Research on Standard System for “Double Control” of Total Energy Consumption and Energy Intensity

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Abstract: The significance of the principles and methods for building the standard system for “double control” was analyzed. A framework of standard system for “double control” was preliminarily built, comprising three subsystems of fundamental common, total energy consumption control and energy intensity control. The features and shortcomings of standards for “double control” was analyzed, as a reference for the continuous improvement of the standard system for “double control”, as well as the research and preparation of key standards in the future.

1. Introduction

As China’s national economy rapidly develops, the energy consumption demand in China ushers in explosive growth, which further aggravates the contradiction between energy supply and demand and challenges regarding energy security. The Chinese government has taken reduction of energy consumption per unit of GDP as a mandatory indicator of its national economic growth since the 11th Five-Year Plan period and proposed a quantitative target of reducing greenhouse gas (GHG) emissions per unit GDP by 40% to 45% in 2020 compared with 2005 in November 2009, with a view to promote GHG emission reduction and boost the development of China’s low-carbon economy. In June 2015, the Chinese government submitted the document Enhanced Actions on Climate Change: China’s Intended Nationally Determined Contributions to the Secretariat of UNFCCC, which clearly sets the target of reducing CO₂ emissions per unit of GDP by 60% to 65% in 2030 compared with 2005.

The 19th National Congress of the Communist Party of China took “Beautiful China” as the strategic goal of a modern and powerful socialist country, calling to follow the basic strategy of harmony between human and nature, speed up reform of the system for developing an ecological civilization, build an energy sector that is clean, low-carbon, safe, and efficient, develop eco-friendly growth models and ways of life, and provide more quality ecological goods to meet people’s ever-growing demands for a beautiful environment. In the Outline of the 13th Five-Year Plan, the Chinese government put forward the goal of “double control” of total energy consumption and energy intensity (the “double control”), which clearly clarifies that “China’s energy consumption for each RMB 10,000 of GDP will be 15% lower than that of 2015 and the total energy consumption will be controlled within 5 billion

TCE by 2020”. The Outline also proposes to achieve the aforesaid goal by taking specific measures such as optimizing the industrial and energy structure, accelerating energy conservation in industrial and other key sectors, vigorously developing circular economy, and implementing energy conservation and emission reduction programs. All these mean that China’s energy strategy has been officially shifted to “double control” of total energy consumption and energy intensity.

2. Purpose and Significance of Establishing a Standard System for “Double Control” of Total Energy Consumption and Energy Intensity

The implementation of standards for control of total energy consumption accelerates the establishment and operation of total energy consumption trading mechanism through such market-oriented means as energy use right and energy-conservation trading, and urges to take the control of total energy consumption as the goal at the organization level during production, so as to eliminate backward and inefficient technologies, restrict the production, marketing and import of high-energy consuming products and equipment, and promote the optimization of energy structure and use of new and renewable energy in place of traditional energy. Standards for control of energy consumption intensity can urge enterprises to take improvement of energy efficiency and application of advanced energy-conservation technologies as their main objectives during design, R&D and production of products, strengthen scientific management of in-use equipment and its systems, improve system matching, reduce system losses, strengthen technological transformation, effectively improve operating efficiency, optimize and upgrade energy-consuming systems as a whole.

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As a blueprint for the development of standardization, the establishment of a standard system makes it possible to prepare efficient plan for overall standardization, offer scientific basis for the research, preparation and implementation of standards, and guarantee the orderly and efficient development of standardization by strengthening macro guidance, clarifying the development direction and determining the focus of work.

Therefore, to solve various challenges currently facing the development of standardization of “double control”, it is imperative to establish a scientific and reasonable standard system for “double control” (“the Standard System”). In other words, we should carry out researches on the Standard System according to the goal of “double control” in China specified in the “13th Five-Year Plan”, clarify the development thoughts and direction of the standards for “double control”, put forward the focuses on the preparation of standards for “double control” in the near future, in the medium and long term, guide the revision of the standards for “double control”, strengthen the systematic and integral “double control” standardization, and promote the overall promotion and breakthrough of “double control” standardization in China in close combination with the market mechanism of energy-conservation services, development trend and demand of energy-conservation technologies.

3. Principles for Establishing a Standard System for “Double Control” of Total Energy Consumption and Energy Intensity

The following principles should be followed when a Standard System is established:

(1) Scientific

Scientific is the basic principle of standardization, which is the fundamental condition to ensure safe, reliable and stable operation of the technical system. As a result, it is the priority among priorities to establish the Standard System. The standard system must take the overall idea of the “double control” and the nature of the social and economic activities involved as the main ideas and scientific basis. In the case of the intersection between industries or disciplines, scientific organization and division should be performed considering the overall demands.

(2) Systematic

Systematic is the embodiment of the internal relation and difference among standards within the system. It is a principle applied to judge the primary and secondary items, prioritize, overcome contradictions and repetitions, seek appropriate levels, and make the standards simplified and unified. The Standard System should clearly define the generality and individuality of standards according to the overall requirements of energy conservation standardization, and properly place the standards at different levels for clear and reasonable classification. Standards should be mutually connected and supplemented.

(3) Coordinated

The Standard System should be coordinated with the energy-conservation standard system, as well as the national standard strategic outline and standard system construction of China. From a systematic perspective, all standards within a standard system should be mutually coordinated and balanced.

(4) Open

The standard system can only be adapted to the scientific and technological level and the needs of economic development in a certain period of time, and is limited by the human, financial and material resources at that time. As a result, we should deem the construction of the system as a dynamic rather than a static process, in full consideration of its future development for further expansion and optimization.

4. Standard System for “Double Control” of Total Energy Consumption and Energy Intensity

4.1 Methods and Ideas

The structural forms of standard systems are all of hierarchical type although different methods are applied for the classification of standard systems in different industries. The standard system with hierarchical structure can reflect its composition, but cannot fully show the relationship between its contents. The standard set involved in the Standard System is a complex and polymorphic standard system, which has both hierarchical structure and relational structure. Thus, the classification and process methods are applied to build the framework model of the Standard System with multiple factors considered.

The combination of classification and process methods enjoys the following advantages: first, the methods pay full attention to the research of standard system objects to avoid the disconnection between theory and system commonly found in traditional process for standard system building. Second, the principle of system engineering is applied to systematically express the complex logical relationships in the standard system objects, thus completing the structural model framework of the Standard System. Third, the standard system structure model obtained can be easily converted into a standard system framework that satisfies the requirements of China’s national standards, thus ultimately building a standard system for “double control” framework for total energy consumption and energy intensity.

The Standard System is aimed to achieve the goal of “double control”, highlights the characteristics of total energy consumption control and energy consumption intensity control, and refines the two related standards regarding the generality and optimization of supply and demand that can be found in both total energy consumption control and energy consumption intensity control, thus forming the basic system structure.

Main ideas for the framework of the Standard System proposed in this paper are as follows:

1. Highlight the key role of relevant standards regarding “double control” in supporting the realization of “double control” goal specified in the 13th Five-Year Plan, and specifically list two major sub-systems of the total energy consumption control standard sub-system and the energy consumption intensity control standard sub-system. Among them, the former focuses on the distribution and transaction of total energy consumption at the organizational level, and is constructed according to the idea of setting of total energy consumption goal -> verification and accounting -> transaction. The later mainly focuses on continuously reducing energy consumption intensity by improving energy use efficiency operation of organization, and is constructed according to the idea of setting of energy consumption intensity control goal -> operation management-> analysis and evaluation-> system improvement.

2. Refine standards supporting the generalities “double control”, fully embody the internal relation between the total energy consumption control and energy consumption intensity control, classify the standards such as terminology, measurement and detection, energy consumption statistics into the common standard sub-system, and the standards such as surplus energy utilization, smart energy, comprehensive energy system, new energy and renewable energy utilization into the supply and demand optimization standard sub-system.

4.2 Composition of standard system for “double control”

The framework of the Standard System is to classify the current standards, developing standards and to-be-developed standards for “double control” in China by nature, categories, subordinate and matching relationships in corresponding positions one by one in layers and categories. Rectangular boxes in the system framework diagram represent a general designation for a sub-system or standards in a certain aspect.

The standards involved in the system are all national or industry standards. Local and enterprise standards are excluded from the scope of investigation and research.

The framework of the Standard System is shown in Figure 1. The framework of the Standard System is divided into two levels vertically, and each level is divided into several categories horizontally. In the first level, four subsystems are divided according to difference focuses of the “dual control” of total energy

consumption and energy intensity, and the universal comprehensive and basic standards, as well as supply and demand optimization such as surplus energy utilization that share generality with the control of total energy consumption and energy intensity as separate subsystems. The second level lists the standard categories that each sub-system should include. As the standard system for “dual control” of total energy consumption and energy intensity is open and inclusive, the sub-system can also be expanded and revised according to the needs of development. The standard categories are also open and can be expanded and revised as the energy-conservation standardization develops.

4.3 Characteristics of Standards for “double control” of Total Energy Consumption and Energy Intensity

The standards for “double control” in China plays a positive role in promoting the improvement of product energy efficiency, promoting the application of energy-conservation technologies and accelerating the optimization of industrial structure. The following deficiencies are found after analyzing the characteristics of the standards for “double control” in various industries:

1) The standards for “double control” are unbalanced. China has been adopting intensity control over energy consumption since the 11th Five-Year Plan. Relevant standards for energy consumption intensity control are taken as the basis for energy consumption intensity control. After more than ten years of development, these standards have been relatively perfect. Steel, coal, chemical and other industries have respectively formulated energy intensity target standards such as mandatory energy consumption quota standards and energy efficiency standards. Recommended standards supporting energy consumption intensity control, such as those for energy conservation monitoring, energy management and energy conservation services, have also been gradually improved. However, there are relatively few standards regarding total energy consumption control. Currently, there are no standards for total energy consumption allocation and trading. It is difficult to support the establishment and operation of market mechanisms such as reasonable allocation of total energy consumption quota for key energy-consuming units in the jurisdiction at all levels and trading of energy use rights.

Fig.1 "Double control" standards system

2) The standards for "double control" in various industries are unevenly distributed. Steel, coal, nonferrous metals, building materials, petrochemical and other industries with relatively concentrated key energy-consuming units are always key areas that practice energy conservation in China. Standards at all levels basically cover such categories as intensity targets, measurement and testing, operation management, and system upgrading. In textile, electronics, transportation and other industries, standards for "double control" have weak foundation. The total number of standards at all levels in this regard is even less than 10.

3) The standard system for "double control" in new fields is not revised in a timely manner. The application of emerging energy-conservation technologies and energy types, such as smart energy, integrated energy systems, new energy and renewable energy, has attracted extensive attention from countries around the world and reflects a new trend for energy development in the future. However, for aforesaid fields, the standard system for "dual control" is not revised in a timely

manner keeping pace with the development of the industry, and there are few standards developed. Thus, its role in industry standardization and guidance is to be further strengthened.

5. Summary

This paper analyzes the purpose and significance of building the standard system for "double control" from the perspective of providing technical support for "double control", with the focus placed on the goal of "double control". It also proposes that the construction of standard system for "double control" should follow the principles of scientific, systematic, coordinated and open. In the meantime, the framework model of the Standard System is established, and the framework of standard system for "double control" comprising three subsystems of generality, total energy consumption control and intensity control is also established applying the classification and process methods. This paper also

sorts out and analyzes the characteristics and shortcomings of the standards for “double control”, and provides reference for the perfection of the standard system for “double control” and the development of key standards in China in the future.

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