Research on the Accurate Measurement and Analysis of Carbon Emissions by Carbon Real Measurement

Abstract—The accurate measurement of carbon emissions is crucial for understanding the relationship between carbon emissions and various factors. This study focuses on developing a carbon real measurement model adapted to multiple industries. The model involves collecting data from power plants in the field and automatically matching various carbon emission parameters with the calculation of carbon emissions. The carbon electricity coupling and carbon real measurement are carried out, based on the carbon conservation method. The whole process of carbon production and emission is accurately pictured, and the carbon practice of carbon emission accurate measurement system application scenario of carbon industries is constructed in this way.

1. INTRODUCTION

At present, there are four main types of carbon measurement methods: IPCC inventory method, material balance method, and emission measurement methods. The IPCC inventory method is an authoritative method for carbon emission accounting at the national level, which is internationally recognized as the most expensive, and is the basis for current carbon source accounting. However, the actual measurement method is to calculate the total amount of gas emissions through the data of flow measurement or noise measurement, and environmental monitoring stations certify the measurement results indirectly. The actual measurement method requires less human and material resources, is less expensive, and is the basis for current carbon source accounting. The material balance method refers to the quantitative analysis of material input to a system or equipment and output from the system, and the principle is the law of mass conservation.

m_i = m_f = m_o + \Delta m

where m_i is the material input to a system or equipment, m_f is the material output from the system, and \Delta m is the material used in the production process. The material balance method is also known as the mass conservation method, which means that the mass of material output from the system, and the material input to a system or equipment must be equal to the mass of material used in the production process. The mass balance method is commonly used to study the decomposition of possible factors affecting carbon emissions, the relationship between carbon emissions and each influencing factor is quantitatively analyzed. Many scholars at home and abroad have constructed various models using the factor decomposition method, such as STIRPAT model, IPAT model, LMDI models, and LEAP model. The decomposition method is commonly used to study the contribution of multiple factors to the total change in carbon emissions.
2. Research Direction

2.1 Fast and Accurate, Automatic Measurement Of Carbon Emissions

2.2 Technology-Enabled, Revitalize The Stock Of Computing Power

2.3 Accurate and Safe, Providing Key Data Support

3. Specific methods

3.1 the configuration of monitoring points to achieve the actual data collection

3.2 Carry out calibration calculations and guarantee data transmission

3.3 Analysis of online monitoring platform based on new energy cloud configuration
In order to achieve real-time monitoring of key data such as flow rate, humidity and CO₂ concentration of carbon emission flue gas in the whole process of power generation, the technical team conducts platform research and development based on the State Grid New Energy Cloud. By developing a mathematical model of differentiated carbon and electricity factors and using big data and other means, it realizes automatic matching of various carbon emission parameters of power plants with the calculation model, automatically and accurately accounting for the emissions of the whole power plant, and the data results can be displayed intuitively and timely. The average error between the two does not exceed 10% when compared with the traditional accounting system. In the design and implementation of the platform, a data collection and confidentiality mechanism has been established in collaboration, and data encryption and desensitization are strictly implemented to fully guarantee data security and help build a service system based on accurate carbon emission data for government services, verification and accounting, green finance and scheduling and trading.

4. CONCLUSION AND SIGNIFICANCE

The carbon measurement is not only a true reflection of the actual carbon emissions of enterprises, which helps enterprises understand their own energy consumption and provide guidance for their carbon emission reduction efforts, but also supports government regulators in setting carbon emission budgets and formulating annual carbon emission reduction plans for specific areas and enterprises, further promoting the fair and effective operation of the carbon trading market. The application and promotion of the carbon measurement data intelligence platform based on the State Grid New Energy Cloud will help improve the data accounting system based on carbon emissions trading.

An online detection model for carbon emission monitoring data of thermal power enterprises was established to dynamically identify the abnormal states of carbon emission monitoring data that do not conform to the data change pattern and the coupling relationship between parameters, and to calibrate the monitoring data to achieve online data quality assessment and early warning, and the agreement between the collected data and carbon emission field data reached 99.5%. The report shows that it has not been described in the reviewed literature at home and abroad.

Based on the research results of carbon emission real measurement method, the first provincial thermal power enterprises proposed the carbon emission accounting method for thermal power enterprises by real measurement method, using the continuous online monitoring data of pressure, temperature, humidity, flow rate, carbon dioxide concentration and other parameters of flue gas emission from units, and calculating carbon dioxide emission of thermal power enterprises by real measurement method, realizing the real-time online accounting of carbon emission data of thermal power enterprises, reducing the time granularity of carbon emission accounting data of thermal power enterprises from annual to hourly, and improving the timeliness of carbon emission accounting data of thermal power enterprises.
Enterprise carbon emission chemical monitoring and evaluation system has been built, realizing the real-time online monitoring of carbon emission of typical coal-fired and gas-fired units of different capacity levels in the province, and completing the historical accumulation of carbon emission data of typical thermal power units. In the process of pilot application, a large amount of on-site transformation experience has been summarized, and a scientific transformation plan with small transformation workload and low cost has been proposed, and a standardized workflow has been formed, which can ensure the quality and high efficiency of the transformation project and lay a foundation for the subsequent research and promotion application of real-time online monitoring of carbon dioxide emissions.

At present, domestic power generation enterprises uniformly adopt the emission factor method for carbon emission accounting, which requires power generation enterprises to report data on unit production activities, fuel consumption and coal quality analysis, and the data collection workload is cumbersome. At the same time, the reliability of the estimation results can be further improved considering the differences in coal quality in different regions and coal combustion efficiency of the units.

Carbon measurement is not only a true reflection of the actual carbon emissions of enterprises, which helps enterprises understand their own energy consumption and provide guidance for their carbon emission reduction efforts, but also supports government regulators in setting carbon emission budgets and making annual carbon emission reduction plans for specific areas and enterprises, further promoting the fair and effective operation of the carbon trading market. The application and promotion of the carbon measurement data intelligence platform based on the State Grid New Energy Cloud will help improve the data accounting system based on carbon emissions trading.

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