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Analysis and Suggestions on the Application of China's Industrial Energy Saving Technology

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Abstract. Industrial energy saving is an important measure to achieve carbon neutrality, and energy saving technology is the core driving force for industrial energy saving. In order to study the development of China's industrial energy-saving technology, this paper organizes and analyzes the "Guidelines and Cases of China's Industrial Energy Conservation Technology Application" issued by the Ministry of Industry and Information Technology according to a unified format, and finds out the characteristics of energy conservation technologies in different industries, the deficiencies in sorting and categorizing cases, and the regions of technology suppliers. In order to help the promotion and application of energy-saving technology and equipment, suggestions are put forward to adjust the collection and reporting methods of cases, optimize the content of case templates, strengthen the publicity and application of cases, and strengthen policy support.

1. Background

Energy-saving technology is the core driving force for energy-saving and emission reduction. The application and promotion of energy-saving technology is an important measure to establish a sound green and low-carbon circular development economic system, and plays an important role in optimizing the industrial structure and promoting green development[i].Since 2009, the Ministry of Industry and Information Technology has continuously released the recommended catalog of industrial energy-saving technology and equipment products, organized a series of energy-saving technology exchange and promotion activities, accelerated the promotion and application of high-efficiency energy-saving technology and equipment products, and promoted enterprises to save energy, reduce consumption, reduce costs and increase efficiency, and realize green growth[ii].The "Action Plan for Carbon Peaking Before 2030" also clearly proposes to promote energy conservation and efficiency enhancement of key energy-consuming equipment, focusing on motors, fans, pumps, compressors, transformers, heat exchangers, industrial boilers and other equipment, and comprehensively improve energy efficiency standards , establish an energy-efficiency-oriented incentive and restraint mechanism, promote advanced high-efficiency product equipment, and accelerate the elimination of backward and low-efficiency equipment; accelerate the green and low-carbon transformation of traditional industries, promote energy-saving technology and equipment in steel, non-ferrous metals, building materials, petrochemical and other industries, and encourage enterprises to Energy saving upgrades. Therefore, actively selecting and promoting high-efficiency energy-saving technical equipment, eliminating outdated high-energy-consuming electromechanical equipment, and increasing the application proportion of high-efficiency energy-saving technical equipment are of great significance for China to achieve energy conservation, emission reduction, and green and low-carbon development[iii].

Generally speaking, there are two ways for the industrial sector to improve energy efficiency: technical energy saving by adopting advanced energy-saving technologies and structural energy-saving by limiting the proportion of high-energy-consuming industries in the industry. While restricting the development of high-energy-consuming industries and other policy measures to improve energy efficiency, formulating industrial policies that fully promote existing advanced energy-saving technologies should be taken as the main way to promote energy efficiency in industrial sectors[iv].

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On December 6, 2022, the Department of Energy Conservation and Comprehensive Utilization of the Ministry of Industry and Information Technology released the "Guidelines and Cases for the Application of China's Industrial Energy Conservation Technology" (hereinafter referred to as the "Case"), focusing on the scope of application, principles, processes, and functions of related technologies Features, application cases, etc[v].This article will analyze it in combination with the content of "Case", and put forward some suggestions, in order to bring some help to the collection of cases, the promotion and application of technology.

2. Introduction and analysis of "Case"

2.1 Introduction to "Case"

The "Case" is divided into 10 sub-documents, covering energy-saving and efficiency-improving technologies in industries such as iron and steel, non-ferrous metals, building materials, petrochemicals, machinery, light industry, and electronics, efficient use of renewable energy, clean and efficient use of fossil energy such as coal, and key energy consumption Equipment and system energy-saving and efficiency-improving technologies, etc. In order to ensure the simplicity of the presentation effect, without affecting the original classification, it is abbreviated as: iron, non-ferrous metals, building materials, chemical industry, machinery, light industry, electronics, renewable energy, equipment, coal.The text structure of each document includes the following chapters: technology name, technology application scope, technology principle and process, technical indicators, technical functional characteristics, application cases and expected energy saving and emission reduction capabilities.

Table 1. Content structure for data analysis.

First level title	Secondary title	Information
Technical name	-	Technical name
Technical scope	-	Technical scope
Technical principle and process	-	Technical principle and process
Technical indicators	-	Technical indicators
Technical Features	-	Technical Features
Applications	Case introduction	Username and technology provider
	User energy consumption	Energy consumption of users before the renovation of the project
	Implementation content and cycle	Transformation content and transformation cycle
	Energy saving and emission reduction effect and return on investment period	Energy consumption, energy saving, carbon dioxide emission reduction, payback period after renovation
Estimated industry penetration rate and energy saving and emission reduction capacity by 2025	-	Estimated Industry Penetration, Estimated Energy Savings, Estimated CO2 Emissions Reduction by 2025

In order to ensure the accuracy of the analysis results, all the items in the "Case" in this paper have been formatted, data analyzed, and supplier regional analysis.

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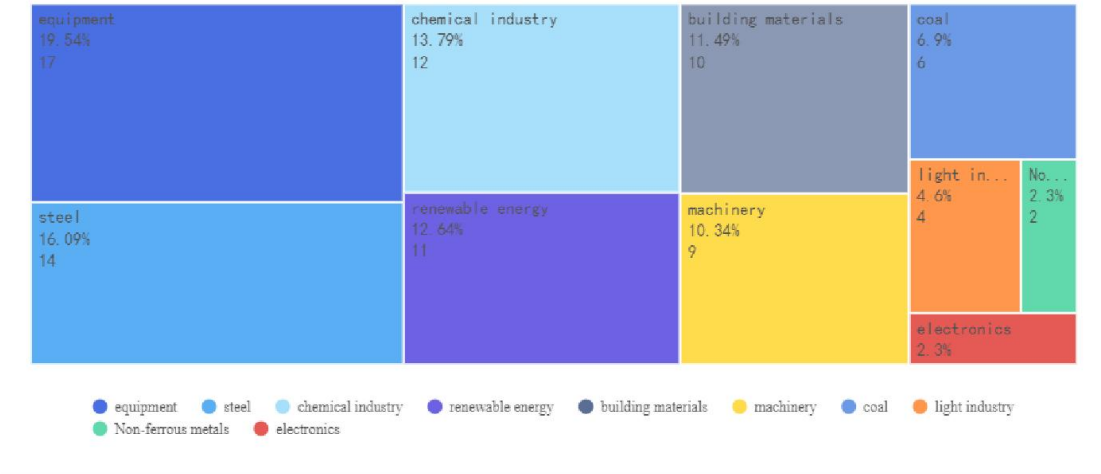

Figure 1. Number and proportion of the cases.

All cases were organized according to a unified text structure, and a total of 87 cases were formed. It can be seen from Figure 1 that the equipment category provides the most cases, with a total of 17 items, accounting for 19.54% of the total. Electronics and nonferrous metals are the least, with only 2 items, accounting for 2.3% of the total.

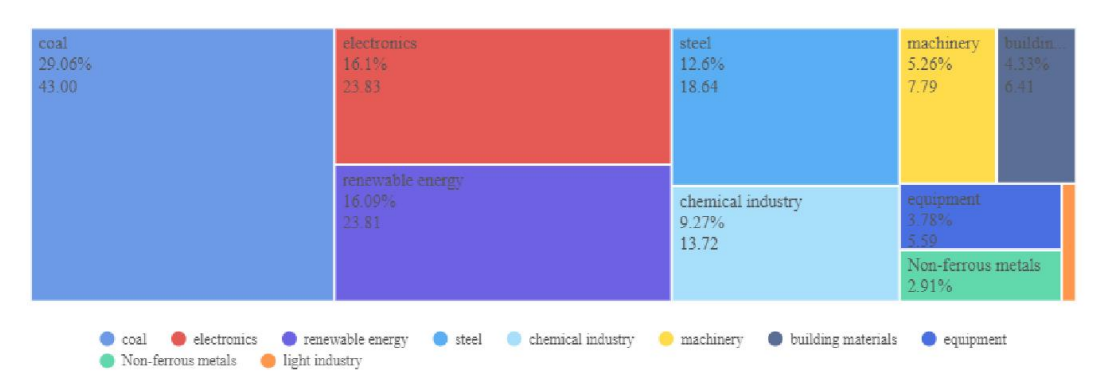

Figure 2. The standard coal saving and proportion of the cases.

Summing up the amount of standard coal saved in all cases, the total saving is 1.4797 million tons of standard coal per year. Among them, coal accounts for the largest proportion, accounting for 29.06% of the total; electronics and renewable energy are basically the same, and the sum of the two accounts for 32% of the total.

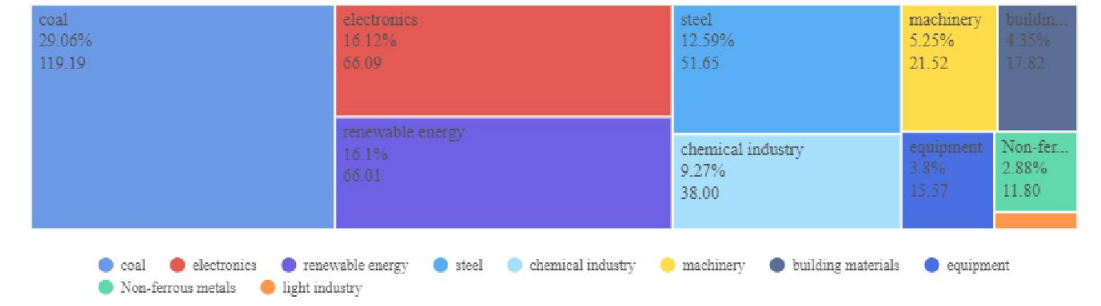

Figure 3. CO2 emission reduction and proportion of the cases.

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Summing up the carbon dioxide emission reductions in all cases, a total of 4.101 million tons of CO2/year is saved. Among them, coal accounted for the largest proportion, accounting for 29.06% of the total.

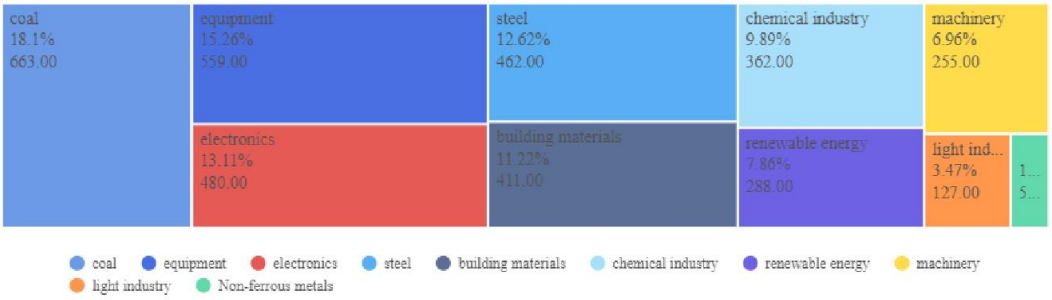

Figure 4. The expected standard coal saving and proportion of the cases.

Summing up the expected saving of standard coal by 2025 in all cases, the total saving is 36.62 million tons of standard coal per year. Among them, coal accounted for the largest proportion, accounting for 18.10% of the total.

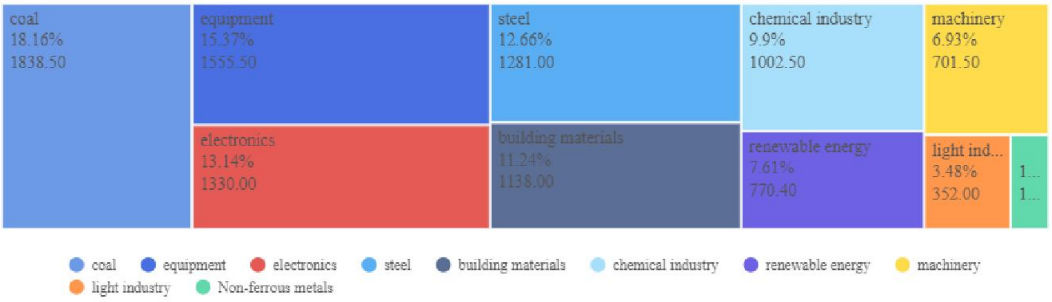

Figure 5. The expected carbon dioxide emission reduction and proportion of the cases.

Summing up the carbon dioxide emission reductions expected in all cases by 2025, a total of 101.219 million tons of standard coal per year can be saved. Among them, coal accounted for the largest proportion, accounting for 18.16% of the total.

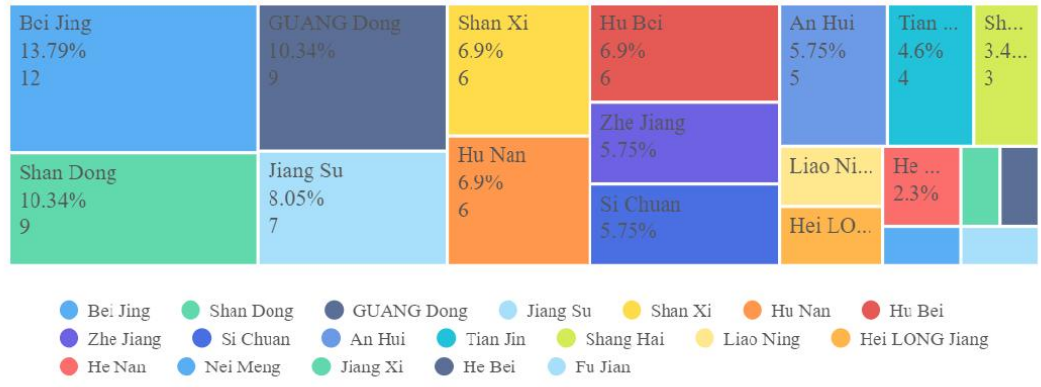

Figure 6. Region and proportion of technology suppliers.

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The technology suppliers in all cases are classified according to provinces or municipalities, including 19 provinces or municipalities in total. Among them, the Beijing area has the most suppliers, with a total of 12, accounting for 13.79% of the total.

2.2 Analysis of "Case"

The content and format of the cases are basically the same, but the relevant data indicators are mainly analyzed and reported by the suppliers themselves, which will lead to inaccurate data analysis. From the above chart analysis, it is possible to form the following results:

(1) The case is divided into the above 10 sub-files, mainly considering the main industries, general equipment, and technologies with good development potential. Due to the number of suppliers, technology development trends and other reasons in each field, the number of cases is not very consistent.

(2) From the above analysis, it can be seen that the project energy saving and CO2 emission reduction are basically consistent in the process of proportional ranking, because the technology suppliers basically calculate according to the carbon dioxide emission coefficient of standard coal.

(3) Judging from the proportions of different fields and the energy-saving ratios of different projects, it can be seen that the energy-saving energy of equipment with the largest number of cases is not large, but the energy-saving and emission-reduction effects of electronics and renewable energy with the fewest cases are better it is good. The electronic project is a case of high-purity crystalline silicon using new technology, and the renewable energy project is a case of power stations and power grids, thus forming the largest energy-saving and emission reduction.

(4) Coal projects account for a large proportion in terms of energy saving and carbon reduction, mainly because of a case of energy-saving technology transformation for efficient utilization of surplus low-calorific value gas, which brought energy saving of 372,000 tons of standard coal. At the same time, this case is also the project with the largest energy saving in the whole file.

(5) According to the content of the case, this paper compares the return on investment period of different projects. The shortest payback period is the cement raw meal grinding aid application project in the building materials industry, and its payback period is only 15 days; the longest payback period is a compressed air energy storage energy-saving technical transformation project in the energy storage field, and its payback period is 12 years.

(6) Judging from the analysis of technology suppliers, there are still some areas that have not reported energy-saving technology cases, which shows that this work has not received their attention.

3. Suggestion

Through the analysis of the "Case", we have seen some problems and deficiencies. In order to help the collection, arrangement and promotion of the "Case", we have formed the following suggestions.

(1) Extend the time for reporting cases and optimize the way of reporting cases. Relevant departments can use the Internet, WeChat, Weibo, SMS and other media channels to collect, organize, review and release cases through more collection channels and publicity methods, thereby increasing the number of cases.

(2) Optimize the content of the case template in order to promote and apply it better. Supplement the contact information of technology suppliers, the amount of project investment and the purpose of funds, so as to facilitate the promotion of technology. According to the types of energy in different cases (electricity, natural gas, coal, etc.), the calculation method of carbon dioxide emission reduction adopts the calculation method of the physical quantity of energy consumption.

(3) Strengthen the publicity and application of cases. Government departments at all levels, combined with their own industrial characteristics, guide industrial enterprises in related industries

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to conduct case study and analysis, and apply appropriate energy-saving technologies in a timely manner.

(4) Strengthen policy support for the promotion of energy-saving technology and equipment. Strengthen communication and cooperation between financial departments, local industry and information technology departments[vi], and policy banks such as China Development Bank, provide relevant fiscal and taxation support and supporting preferential policies to enterprises shortlisted in the "Case", increase the financing capacity of enterprises, and expand the promotion of technical equipment shortlisted in the "Case" application.

4. Conclusion

The Department of Energy Conservation and Comprehensive Utilization of the Ministry of Industry and Information Technology released the "Guidelines and Cases for the Application of National Industrial Energy Conservation Technology" on December 6, 2022. This article organizes and analyzes it in a unified format and discovers the characteristics of energy conservation technologies in different industries , the lack of case sorting and classification, and the regional distribution of technology suppliers, and thus put forward suggestions such as adjusting case collection and reporting methods, optimizing the content of case templates, strengthening case benchmarking and application, and strengthening policy support, so as to help energy-saving technologies Promotion and application of equipment.

Acknowledgments

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