and set up an effective way to deal with climate change within market mechanism, this will allow the controlling of greenhouse gases to be transformed from purely administrative to more reliance on market forces.

In 2008, the Shanghai environment energy exchange (SEEEX), the Tianjin emissions trading exchange (TCX) and the Beijing environmental exchange (CBEEX) were successively established. In 2009, Zhejiang, Guangdong and Hubei province have set up environmental equity trading institutions successively; in 2011, the national development and reform commission (NDRC) approved a pilot project on the trading of carbon emission rights in Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong and Shenzhen. The pilots make local laws and regulations actively in order to determine the objectives and coverage of controlling the greenhouse gas, such as establishing a mechanism of greenhouse gas measurement, reporting and verification (MRV); allocating the quotas of emission; developing registration system, establishing the special management institutions; setting up market supervision system as well as personnel trading and capacity-building and so on, these measures make the pilot form a carbon trading system initially.

Each pilot has set standards for fitting into the industry according to their own level of development and industrial structure. All seven pilots bring the electricity industry into its standard because of several characteristics in electricity industry such as single-product, the probability of emission transfer is small and occupying a large proportion in the total emissions. At the same time, china has included the power industry as one of the first batches of pilot projects which implement the accounting method of greenhouse gas emission.

November 4, 2013, the NDRC issued the "Accounting methods and reports guidance for China power generation greenhouse gas emissions” and " Accounting methods and reports guidance for china Grid Enterprises greenhouse gas emissions ", they are the main accounting standards for greenhouse gas emissions in the electricity industry. The standards are also based on guidelines and accounting for greenhouse gas in each provinces and cities which were made by local government according to national documents, such as “Beijing enterprises (unit) carbon dioxide accounting and reporting guide (2013 edition)”; “Guidelines and accounting of greenhouse gas emission in Shanghai (trial)”; “Guidelines and accounting of greenhouse gas emission in Chongqing

enterprises (trial)"; "guidelines on carbon dioxide emission in Guangdong province (trial) " and so on.

III. Problems of Greenhouse Gas Emission Regulation in Electricity Industry

At present, although the electricity industry has achieved positive results in energy conservation, emission reduction and climate change, it still have many problems such as low efficiency, unreasonable power supply structure, low level of power supply facilities and the development mechanism is not smooth, one of the reasons for these problems is that the supervision mechanism of modern electricity industry based on market economy has not been established effectively. Although china's electricity industry has been commercially operated, most power companies are wholly state-owned, so the complexity and difficulty of industry regulation is much higher than other industries. The development of electricity industry faces new problems in the new round of power reform, and the system of industry regulation need to make adaptive adjustment urgently.

A. The policy level

The regulatory policy system emphasizes the "command-control" approach, so the role of the market needs to be strengthened. In the environmental regulation of power industry, China mainly relies on "command-control" approach, and supplemented by economic methods. With the development of the market economy and the deepening of the reform of the electricity market, facing the new situation of market-oriented economy, the "command-control" approach should play an auxiliary role properly and the economic policy should slowly rise to the dominant position.

Reward policies, tax policies, special funds and other economic policies are lacking. Many developed countries have taken carbon tax as one of the main means of energy conservation and strengthening the regulation of greenhouse gas emissions. In contrast, China's policy of coping with climate change and regulating greenhouse gas emissions is often biased towards administrative management while ignoring economic policies. There is hardly any incentive policy such as incentives, taxes and other economic incentives for power enterprises in the development and promotion of energy-saving projects, energy saving products and energy-saving technology research.

B. The legal level

The framework of laws and regulations is not sound and many areas of supervision are unregulated. The measures of supervision in china are largely depend on the strength of the government's administrative coordination, but the laws and regulations of electricity, environmental protection, energy-conservation related to the regulation of greenhouse gas emissions in the power industry are largely deficient, there is legal vacuum in many important fields.

The system of laws and regulations is not systematic. The legal system of greenhouse gas supervision related to the power industry is not perfect, and there is no unified strategy for legislation. Many regulations are only slightly involved in the laws and the regulations are not systematic.

There are not clear administrative law enforcement bodies, law enforcement methods and law enforcement procedures. China's regulatory laws and regulations pay more attention to the subject and object of supervision such as regulatory agencies and key-energy-consuming enterprises and so on; however, there are no procedural safeguards to enforce these rules. There are not effective punishments for the violation of greenhouse gas emission regulations in the electricity industry, and it will make it difficult to form an effective restriction on high energy consumption.

C. The system level

Regulatory agencies are incomplete and regulatory functions are fragmented. The division of the function of greenhouse gas emission regulation in China's electricity industry is not clear. The multi-sectoral supervision has dispersed the regulatory responsibilities and made it difficult for the department to coordinate; leading to low regulatory efficiency and regulation is difficult to achieve the desired results.

The subject of greenhouse gas emissions is unclear. The electricity industry's greenhouse gas emissions regulation cannot be separated from the regulation of greenhouse gas emissions from all sectors of the industry, but now the supervision system of top-down is lacked and the main body of the regulatory responsibility for greenhouse gases in the electricity industry is unclear.

D. Operational mechanism level

The standard, index system, calculation and verification methods of greenhouse gas emission in power industry need to be further strengthened. Although the electricity industry have a series of control index such as installed capacity, power generation, coal consumption and loss rate, there is not clear target for greenhouse gas emissions, currently, there is no unified index system of power supply group (including the group level, branch level and enterprise level) energy-saving emission reduction. Foreign standards are not suitable for domestic projects in terms of greenhouse gas emission calculation, verification methods and standards, so the boundary of the system is more difficult to determine. Statistical work of energy conservation and emission reduction is weak; the main data of energy conservation and emission reduction is depended on the enterprise's own declaration, as a result, the accuracy and the timeliness of statistical data are poor.

Lacking of effective supervision and evaluation mechanism, and there is no developed independent third-party certification or verification institution. The supervision mechanism of energy-saving and emission reduction is not perfect limited by the existing power supervision methods, and there is a lacking of long-term and unified supervision or comprehensive evaluation for energy-saving and emission reduction.

The mechanism of assessment made by the managers of power enterprises and government departments failed to make adaptive adjustment. With the promotion of energy conservation and emission reduction in china, the corresponding system of leadership accountability has not been established, so that the high-level restraint is not enough, and the lower level implementation is insufficient.

IV. The Design of Greenhouse Gas Regulation in China's Electricity Industry

A. design of regulatory index system

The greenhouse gas emission controlling index of the power industry should be set in accordance with the principles of clear, measurable, law-based and operable, and the intensity of greenhouse gas emission per unit is used as a constraint index in order to ensure the realization of the national carbon intensity reduction targets and improve the overall carbon dioxide controlling level in electricity industry. The regulation index system of greenhouse gas emission in power industry is divided into target, structure index, technical index and management index. The target is to control the overall level of greenhouse gas emission in the electricity industry and to realize the target of the reduction in national greenhouse gas emission according

to the index set by the demand of greenhouse gas emission reduction. Structure index, technical index and management index are set up for emission reduction, which were used for regulating the effectiveness of greenhouse gas emission reduction in the structure adjustment, the progress of technology and means of management of electric power industry, and they have a certain industrial characteristic.

This index system has set the primary and secondary indexed, and these two indicators are related to each other. The secondary index is the basic index for calculating or getting a primary index. The regulation index system of greenhouse gas emission in power industry is shown in “Fig. 2”.

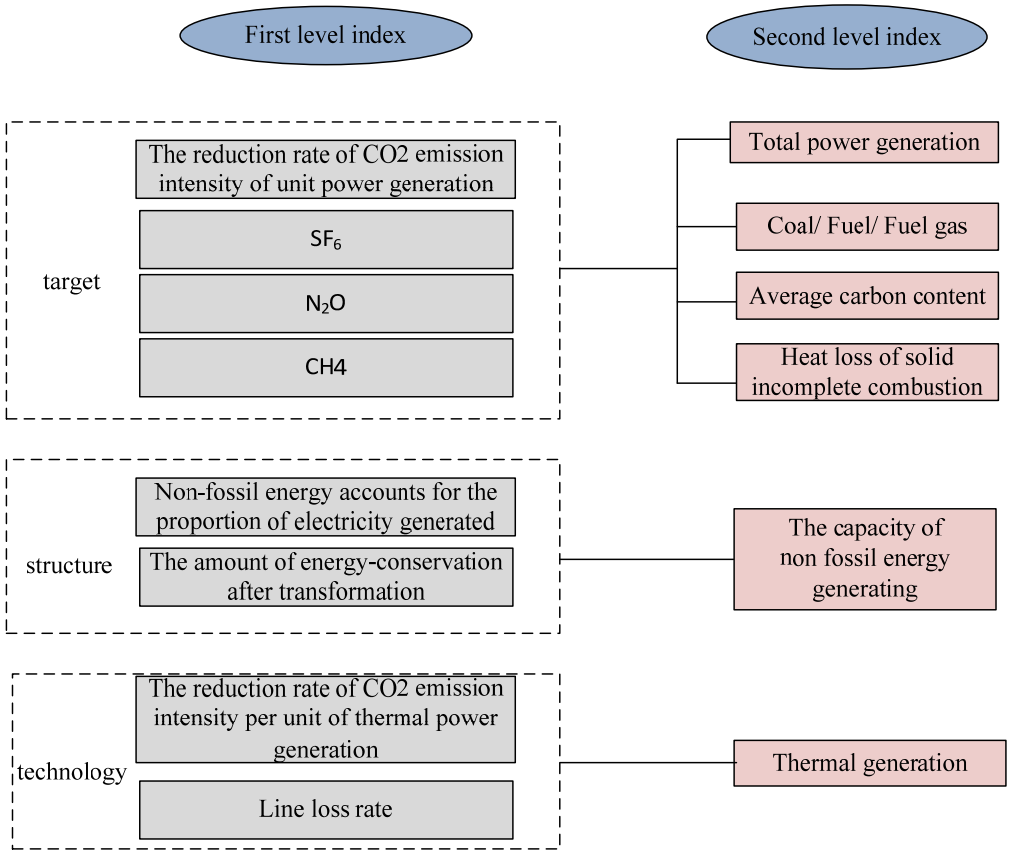

Figure 2. Index system of regulation of greenhouse gas emission in power industry

B. The design of regulatory scheme

Regulatory responsibilities for climate change in the power industry can be exercised by the national energy administration, which adopts models of “one lead, other coordination” and “Combination of dependency regulation and industry supervision” in the regulatory work; it can define the responsibilities of the lead department and the coordination department. The bureau of energy sources local government can have a direct supervision for electricity enterprises from place to place.

The china electricity council provides technical support to the energy bureaus and other regulatory departments, and assists the electricity industry in regulating greenhouse gas through the management of industry self-regulation on the other hand. The framework of the power industry's greenhouse gas regulatory is shown in “Fig. 3”.

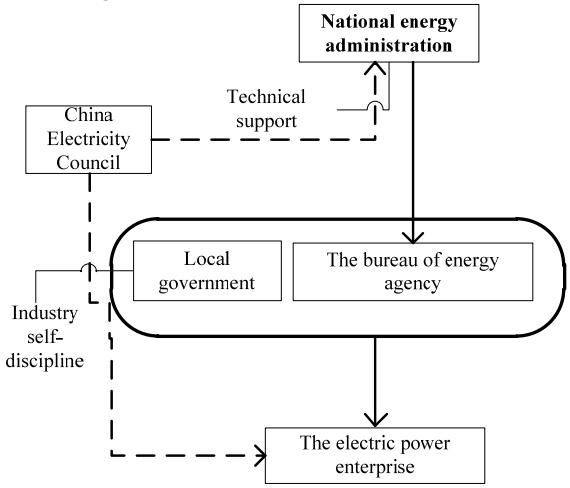

Figure 3. The framework of the power industry's greenhouse gas regulatory

The greenhouse gas emissions in electricity industry mainly focus on regulating carbon dioxide. For power generation enterprises, all greenhouse gas emissions calculation include carbon dioxide emissions from the burning of fossil fuels, the process of desulfurization of coal-fired power plants and the use of electricity from net purchases. For power grid enterprise, all greenhouse gas emissions calculation include the sulfur hexafluoride emissions from the process of repairing and decommissioning for hexafluoride equipment and the carbon dioxide emissions generated from power production processes corresponding to loss in transmission and distribution.

V. Conclusion

Aiming at the regulation of greenhouse gas emission reduction in China's power industry, this paper analyzes the current situation of greenhouse gas emission in China's electricity industry and finds out the problems existing in the policies, laws, institutions and operational mechanism of the electricity industry in the regulation of emission reduction. This paper makes a further clear for regulatory bodies and regulatory responsibilities and the aspects needed to focus on controlling of the electricity industry in the process of greenhouse gas regulation through the design of third levels of regulatory index system and regulatory programs. The regulation of greenhouse gas emission in electricity industry should take the National Energy Bureau as the main body and coordinate with various departments and governments at various levels, which is an effective regulatory path in line with the current situation of china’s system and it can achieve the maximum of the regulation effect.

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