Proposals for Carbon Reduction Measures for Industrial Enterprises under the Dual Carbon Targets

Qiang Wu[1a,] Jian Tan[2b], Song Gao[1c], Zesen Li[2d], Shiyu Meng[3e], Xiaotong He[3f]

[1]*State Grid Jiangsu Electric Power CO., Ltd.;*
[2]*Economics and Technological Research lnstitute, State Grid Jiangsu Electric Power CO., Ltd.;*
[3] *State Grid (Suzhou) City & Energy Research Institute.*
[a]*wq_sz@js.sgcc.com.cn,* [b]*tanjian@js.sgcc.com.cn,* [c]*Gao_song@js.sgcc.com.cn,* [d]*lizs3@js.sgcc.com.cn,*

[e]*hbdldxmsy@126.com,* [f]*hext@js.sgcc.com.cn,*

ABSTRACT
The global warming situation is serious, and the world's awareness of climate change issues is deepening. According to the China Carbon Neutrality Study by 2060, the Global Energy Internet Development Cooperation Organization (G-2060) has reduced the number of tons from 10.9 billion tons in 2028 to 1.38 billion tons in 2050. With the development of dual carbon target, the require-ments of carbon reduction in the construction and operation of industrial enterprises are becoming more and more prominent, so it is necessary to carry out comprehensive research on carbon reduction measures around the reduction of consumption and emission reduction of industrial enterprises, and from the aspects of carbon reduction. Industrial enterprises actively implement carbon emission reduction, which will generate new demand in equipment energy conservation and system energy conservation. In terms of energy substitution, comprehensive energy services and energy-saving services, the above demand will provide advantageous conditions for the market expansion of power grid companies.

Keywords: *carbon peak; carbon neutral; carbon emission reduction; industrial enterprises*

1. INTRODUCTION

Global warming is a serious situation, the world's awareness of climate change issues has deepened, as of August 2021, 127 countries around the world have committed to carbon neutrality, General Secretary Xi Jinping at the 75th session of the United Nations General Assembly proposed the "30.60" target, and on major occasions to deliver carbon peak and carbon neutral important speeches. China's carbon neutrality study by 2060 shows that around 2028, China will achieve carbon peak, carbon emissions reached about 10.9 billion tons, and in 2050 car-bon emissions fell to 1.38 billion tons, the task is tight, China's carbon emission reduction pressure is huge. With the dual carbon target, industrial enterprises in the construction and operation of the process of carbon reduction requirements are increasingly prominent, so it is necessary to analyze the key links of carbon emissions based on the current situation of carbon emissions in the industrial sector, around the industrial enterprises to reduce con-sumption and emission reduction, put forward corresponding development proposals, from demand reduction, Comprehensive study of carbon reduction measures in areas such as energy efficiency improvement.

According to the comprehensive report of "China's Long-Term Low-Carbon Development Strategy and Transformation Path Study" of Tsinghua Climate Institute, the power and thermal production industries are the main sources of CO2 emissions in China, and industry, transportation and construction are also important contrib-utors to China's CO2 emissions. In 2020, if indirect emissions due to electricity consumption are included, China's industrial carbon dioxide emissions account for about 70%, construction accounts for about 20%, transportation accounts for about 10%.

In the industrial sector, the share of carbon emissions in power generation, steel, cement, chemicals and other industries is 35%, 16%, 16%, 7%, etc.

Therefore, this paper selects the power generation, steel, cement, petrochemical and other carbon emissions accounted for a larger proportion of the industry,

through the analysis of its process production process, analysis of the key links of carbon emissions, support the subsequent industrial enterprises carbon reduction measures pro-posed.

2. INDUSTRIAL ENTERPRISE CARBON EMISSION PROCESS ANALYSIS

2.1. Power generation enterprises

According to the China Energy Development Outlook (2020), released by the China Network Energy Research Institute, the industrial and power sectors will account for 70% of all energy consumption in 2020. As elec-tricity substitution accelerates, some carbon emissions shift from the end-use sector to the power sector, which will become the main source of carbon emissions.

As the world's largest consumer and producer of coal, coal has been deeply rooted in China's energy system and economic system. From the production process and energy consumption structure of the power generation in-dustry, in 2020, China's coal consumption accounted for about 57% of total energy consumption, coal, oil, natural gas and other fossil fuel combustion is the most important way to generate electricity, heating industry also to burn fossil fuels as the main heating method. From the installed capacity, China's total installed coal unit capacity of about 1.1 billion kW, the power industry accounted for 54% of China's total coal consumption, is the main carbon emissions, the power industry carbon emissions are huge.

Combined with the greenhouse gas accounting guidelines, the carbon emission range of power generation en-terprises mainly includes three aspects, one is the fossil fuel combustion process, the other is the carbon emissions generated in the production process, and the third is the purchase of electricity, thermal-related emissions. At its root, the high carbon emissions of the power generation industry cannot be separated from the burning of large amounts of fossil fuels.

From the point of view of the key link of carbon emissions, the emission reduction of power generation en-terprises can start from reducing fossil fuel combustion, improving the efficiency of coal-fired power plants and developing carbon capture, utilization and storage technologies, such as the development of local wind power, photovoltaic and other renewable energy sources;

2.2. Steel enterprises

Combined with the greenhouse gas accounting guidelines of steel producers, there are four main sources of carbon emissions in the steel production process, including fossil fuel combustion emissions, industrial process emissions, net purchase and use of electricity, carbon sequestration products implied carbon emissions.

CO_2 emissions from fossil combustion, net consumption in steel production, including washing coal, anthra-cite, soot, coke from kilns such as coke ovens, sintering machines and blast furnaces, as well as emissions from trains and automotive diesel fuel used in the production and transportation of the plant. Because the essence of the production process of steel enterprises is the process of restoring iron from ore, it also requires a lot of energy.

Yuanxuan Technology Company data show that 66% of the carbon emissions in the steel manufacturing pro-cess from the long process of blast furnace ironmaking process, can use the lower carbon emissions of electric fur-nace short process using scrap steel production, and predicted that by 2050 through electric furnaces and scrap in-stead of long process steelmaking, can contribute to the steel industry carbon dioxide cumulative emission reduc-tion of 20%.

From the point of view of the key link of carbon emissions, the reduction of steel enterprises can start from reducing fossil fuel combustion, scrap recovery and so on, such as using waste heat to improve the proportion of self-generating power generation, low-carbon development, improve the conversion efficiency of waste heat gen-erator sets, improve the low-temperature waste heat recovery process into a high temperature and high pressure process, improve the utilization rate of residual energy, reduce energy consumption, with blast furnace top gas cir-culation, carbon dioxide enrichment and other technologies, reserve development CCOS technology.

2.3. Cement enterprises

As China's cement production accounts for nearly 60% of the global cement production, resulting in China's cement industry carbon emissions are huge. Combined with the greenhouse gas accounting guidelines of cement production enterprises, carbon emissions mainly include three categories, one is fuel combustion process emis-sions, the other is industrial production process (carbonate raw material decomposition in industrial production process) emissions, and the third is the purchase of electricity, thermal emissions. Unlike coal-fired power genera-tion, steel and other industries, carbon emissions in cement production come from the decomposition of carbonates in raw materials, in addition to fossil fuel combustion.

From the production process, the carbon emissions of cement production enterprises mainly come from the clinker production process. McKinsey data show that limestone calcination produces about 55 per cent of total

carbon emissions from the entire production process, while the high-temperature combustion of fossil fuels emits 40 per cent of carbon dioxide, accounting for 95 per cent of total carbon emissions from the clinker production phase.

From the point of view of the key link of carbon emissions, the emission reduction of cement production en-terprises can start from clinker substitution, reduce fossil energy combustion and so on, such as optimizing and adjusting the raw material structure of cement products, realizing clinker substitution, reducing clinker consump-tion, improving energy efficiency level, achieving emission reduction targets through energy conservation and emission reduction technology progress and application promotion, using alternative fuels, improving fuel substi-tution rate, effectively reducing fossil energy, etc.

3. PROPOSED CARBON REDUCTION MEASURES

The Greenhouse Gas Accounting System (Greenhouse Gas Protocol), a gradual development of enterprise greenhouse gas accounting standards since 1998 by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), consists of four independent but interrelated standards, including the Greenhouse Gas Accounting System Enterprise Accounting and Reporting Standards, the Enterprise Value Chain (Scope 3) Accounting and Reporting Standards, Product life cycle accounting and reporting standards and the GHG Accounting System Project Quantitative Methodology.

GHG Protocol divides greenhouse gas emissions into three types, namely range 1, range 2, and range 3. Among them, scope 1 is direct control or ownership of the direct emissions from sources within the control of the enterprise entity, including static combustion, mobile combustion, chemical or production processes, or unor-ganized escape; Consumers use products and services, etc.

Based on China's greenhouse gas accounting guidelines and GHG Protocol, carbon reduction in industrial en-terprises can mainly from the perspective of reducing fossil fuel combustion, recycling raw materials, energy effi-ciency improvement and other total control of carbon emission reduction work, after the completion of total carbon emission reduction control, from the energy side, reduce carbon emissions, such as renewable energy development.

Therefore, this paper starts with demand reduction, energy efficiency improvement and zero carbonization of energy, and puts forward some suggestions for carbon reduction measures for industrial enterprises.

3.1. Demand reduction

Combined with the analysis of the carbon emission process of enterprises with a high proportion of carbon emissions in the industrial field, taking into account the total carbon emission control, the carbon emission reduc-tion work of industrial enterprises can start with the reduction of demand, reduce the demand for raw materials, carry out waste steel recycling, non-ferrous metal recycling, clinker substitution and other recycling resources, can also be applied to improve the efficiency of material use, reduce carbon emissions of industrial enterprises.

Scrap recycling. Design the scrap recycling process of industrial enterprises, recycle depreciation scrap (steel contained in scrap equipment in daily life), steel mills produce their own scrap and process scrap, replace some pig iron, increase scrap ratio, improve scrap utilization rate, reduce scrap costs, while reducing greenhouse gas emis-sions from pig iron smelting process.

Recycling of industrial production by-products. The use of dry-out technology, for the steel production pro-cess emissions of most gases, such as blast furnace gas, coke oven gas, converter gas, to achieve exhaust gas, waste heat reuse, reduce carbon emissions, improve energy efficiency.

Recycling of metal resources. Recycling secondary resources such as metal scrap, corner materials and resi-dues, saving a large number of raw mineral needs of enterprises, using the "metal ore resources - products - re-newable metal resources" cycle process, from the source of the mining end to control pollution emissions, as well as smelting processing process wastewater, waste gas and waste residue emissions, effectively achieve energy conservation and emission reduction of industrial enterprises.

Clinker substitution. Reduce clinker consumption, replace some clinker with mixed materials, such as re-source-based use of steel slag, slag, fly ash, calcium silica slag, electric slag, alkali slag and other solid waste, as an alternative raw material for cement enterprises, significantly reduce natural mineral resources and energy con-sumption, reduce carbon emissions of cement enterprises.

Plastic regeneration. Develop the construction of recycling system for recycled plastics in industrial enter-prises, further improve the replacement ratio of renewable resources to native resources, improve the use of plastic resources in recycling, processing, utilization and other links, directly reduce energy resource consumption;

New material applications. Broaden the idea of promoting carbon emission reduction in industrial enter-

prises, enrich the theoretical knowledge and practical experience of carbon emission reduction, develop new mate-rials in the industrial field, such as biodegradable film materials, have reliable biosecurity, biodegradability, can reduce energy dependence, especially in carbon reduction, its raw material carbon emissions than traditional fos-sil-based plastics such as PP reduced by about 70%, improve the level of green innovation, shorten the production process, reduce production costs, reduce carbon dioxide emissions, but also promote China's new material tech-nology cutting-edge research.

3.2. Improved energy efficiency

Energy efficiency improvement is another means of controlling total carbon emissions, mainly in the produc-tion process to control carbon emissions. Based on the carbon production process and key links of typical industri-al enterprises, we can improve the energy production efficiency and reduce carbon emissions from the aspects of equipment energy saving, system energy saving and management energy saving.

The equipment is energy efficient. Carry out energy-saving transformation actions of green lighting and other equipment, eliminate backward devices, apply energy-efficient technology and equipment in steel, building mate-rials, non-ferrous metals, chemical industry, textile, papermaking and other industries, and improve the energy efficiency level of high energy-consuming equipment such as industrial boilers, kilns, variable frequency motors, power distribution transformers, etc.

The system is energy efficient. Industrial enterprises can implement systematic and comprehensive ener-gy-saving technology transformation, promote steel, cement, chemical and other industries in thermal subsystems, sewage systems and other systems energy-saving technology transformation, to achieve the integration and opti-mization of advanced energy-saving technology, promote the efficient recycling of residual heat, promote low-grade residual heat of steel and chemical enterprises to urban residents heating, promote the integration of production cities.

Manage energy savings. Build a digital energy efficiency platform for industrial enterprises, innovate energy efficiency improvement methods from a management perspective, optimize the production process of enterprises, realize process optimization and improvement, improve equipment efficiency, improve energy efficiency and re-duce pollutant emissions;

3.3. Energy low-carbon

Under the premise of total volume control, we can consider reducing carbon emissions from the energy side, such as renewable energy development, equipment electrification level, etc., from energy zero carbonization to achieve carbon reduction in industrial enterprises. This section combines the typical enterprise carbon emission reduction cases in the third chapter, and puts forward some suggestions on zero carbonization of energy from the aspects of increasing the proportion of local renewable energy utilization, electric heating technology application, negative carbon absorption, etc.

Increase the proportion of local renewable energy use. Reduce the use of fossil energy, promote the construc-tion of distributed renewable energy or clean energy centers for industrial enterprises, develop resources such as hydro, geothermal, hydrogen and biomass, develop local wind power, photovoltaics and other renewable energy generation, and promote the green and low-carbon transformation of industrial enterprises' energy systems through the independent purchase of green electricity.

Improve the level of electrification of enterprises. Key enterprises such as steel, cement and non-ferrous en-terprises to accelerate the development of electrification level, the application of electric drive, electric heating and other technologies, to achieve the optimization of rolling steel and other production processes, to meet the produc-tion standards of industrial products, to achieve the enterprise industrial chain and industrial products double car-bon reduction.

Negative carbon absorption. The production process of carbon dioxide emissions for purification, and then into the new production process for recycling or storage, carbon dioxide resources, the development of CCS and CCUS technology, such as the world's first cement kiln by conch construction of flue gas carbon dioxide capture purification demonstration project successfully put into operation, the first carbon capture and utilization to achieve industrialization of the first, through negative carbon absorption, resist some industrial greenhouse gas emissions, reduce emissions pressure.

4. CONCLUSIONS

Taking industrial enterprises as typical energy users, the paper combs their carbon emission process, and puts forward some suggestions on emission reduction measures for industrial enterprises under the dual carbon target. The paper puts forward relevant suggestions from three aspects: demand reduction, energy efficiency improvement and low-carbon energy. With the development of enterprises, it is necessary to gradually establish a carbon emission management system for the whole life cycle of enterprises, which is conducive to supporting enterprises to build industry demonstration benchmarks and strengthen brand influence.

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