

# Research on MRV system of iron and steel industry and verification mechanism establishment in China

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**Abstract.** The national carbon emissions trading market will be launched in 2017 in China. The iron and steel industry will be covered as one of the first industries. Establishing its MRV system is critical to promote the development of the iron and steel industry in the carbon trading market. This paper studies the requirements and procedures of the accounting, monitoring, reporting and verification of the seven iron and steel industry carbon trading pilots. The construction and operating mechanism of the MRV systems are also analyzed. Combining with the emission feature of the iron and steel industry, we study the suitable national MRV system for the whole iron and steel industry to consummate the future national carbon trading framework of iron and steel industry.

## 1. Overview

With the rapid development of economy and the rapid increase of greenhouse gas emissions, the global climate change has become the focus of the world's attention. In tackling climate change, China has carried out a number of work, and clarified a binding emission reduction target of 18% decline in the unit's GDP carbon emission intensity by 2020 for the outline of the 13th Five-Year Plan. We also put forward the effective control of carbon emissions of the key industries such as the electric power, iron and steel, building materials and chemical industry, and promoted the low carbon development of the key areas such as the industry, energy, construction and transportation. We controlled the emission of non-carbon dioxide greenhouse gases and promoted the construction of a unified national trading market of carbon emissions, implemented the reporting, verification, certification and quota management system of carbon emissions of the key unit. And we improved the statistical accounting, assessment and accountability system, and perfected the carbon emission standard system.

To overall control our carbon emissions and constrain the carbon emissions by means of the market, we actively carried out pilot work of the carbon emission trading. At the end of 2013, Shenzhen, Beijing, Shanghai, Guangdong and Tianjin have successively launched the local carbon trading market. In the second quarter of 2014, Hubei and Chongqing have also launched online transaction. Based on the experience of the pilots, China will officially launch the national carbon market [1] by the end of 2017.

As a high energy consumption industry, the CO<sub>2</sub> emissions of the iron and steel accounts nearly 20% of the China's total emissions [2], which must be one of the leading roles of the China's carbon emissions permit trading market for the future. Therefore, the examination of the accounting, reporting and verification (MRV) system of the iron and steel industry and the related suggestions are of great significance to ensure the orderly progress of carbon emissions trading.

At present, seven pilot provinces and cities in China have issued relevant codes and standards for local accounting, verification and reporting. For the iron and steel industry, the accounting methods



and standards in different places are different. The pilot provinces and cities have conducted the reporting and verification in accordance with the uniform requirements instead of the industry.

For the carbon emission accounting in the iron and steel industry, seven pilot provinces and cities have issued relevant documents on accounting of the greenhouse gas emissions. Tianjin, Shanghai, Hubei and Guangdong have issued accounting documents specifically for carbon emissions of the iron and steel industry, including the Guidelines on accounting of carbon emissions of iron and steel industry in Tianjin City (trial), accounting and reporting methods of greenhouse gas emissions of iron and steel industry in Shanghai City (trial), Quantification guidelines on greenhouse gas emissions of steel manufacturing industry (trial) (Hubei) and Guidelines on information reporting of carbon dioxide emissions of iron and steel enterprises in Guangdong Province (trial). Beijing, Shenzhen and Chongqing have released the industry-non-classified documents related to the accounting of greenhouse gas, including the Guidelines on accounting and reporting of carbon dioxide emissions in the Beijing enterprises (units), Standards and guidelines on quantification and reporting of greenhouse gas emissions for the organization and Guidelines on accounting and reporting of carbon emission for the industrial enterprises in Chongqing. The accounting boundary, method, data acquisition, etc. are stipulated in these documents. Based on the experiences of the seven pilots, in January 2015, our country issued GB/T 32151.5 Requirements of accounting and reporting of greenhouse gas emissions - Part 5: Iron and steel production enterprises (hereinafter referred to as the "national standard"), which is used to standardize the accounting and reporting of carbon emissions of the China's iron and steel industry.

## **2. Accounting Scope and Boundary**

The carbon dioxide emissions are only checked for the China's current emissions of greenhouse gases in the iron and steel industry.

Seeing from the organizational boundary, the greenhouse gas emissions from the production system shall be checked and reported in the factory boundary area of a legal person or a legal entity. Seeing from the operation boundary, the emissions from its main production system, auxiliary production system and auxiliary production system shall be checked. The seven pilots adopt the concept of direct emissions, indirect emissions and special emissions. The direct emissions include fuel combustion emissions (exclude the biomass fuel) and process emissions. Some provinces and cities need to account the emissions of a mobile source that serves the production. The indirect emissions include the emissions of the purchased electricity and heating power. The special emissions include solid carbon emissions and emissions of materials such as output energy. The concept of direct emissions and indirect emissions are no longer used in "national standard", while the five types of carbon emissions such as the fossil fuel combustion, process, purchased electricity/heating power, output electricity/heating power and carbon sequestration of the production process are checked, which not only conforms to the accounting boundary of the pilot provinces and cities in our country, but also strengthens the calculation of emissions from the output energy and expands the scope of accounting.

## **3. Accounting Method**

The current accounting methods of the greenhouse gas emissions in the industrial enterprises are mainly divided into emission factor method and material balance method.

Guangdong and Hubei provinces adopts the material balance method for the accounting in the iron and steel industry, the pilot provinces and cities such as Shanghai, Beijing and Tianjin adopt the emission factor method and material balance method for the accounting, and "national standard" adopts the emission factor method for the accounting.

Material balance method is a method to calculate the carbon emissions in accordance with the carbon balance method, its advantage is that the calculation results are more accurate, the drawback is that in data collection, the carbon content for each batch of material shall be tested, which increases the time and economic cost of the enterprise.

Emission factor method is a method that mainly multiplies the activity level data by the emission factor to obtain the emissions, its advantage lies in the low difficulty of data collection, less monitoring data and more convenient calculation, its drawback is that because the emission factor self-test is difficult, the use of its default value cannot reflect the actual situation of the enterprise emissions, and the default value of the emission factor also cannot reflect the regional industrial characteristics of the various provinces and cities.

#### **4. Data Sources**

The data mainly includes the activity data and emission factor data.

Activity data including the data on the activity of fossil fuels, power consumption, heat consumption, carbon product yield and purchasing volume of the materials such as limestone, usually such data mainly comes from the monitoring or measuring data of the equipment, raw material supply list, purchase invoice, ledger, financial cost statement, statistical ledger and statement, inventory statement, warehouse receipts, etc. Activity data is the necessary data base to calculate the emissions with the material balance method or emission factor method.

For the emission factor data, both the pilot provinces and cities and the "national standard" provided the default value of the material emission factor involved in the production process, meanwhile the "national standard" encouraged the enterprises to conduct the emission factor self-test, and provided the relevant standards and requirements that shall be met.

#### **5. Reporting Requirements**

The reporting of carbon emissions of the China's iron and steel industry is a process of data collating and reporting based on the accounting. Because the different pilot provinces and cities have different contents of the accounting method and reporting level of carbon emissions of the iron and steel industry in the pilot regions, the carbon reporting form is also different.

Seeing from the reporting level, accounting is the basis of the reporting. The carbon emissions accounting with division of process or emission source shall be carried out as required by the content that needs to be reported. Guangdong Province adopted the form of multistage carbon emissions report for the iron and steel industry, and required the enterprises to report at the enterprise level, emission unit level and equipment level according to their own situations, and stipulated the lime firing and steel production to be reported at the emission unit level, while outsourcing electricity to be reported at the corporate level, which required the enterprises to understand the production process, the involving emission sources, etc. before the accounting and reporting. The remaining six pilot provinces and cities have not made mandatory provisions in the emission reporting level, and have provided a reporting template at the emission unit and emission facility levels in the appendix. There was no clear rule on the reporting level in the "national standard". In the report template, the data statistics of the fuel combustion emission, production process, purchasing and output electricity, heat and carbon sequestration were made according to the emission source type, and the emissions were aggregated.

Seeing from the reporting content, it also varied with the reporting level. The main contents include the basic information on greenhouse gas emissions from the reporting entity, greenhouse gas emissions, activity data and sources, emission factor data and sources. For the reporting entity of the report at different levels, separate reports shall be made on the emission units and emission sources as required.

#### **6. Verification Requirements**

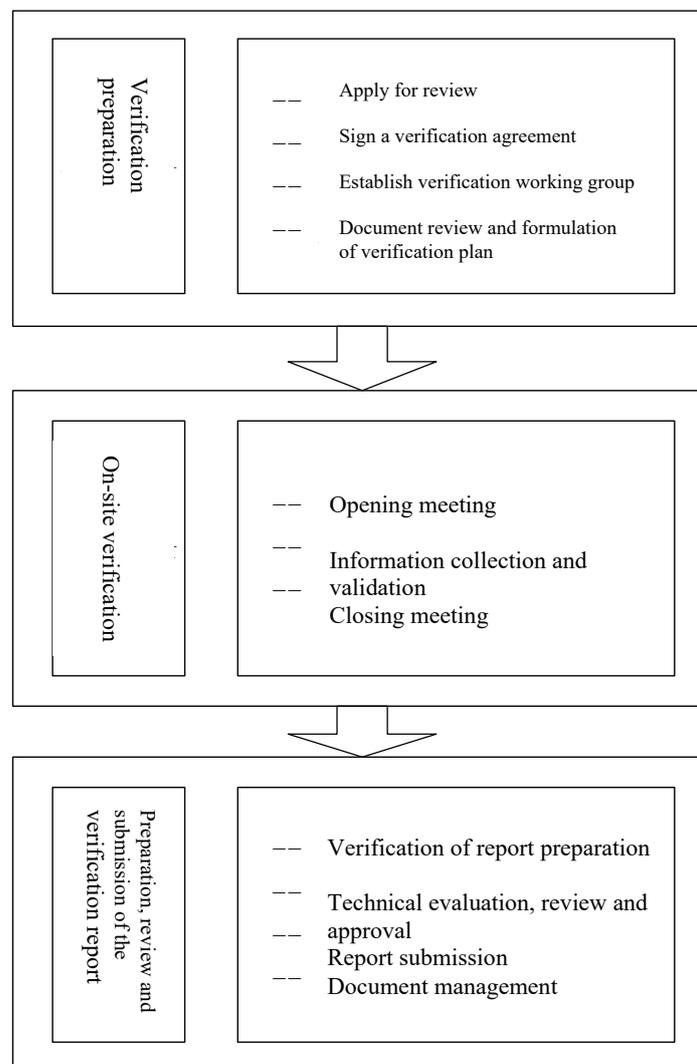
Verification is an authenticity verification process of data and descriptive content for the accounting report, and is closely related to the methods and contents of accounting and reporting, which is another kind of expression of accounting and reporting itself. In the verification norms of the seven pilot areas, all of them have taken one-stage verification except Shenzhen which has taken two-stage verification.

At present, the seven pilots have not released the documents on verification of greenhouse gas emissions for the iron and steel industry, instead, they have released documents on the verification of

the industry-non-classified greenhouse gas emissions, including Verification norms of carbon emissions of the enterprises in Guangdong Province, Working rules on verification of carbon emissions in Shanghai, Guidelines on a third party verification procedure of carbon emissions reporting in Beijing, Accounting report and verification rules on the carbon emissions of industrial enterprises in Chongqing, etc. On January 11, 2016, the General Office of the National Development and Reform Commission issued five documents including the Reference guide to a third party verification of the national carbon emissions trading, which provided system support for the establishment of the national carbon emissions trading market in 2017. One of the more important point was to emphasize the verification of supplementary data related to quota allocation.

Seeing from working mode of the verification, it mainly includes document review and site audit. Most of the pilots have stipulated or requested sampling plans for the sampling of multi-site enterprises.

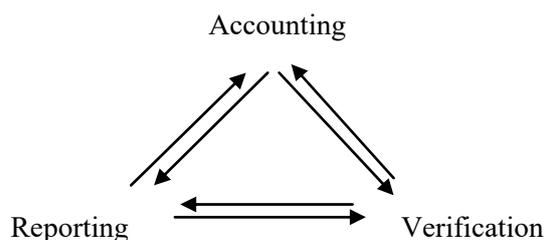
Seeing from working procedure of the verification, the verification working procedure of each pilot can be divided into three basic steps: verification preparation, on-site verification, preparation, review and submission of the verification report (see Fig. 1).



**Figure.1** Flow chart for verification

## 7. Suggestions on Construction of MRV System in China's Iron and Steel Industry

It can be seen from the status of accounting (M), reporting (R) and verification (V) that these three aspects constitute a stable system by mutual influence and restriction: accounting provides data support for the reporting, at the same time the involved content of reporting restricts the accounting's boundary and scope. The reporting provides basic material for verification, and the verification guides the reporting to be further improved. Verification of accounting methods is part of the verification process, and the verification results provide references for the scientific nature of accounting methods (see Figure 2).



**Figure.2** Relationships between MRV

In view of the iron and steel industry, China has released the Requirements of accounting and reporting of greenhouse gas emissions - Part 5: Iron and steel production enterprises, which stipulated the accounting boundary, accounting methods, monitoring requirements, reporting content and so on. As one of the first industries covered in the trading market of the national carbon emissions in 2017, the iron and steel industry characteristics are more prominent, the establishment of the MRV system is a policy and institutional guarantee to ensure the scientific, standardized and orderly operation of the iron and steel industry in the carbon emissions trading market.

According to each pilot's current situation research of accounting, reporting and verification of greenhouse gas emissions in the iron and steel industry, and combining the "national standard" issued by our country and the characteristics of the iron and steel industry, it should pay attention to the following aspects for the establishment of verification mechanism of the greenhouse gas emission in the China's iron and steel industry:

- Grasp the key points of verification. The key points of verification should be in areas where emissions are greater, and carbon dioxide emissions from the energy consumption should be focused on;
- The verification process should focus on the verification of emission units and key emission sources. There is no clear division of the required accounting units and facilities in the "national standard", which only requires the comprehensive calculation based on the five types of emissions. For verification, the verification of emission units and key facilities is an important step in the verification process, and the emissions should be verified at the same time consistent with the accounting boundary.
- Simplify the verification procedures. As the key emission unit, the iron and steel industry has a good data base. For the enterprise that its main production process has not changed in the last three years, its emission facilities haven't been newly supplemented or withdrawn compared with the previous year, and its yield of long process and short process can meet certain conditions, the document review can be used to verify and simplify verification procedures;
- The verification requirements should be appropriately adjusted for the different production status of the enterprises. For the enterprise with the good monitoring equipment and monitoring level, its unit process, emission source and other emission data may be verified according to the verification report. For the enterprise with the poor data base, its carbon emissions of the enterprise level may be verified, guide it to build up the relevant accounting plan in the process of verification, perfect the data collection and strengthen the management of the greenhouse gas emissions;

- Establish the detailed rules for carbon emission verification in the iron and steel industry. Comprehensive and detailed operating rules are important means to ensure the fairness and data accuracy of MRV system. The MRV system is the basis of decision making for emission reduction policies of other greenhouse gases, and its data accuracy and fairness are of vital importance. The comprehensive and detailed operating rules shall refer to the detailed rules and regulations on the monitoring method level, and shall also include the detailed rules and regulations on the monitoring, reporting and verification procedures and specific steps. It shall not only include the methods and the qualification requirements, but also establish the procedural laws and regulations. The standardized operating rules can reduce uncertainty in operation and improve data quality.

- It should make great efforts to establish and improve the approval management system of the third party verification agency, this will not only facilitate the standard management of the verification agency, ensure the fairness and objectivity of the third party verification agency and strengthen the professional ability of the inspectors, but also be conducive to improving the management level of verification agency, enhancing the effectiveness of verification work and promoting the sustainable development of carbon verification. The legal basis is the basic guarantee of MRV system. The MRV system of all major greenhouse gases are supported by mandatory laws and regulations, and the basic law of most systems is the highest level of law in the country or region. This greatly guarantees the orderly operation of the procedures for the MRV system.

## 8. Conclusion

Now, China is building a carbon market guaranteed by the MRV system. The steel industry is among the first to be included in the carbon emissions trading. When building the MRV system of iron and steel industry in our country, firstly, the key point, content and procedure of verification should be determined according to industry characteristics, and then formulate the detailed system operating rules and regulations according to the internationally recognized standards and guidelines and the China's national conditions. At the same time, the capacity-building of the third-party agency should be intensified and professional verification personnel should be trained. In the early stage of construction, the degree of freedom of enterprise accounting and reporting can be appropriately extended to expand coverage area.

Because the steel industry boasts high energy consumption and high emission, standardization and operability are important in its accounting, reporting and auditing. The MRV system will help the steel industry to engage in carbon trading and enable other industries to build their own MRV systems. This is a critical step for China's carbon market.

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