PARTNERSHIP FOR MARKET READINESS

A Survey of the MRV Systems for China's ETS Pilots

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The Partnership for Market Readiness (PMR) is a global partnership, which provides funding and technical assistance to support the design and development of market-based instruments to reduce greenhouse gas (GHG) emissions. The PMR is country-led and builds on countries' own mitigation priorities. It emphasizes improving technical and institutional capacity to scale up mitigation efforts, including domestic emissions trading, crediting mechanisms and carbon taxes, among others.

Comments and questions on this report should be directed to the PMR Secretariat pmrsecretariat@worldbank.org).

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Introduction

This report provides a survey of the key features associated with greenhouse gas (GHG) monitoring, reporting, and verification (MRV) systems that support the pilot emissions trading schemes (ETS) in China. The seven pilots are

1. Beijing,
2. Chongqing,
3. Guangdong,
4. Hubei,
5. Shanghai,
6. Shenzhen, and
7. Tianjin.

Six of the seven pilots have successfully launched; the exception is Chongqing. The pilot cities/provinces are different in terms of economic structure and development, and the corresponding MRV systems reflect the specific needs of each pilot ETS. Sectors covered by the ETS pilots are based on their respective economies and the emission profile of the province. The threshold for determining covered enterprises is also based on the same standard. Provinces with industry-driven economies cover heavy industries and other large companies, while provinces with service sector-driven economy cover fewer heavy industries and more service sector enterprises and the threshold is set smaller.

The GHG accounting methodologies of the six initiated pilots do have several similar features. For example, companies can choose to quantify their emission via either calculation-based or measurement-based methods, except for Tianjin which does not include measurement-based approaches. A Key decision among the pilots is whether to include mobile source and what type of indirect emission to account for and report. Beijing and Guangdong pilot exclude mobile source. All of the pilots account for CO_2 emissions from electricity consumption, but only Shanghai, Tianjin, Shenzhen and Guangdong consider heat consumption. Regarding data requirements for the calculation methods, all pilots provide the option of using measured or default values for emission factors. However, the requirement and frequency for measured values is different from pilot to pilot. The verification processes in the pilots are similar to each other, too, although described in various details.

This report has the following structure. (1) It begins with an overview of each ETS, to provide context for the MRV systems of the pilots. (2) The second part includes a summary table of the attributes of the MRV systems for all the pilots. (3) The report concludes with observations about the similarities and differences of the MRV systems for the pilots as well as the published rules and procedures for the national MRV system. The technical challenges for developing the MRV are also identified. Practical aspects of the determination of boundaries, development of methodology, acquisition of activity data, emission factors and evidence for cross check are discussed. Engagement of stakeholders, capacity building and supporting institutions are also explored, as well as lessons learned.

An Overview of China's ETS Pilots[1]

Beijing

City introduction: Beijing's economy has growing steadily, with GDP reaching 1.78 trillion RMB by 2012. The service sector represents a broad segment of the economy. 75.5% of the GDP is produced by the service sector, while 23.5% comes from secondary sectors. The population is 19.6 million and increasing. Total area of Beijing is 16.4 thousand km^2.

Launched date of emission trading: 2013.11.28

Principal legislation:[2] Decision on Launching ETS Pilot under Strict Emission Cap

Supporting regulation and guidelines:

(1) CO2 Accounting and Reporting Guidance for Enterprises in Beijing

(2) Regulation on the verification body of Beijing ETS (Trial)

(3) Allocation method of Beijing ETS (Trial)

(4) Reporting procedures for GHG emissions in Beijing

(5) Operational guidance for the Registry system of Beijing ETS

(6) Trial Detailed Rules for OTC Trading of GHG Emission Permits for Enterprises in Beijing

(7) Trial Measures by BEX for GHG Emission Permits Trading

Number of controlled companies: 490

Percentage of covered emission: 49%

Cap setting: The cap is formulated in relation to the GHG emission reduction target and the economic development trend. However, no official cap has been published.

Allowances allocation: Existing facilities for cement, petrochemical, , service and other industrial sectors (except for cement, petrochemical, power and heating) receive allowances through grandfathering while existing facilities of power and heating receive allowances based on historic carbon intensity. New entrants will be allocated based on benchmarking.

Offsets: 5% of allowances; at least 50% local projects

Registry: Online

MRV: Beijing ETS pilot finished its historic GHG emission (2009-2012) accounting in August 2013, after workshops and training sessions held for enterprises and verifiers. The accounting methodologies and

[1] The Chongqing ETS has yet to launch; the designs of the ETS has not been finalized and information on the MRV system is not available. Therefore, Chongqing is not included in this section.

[2] Legislation and guidance are drawn from local DRCs and the pilot exchanges. See lists of websites at the end of the report.

requirements are set out in the accounting and reporting guideline for six sectors, including power, heat, cement, chemical, other industrial sector and service sector.

Rules for trading: The trading platform for Beijing ETS is designated to China Beijing Environmental Exchange (CBEX). The trading product of CBEX is the Beijing Emission Allowance (BEA). Since BEAs are allocated for the three-year pilot period at the beginning, allowances for each vintage year can be traded on the market. Controlled entity and investment organization are entitled to trade BEAs, while natural person is excluded at the moment. The BEA can be traded via open transaction or OTC.

Trading status as of 2014.04.18:

Volume: 95,700 tons

Price: 52.12 RMB/ton

Guangdong

Province introduction: Guangdong is the pioneer of China's economic reformation. The GDP reached 5.7 trillion RMB by 2012, with primary, secondary and tertiary sectors accounting for 5.0%, 48.8% and 46.2%. The population had grown to 105.9 million in 2012. Total area is 179800 km^2.

Launched date of emission trading: 2013.12.19

Principal legislation: Regulation on Guangdong ETS management and trading (daft)

Supporting regulation and guidelines:

(1) Work Plan of Guangdong ETS for First Round of Allowance Allocation

(2) GHG Permit Trading Rules of CEEX

Number of controlled companies: 242

Percentage of covered emission: 50%

Cap setting: The cap of Guangdong Pilot is formulated through consideration of provincial GHG emission target, national and provincial industrial policy and economic development. The cap is set at 388 million tons, with 350 million tons available for controlled entities and 38 million tons held for reserve.

Allowances allocation: Combined heat and power generation, mining and other grinding for cement sector, petrochemical, short steel making process are based on grandfathering. Pure power generation, clinker production and cement grinding for the cement sector and long steel making processes are based on benchmarking.

Offsets: 10% of emission; at least 70% of local projects

Registry: Online

MRV: Guangdong ETS pilot provides for general rules on GHG accounting and reporting as well as four sector guidelines for the power, cement, iron and steel, and petrochemical sectors. Verification rules for Guangdong enterprises and workbooks for verification are available.

Rules for trading: The China Emission Exchange is the trading platform for Guangdong ETS pilot. Only controlled entities are allowed to trade Guangdong Emission Allowances at the moment. Trading may be completed via listed trading, unidirection bidding or OTC.

Trading status as of 2014.04.18:

Volume: 126,000 tons

Price: 60.16 RMB/ton

Hubei

Province introduction: Hubei is known for its secondary industries such as automobile manufacturing and chemical production. Its GDP had reached 2.2 trillion RMB by 2012, with primary, secondary and tertiary sectors accounting for 12.8%, 50.3% and 36.9%. Population rose to 57.8 million in 2012. Total area of Hubei is 187400 km^2.

Launched date: 2014.04.04

Principal legislation: Interim Measures for Hubei ETS Management

Number of controlled companies: 153

Percentage of covered emission: 35%

Cap setting: The cap is formulated according to the provincial GHG emission reduction target and the economic development goals. The cap for 2014 is 324 million tons. The cap is divided into three categories, pre-allocated allowance, allowance for new entrants and governmental reserve.

Allowances allocation: Allowances will be allocated for free at the beginning. About 80% of the allowances will be determined by historic emission, while the other 20% will be determined by early action. Along with the data quality improvement, allocation method will shift to benchmarking.

Offsets: 10% of allowances, restricted to local projects

Registry: offline

MRV: The guidelines for MRV haven't been released yet. However, the historic GHG accounting, reporting and verification evaluations have been completed. According to the draft release, the MRV of the Hubei ETS consists of a general guideline for all sectors, which includes power, chemical, glass, aluminum, calcium carbide, paper, automobile, iron and steel, iron alloy, ammonia and cement.

Trading status as of 2014.04.18:

Volume: 1,607,700 tons

Price: 24.08 RMB/ton

Shanghai

City introduction: Shanghai is a municipality directly under the central government. As of 2012, the gross domestic production reached 2 trillion and the population reached 23.8 million. In the Shanghai's

economy, secondary industries accounted for 39% and the tertiary industries accounted for 60%. Shanghai occupies area of 6340.5km^2.

Launched date of emission trading: 2013.11.26

Principal legislation: Trial Measures for Shanghai ETS Management

Supporting regulation and guidelines:

(1) Guidance on GHG Accounting and Reporting for Shanghai Enterprises (and 9 sectoral guidelines)

(2) Draft Regulation for Shanghai ETS Management

(3) GHG Permit Allocation and Management Solution for Shanghai ETS during 2013~2015

(4) GHG Permit Trading Rules of SEEX

Number of controlled companies: 191

Percentage of covered emission: 57%

Cap setting: The cap is formulated according to GHG emission reduction target and economic development trends. In addition, the proportion of the emissions covered by the ETS is taking into account. However, the exact number of the cap is not published.

Allowances allocation: Industries other than power sector, malls, hotels, commercial buildings and railway stations will receive allowances based on grandfathering; power, airlines, airports and harbor will be based on benchmarking. Another unique feature of the Shanghai pilot is that the allowance is allocated for three years one-off at the beginning of the pilot period.

Offsets: 5% of allowances

Registry: Online

MRV: The Shanghai ETS covers a broad segment of the economy, including industrial and service sectors. The competent authority released a series of guidelines for GHG accounting and reporting in December 2012. There is one general guideline and nine sector guidelines for iron and steel, power, ferrous-metal, non-ferrous metal, paper, airlines, chemical engineering, large buildings, transportation stations in the series.

Rules for trading: Shanghai Environment and Energy Exchange (SEEX) is the trading platform for Shanghai ETS pilot. Only controlled entities are allowed to trade Shanghai Emission Allowances at the moment. Trading may be completed via listed trading or OTC.

Trading status as of 2014.04.18:

Volume: 238,800 tons

Price: 66.69 RMB/ton

Shenzhen

City introduction: Shenzhen is the gateway of southern China. Its economy, which had reached 1.30 trillion RMB by 2012, relies on manufacturing and tertiary industries, particularly IT industry. Secondary and tertiary industries accounts for 44.3% and 55.7% respectively. Population in Shenzhen had grown to 10.5 million and total area is 1953 km^2.

Launched date of emission trading: 2013.06.18

Principal legislation: Provisions of Shenzhen Special Economic Zone for ETS Regulation

Supporting regulation and guidelines:

(1) Specification with guidance for quantification and reporting of the organization's greenhouse gas emissions

(2) Specification with guidance for verification of the organization's greenhouse gas emissions

(3) Interim Measures for Spot Trading in CEX of Shenzhen

(4) Draft Interim Regulation for Shenzhen ETS Management

Number of controlled companies: 635; Building: 197

Percentage of covered emission: 54%

Cap setting: According to the overarching regulation, the cap is formulated through considering GHG emission reduction targets, economic development and other factors such as emission coverage and emission reduction potential. The cap for the pilot program has not been released.

Allowances allocation: Part of the power sector receives allowances according to historic carbon intensity while other power companies, water supplier, other industries and buildings apply benchmarking for allocation.

Offsets: 10% of emission

Registry: Online

MRV: Shenzhen is the first to release monitoring guideline and verification guidelines and carry out historic GHG emission accounting, covering 26 sectors including power, water supply and so on. The guidelines, which provide general accounting guidance for all sectors, derive from ISO 14064-1, taking into consideration of local conditions. Since large buildings are also covered by the ETS, the competent authority released a verification guideline for accounting GHG for buildings separately.

Rules for trading: The trading platform for Shenzhen ETS pilot is China Emissions Exchange (CEX). Trading of Shenzhen Emission Allowances is open to controlled entity, investment organization and natural person. Trading may be completed by spot trading, E-bidding and block trading.

Trading status as of 2014.04.18:

Volume: 197,328 tons

Price: 66.69 RMB/ton

Tianjin

City introduction: Tianjin municipality is the economic center of the Bohai Sea rim, with GDP of 1.29 trillion RMB and population of 14.1 million as of 2012. The primary, secondary, and tertiary shares of its economic structure of Tianjin are 1.3%, 51.7% and 47.0%, respectively. Tianjin has population of 9.93 million and total area of 11920 km^2.

Launched date of emission trading: 2013.12.26

Principal legislation: Tianjin ETS Interim Regulation

Supporting regulation and guidelines:

(1) GHG Permit Trading Rules of TCX
(2) Guidance for the accounting of GHG emissions for enterprises in Tianjing

Number of controlled companies: 114

Percentage of covered emission: 60%

Cap setting: The cap is formulated through consideration of GHG emission reduction target, industrial policy and planning, sector coverage and also historic emission. The number has not been published.

Allowances allocation: Existing facilities except for power and heating are allocated with allowances through grandfathering while existing facilities of power and heating received allowances based on historic carbon intensity.

Offsets: 10% of emission

Registry: Online

MRV: Tianjin ETS pilot provides for the enterprises a series of guideline consists of a general guideline and 5 specific guidelines for power and heat, iron and steel, chemical, refinery and ethylene and other industrial sectors. Methodology and data requirements are set out in the specific guidelines while the general guideline offers guidance on monitoring plan, quality assurance etc.

Rules for trading: Tianjin Climate Exchange (TJCE) is the trading platform for Tianjin ETS pilot. Controlled entity, investment organization and natural person can open accounts at TJCE to trade Tianjin Emission Allowances via online spot trading, OTC or auctions.

Trading status as of 2014.04.18:

Volume: 140000 tons

Price: 28.43 RMB/ton

Observations about Similarities and Differences among the MRV Systems

China has not launched the national ETS, but has published the monitoring and reporting guidelines (MRG) for 10 sectors at the national level. The information of Chongqing ETS pilot is largely not yet published at the moment, thus the national MR guidelines as well as MR guidelines in the pilot ETS (with available information of Chongqing) will be discussed in this chapter.

Covered sectors

Ideally, all significant emitters and all relevant emission sources should be covered by the ETS, but in order to reduce the operating cost of ETS normally only large emitters are controlled under the scheme. The national MR guidelines includes 10 sectors, power generation, power transmission and distribution, aviation, cement, ceramics, flat glass, electrolytic aluminum, magnesium smelting, chemical and iron & steel. The ETS pilots choose which sectors to regulate according to their emission level and feasibility of being monitored, reported and verified.

Given that the covered sectors of Chongqing pilot are not published yet, this section will only address the remaining six sectors. Power and chemical sector is the only sector covered by all pilots, followed iron & steel sector covered by four out of six pilots. Heat, refinery, cement and paper industries are covered by half of the pilots while textile and non-ferrous metal industries are covered by two pilots.

Hubei Province's economy builds on large portion of industrial sectors, which consists of considerable number of large-scale industrial sectors. The Hubei pilot therefore includes 11 industrial sectors, such as power, iron and steel, alloy, ammonia and so on.

Beijing, Shanghai and Shenzhen are cities with large service sectors and a relatively small portion of industries. These pilots also regulate service sectors besides industries. Beijing and Shanghai pilots include various service sectors while Shenzhen regulate large buildings.

Similarly, the national MRG set out accounting methodologies for power sectors, energy intensive industries and civil aviation. The MRG series is still in development, more sectors will be covered in the coming years.

Threshold for included enterprises

Accounting and reporting of GHG emissions is still at the beginning stage, and is a key component of all climate change related policy making. Therefore, some pilots (Beijing, Shanghai, Shenzhen and Guangdong) set a two-level threshold for determining covered entities, consisting of a reporting only threshold and a compliance threshold which requires emitters to report emission and submit commensurate allowances respectively.

Emission threshold may be based on GHG emission, energy consumption or both of the two. Tianjin, Shanghai and Shenzhen stipulate the threshold with GHG emissions, while Hubei uses energy consumption. In the Beijing and Guangdong pilots, if either GHG emission and energy consumption threshold is triggered, the enterprises will need to report to the competent authority.

Shenzhen is the only pilot covering buildings as a sole group. Buildings with area exceeding a specified threshold need to report to the competent authority.

Hubei has set a distinct compliance threshold of 60000 tons of coal-equivalent, which is above the thresholds of other pilots. Although a reporting threshold for emission reporting only is mentioned in the work plan, the threshold has not yet published at the moment.

Accounting boundary

Unlike the EU ETS, in which the accounting boundary is based on the installation level, the accounting boundaries for pilot ETS and national ETS are more based on the *legal person*, which means every emission source associated with the company should be reported by the company, with only Guangdong and Shenzhen ETS based on the organization boundary.

International MR standards such as ISO 14064 and WRI Greenhouse Gas Protocol determine accounting boundary based on organizational and operational boundaries, and the MR guidelines of Guangdong and Shenzhen pilots are formulated according to ISO standards.

The *legal person*-based boundary has some advantages for China. For one hand, this kind of boundary is the same with the requirements for energy statistics; for another, it is easy to accumulate the data on the enterprise level for some sectors, while difficult to collect data on the installation level.

All the MR guidelines require enterprises to report emission related to production and operating activities save Shenzhen – this issue is not specified in its guidelines.

Emission sources

Enterprises in all the pilots and future national ETS would need to report both direct and indirect emissions, but the MR guidelines vary regarding to specific emission sources. Emission sources that are common to all the MR systems include stationary fossil fuel combustion, process emissions and electricity consumption.

Emissions from waste treatment need to be addressed in the Beijing and Guangdong pilots. According to Beijing and Guangdong's MR guidelines, direct emission from mobile source is excluded even if it is within the accounting boundary. There are different kinds of indirect emission, like electricity consumption and heat consumption. Although all MR guidelines in China accounts for indirect emission, Beijing and Hubei pilot only takes into account of emissions from electricity consumption, while other four pilots require to report emissions from heating as well.

Monitoring Methodology

In accordance with the national and pilot MR guidelines, the accounting of GHG emissions relies on calculation-based methodologies, which may be an emission factor approach or mass balance. Measurement-based methodology could be used in some pilots, including Beijing, Shanghai, Hubei, Guangdong and Shenzhen. However, in the national MR guidelines, only the calculation-based methodology can be applied.

Data Requirements

As to data requirement, there are two approaches for regulating data acquisition. The first one is to stipulate in details about the data source, measurement frequency and measurement standard. This approach is adopted by all MR systems except for Shenzhen.

For the first approach, fuel consumption is derived from energy consumption account or statistics. According to the national GHG accounting and reporting guideline as well as Beijing, Tianjin pilots, enterprises of the power sector should test the NCV, while default values can be used for other sectors. For most pilots and the national guideline, carbon content and the oxidation factors can refer to measured or default values. When accounting indirect emissions, the requirements in all the pilots and the national guidelines are similar, activity data comes from receipts or invoices and emission factors supplied by default values in the guidelines.

The second approach, which is adopted by Shenzhen, sets out different levels for activity data and emission factor acquisition. Instead of restricting data requirement, this approach encourages the use of higher level data with lower uncertainty. When lower level data is used, a statement explaining the reason should be sent to the competent authority. Guangdong pilot combines the two approaches. Tiers are set out in the guideline, as well as the measurement requirements and frequency. Companies are encouraged to use the tiers with high certainty. When measurement of parameters are not possible, default values could be applied.

Monitoring Plan

Not all the MR guidelines integrate a monitoring plan. Tianjin, Shanghai, Guangdong and Hubei pilots require enterprises to submit a monitoring plan to describe monitoring approaches, with slight differences of the content of monitoring plan. The plans include general information of the enterprises, methodology choice, parameters monitoring frequency and method. Some of the plans include other requirements as well, such as data management, uncertainties, among other items.

Quality assurance and control

Development and improvement of the data management system stands at the core of the quality assurance and control. Every MR guideline provides relevant provisions to standardized data collection, processing and archive. Establishing a dedicated department with competent personnel also appears in several of the MR guidelines. Besides the personnel and data management, there are some other issues raised in the some of the guidelines. For example, Tianjin emphasize training program for relevant staff and internal review for GHG accounting. Hubei pilot adopts the DB42/T 727-2011 (Implementation guidelines for quantification, verification, reporting and modification of GHG emissions) for conducting data quality analysis.

Uncertainty analysis

The national MR guidelines do not specified requirements regarding uncertainty analysis, but all other pilots, except for Hubei and Chongqing of which the details are not published, include uncertainty analysis as part of the guidelines. In analyzing uncertainty, there are two types of analysis, qualitative and quantitative. The Shenzhen pilot describes both methods in the guideline. Others require only one

type of analysis. Beijing, Shanghai and Guangdong require quantitative method (mainly the error propagation method), while enterprises in Tianjin need to describe uncertainty in relation to monitoring accuracy, use of default value, missing data, misuse of formulas, and other matters.

Verification institutions

Unlike the EU ETS, all of the pilot ETS require third party verification of emissions reported by the emitters. Normally, the cost for verification should be borne by the emitters, but to facilitate the ETS, local DRC funds the historic emission verifications. The competent authority is in charge of the accreditation of verifiers. The competent authority accredits various numbers of verifiers to carry out verification according to the demand. Large number of controlled entities in Beijing, Shanghai and Shenzhen pilots requires more verifiers to successfully complete the task in a short period. Whereas control enterprises in Tianjin and Guangdong needs less verifiers. Organizations for verification of GHG emissions in the national level haven't been designated yet.

The process of accrediting verifiers and matching verifiers with companies are quite different in pilots. Beijing and Guangdong select verifiers openly and put them on record. Verifiers are appointed to the companies by the competent authority in the first two years. From the third year on, companies can freely choose verifiers as long as it is in the authority's record list. In Shenzhen and Shanghai, verifiers are accredited the same way in Beijing and Guangdong, but companies are free to choose verifiers from year one in Shenzhen and the service of verification is appointed to the verifiers through governmental procurement, whereas Tianjin incorporates the accreditation of verifiers into the procurement process where biding participants must meet the requirements set out in the tendering information.

Verification requirements and procedures

The verification guidelines consist of similar stages and processes. Although the guidelines describe the process in different length, they can be grouped in three stages: preparation stage, implementation stage and reporting stage. In the first stage, verifiers sign a contract with enterprise, set up a verification team and make a verification plan. During the implementation stage, verifier conducts document review, field visit. In the final stage, report will be finalized, go through internal technical review and finally submitted to the competent authority.

Verification report

Four pilots have verification report contents in their guidelines, but in a different way. Beijing's verification guideline requires verifiers to report conformity with the local MR guidelines, assumptions, equipment calibration and other information. Shenzhen pilot focuses on reporting of emission inventory, verification method and procedures and the status of the non-compliance. Verification report in Guangdong consists of a long list of headlines, among which emission number and emission source, evidence list and founding are the most important elements. The verification report in the Hubei pilot focuses on the implementation of the monitoring plan, demonstrating the status of the verification, the implementation status of the monitoring plan, emission calculation and results.

Penalty for non-compliance

There are largely three types of fines for non-compliance in the MRV mechanism. The first type is fraudulence, concealment and refusal to report; the second type is obstruction of verification; the third type is that the verifiers provide fraudulent information or reveal confidential information. The three types of actions bear with different level of penalty in different pilots in terms of fine and penalty type. Shanghai, Hubei, Guangdong and Shenzhen set out specific penalties for all three type of action, while Tianjin lays down rules for two types and Beijing only stipulate fine for emitters who fails to fulfill reporting obligation.

Key Issues Facing All Pilots

Stakeholder Engagement

The MRV mechanism is the basis for climate policy making and the operation of ETS. The process involves large groups of stakeholders, ranging from governmental officials, research institutions, compliance entities, to verifiers. In different stages of the MRV development, different stakeholders get involved.

MRV design (Formulation/call for submission). In the formulation of MRV, experts from universities, research institutes and consulting firms take part in the design of the MRV guidelines, led by the DRC for each city/province. After the draft version is finished, different stakeholders including experts in the enterprises and associations will be invited to give feedback. After that, the guidelines will be put on the official web and a call for public opinion is made. The guidelines will be finalized after taking into account the feedback from the public and experts.

Capacity building. To facilitate the accounting and reporting of GHG emissions and the verification process, the competent authority needs to organize trainings for personnel from the enterprises and verifiers. The lecturer could be from the local think tanks, for example organizations that drafted the accounting, reporting and verification guidelines, or it could be experts from abroad who have rich experiences on implementation of MRV mechanism. The competent authority may also provide guidance on compliance issues.

Implementation. The main stakeholders in the implementation phase are the compliance enterprises, verifiers and the competent authority. The enterprises carry out monitoring plan, collect data and submit reports. The verifiers will first check the emission report. After the document review and site visit, they can determine the final emissions, write the verification report and submit to the competent authority. The competent authority provides guidance along the process and ensures compliance.

Technical challenges

Boundary Determination. In determining accounting boundaries, enterprises rely on the provisions of the guidelines. However, there are practical issues may involve further interpretation. For example, within the boundary of an enterprise, there may be residential area for the staff. It could be difficult to discern whether to include the emission from the community without specific provisions.

Outsourcing is a common measure to lower the operating cost, for example staff canteen, heating of the building and so on. They are often located within the accounting boundary and owned by the reporting entity. However, reporting of the emissions may not be the responsibility of the owner but of the one who operates the facility, according to the accounting guideline of the Beijing pilot.

For the some service sectors such as real estate and shopping malls, there are often overlaps in emission accounting, since building or part of the building is often leased to other companies. If the lessee is also a controlled entity, the emissions caused by it must be excluded from the owner of the building.

Methodology Development. Calculation of the emissions is the key part of the MR guidelines and also a major challenge in MR design. Most calculation-based methodologies utilize standard method, which sum all emissions to provide the total. Emissions are calculated by multiplying activity data by an emission factor. However, the structure of some industries is complex. For example, the chemical sector may produce various types of products. Even in a sector with a simple product structure, its production process could be complex enough to make it difficult to calculate emission via standard method. So in this situation, the mass-balance method is often used.

Measurement-based methodologies are also available for emissions accounting, which often come with a higher cost and sometimes with an equivalent level of uncertainty. For example, in the power sector, most coal-fired power plants are already equipped with CEMS to monitor SO_2 emissions and they only need to insert a carbon probe into the chimney to monitor CO_2 emissions. However, due to turbulence in the chimney, the method of installation, and placement of the probe can have a great impact on CO_2 monitoring.

Acquisition of parameters for calculation-based methodology. In some cases it is a challenge for compliance entities to acquire the relevant parameters to calculate their emissions. For small companies, the only time they weigh the coal is when they pay for it. The consumption of coal will be recorded by rough estimation. For example, estimate the weight of a cart of coal and record how many cart are burnt. Or they can rely on the invoice from the supplier. Either way, inaccuracy of the activity data will be imposed.

Emission factors are calculated from NCV, carbon content per energy and oxidation factor. These parameters all need measurements. Small companies often lack of capability to measure these values by their own.

Meters for measurement of electricity, natural gas needs regular calibration to stay accurate, but in the reality, the calibration is sometimes forgotten or ignored. This may also constitute an obstacle for getting an accurate emission number.

Acquisition of evidence for cross check. As to verification, there are also challenges posed to the verifiers. Cross check of data source is a basic step in verification and invoices and receipts are the commonly used evidences. However, the reporting period is usually different from the financial cycle, which makes it harder to cross check with invoices.

Annex I: Capacity building workshops

An ETS is a relatively new concept to the authorities and industries in China, especially in terms of technical design and implementation. To facilitate the operation of ETS, the DRC in the pilots have organized training sessions for the industries and verifiers to get acquainted with relevant concepts, obligations, MRV guidelines and relevant procedures. Table 1 provides a list of the training workshops.

Table 1 MRV training list[3]

Beijing	2012.12.11	Training on enterprises GHG accounting and reporting
	2013.08.05	Training on enterprises GHG accounting and reporting and third party verification
	2013.12.03	Emission trading scheme training
Shenzhen	2013.05.8-9	Operational training on enterprises emission trading system
Hubei	2012.12.21	Training on enterprises GHG accounting, reporting and verification
Shanghai	2012.11.19-21	Training on emission reporting system
	2013.01.13	Workshop on Shanghai emission trading scheme

[3] Here we only list the training that we know or that we can find in the public channel.

Annex II: Technical supporting institutions

The MRV guidelines cover many sectors and rely on different expertise to develop. Therefore, a group of supporting institutes is needed to develop a series of MRV guidelines. The names of institutes can be found in 2.

Table 2 Technical supporting institutes

Beijing	National Center for Climate Change Strategy and international Cooperation Sino-Carbon Innovation & Investment Co. Ltd. Beijing University of Civil Engineering and Architecture
Tianjin	Not published yet
Shanghai	Shanghai Environment and Energy Exchange Shanghai Information Center Shanghai Energy Saving and Emission Reduction Center China Quality Certification Center Shanghai Energy Efficiency Center
Shenzhen	Market Supervision Administration Bureau of Shenzhen Municipality Cesi Information Technology Co.Ltd. Shenzhen Development and Reform Commettee Shenzhen Institute of Standard and Technology Shenzhen Academy of Metrology & Quality Inspection CTI Certification
Guangdong	CEPREI Certification South China University of Technology Sun Yat-Sen University Guangzhou Institute of Energy Conversion China Quality Certification Center
Chongqing	Not published yet
Hubei	Not published yet
National	Tsinghua University NCSC Sino-Carbon Innovation & Investment Co. Ltd.

Annex III: Resources

Local DRC:

www.bjpc.gov.cn

www.tjdpc.gov.cn

www.shdrc.gov.cn

www.gddpc.gov.cn

www.hbfgw.gov.cn

www.szpb.gov.cn

Pilot exchanges:

http://www.cbeex.com.cn/

http://www.chinatcx.com.cn/tcxweb/

http://www.cneeex.com/

http://cnemission.com/

http://www.hbets.cn/html/index.shtml

http://www.szets.com/Portal/home.seam

Annex IV: A Summary of the MRV Systems for the China's ETS Pilots

Elements	National	ETS Pilots						
		Beijing	Tianjin	Shanghai	Shenzhen	Chongqing	Guangdong	Hubei
1. Organizational management of MRV program	Competent Authority: NDRC-Department of Climate Change	Competent Authority: Local DRC; Relevant organization: financial, fiscal, statistical and other departments	Competent Authority: Local DRC, Relevant organization: Tianjin Financial Affairs Office, Tianjin Securities Regulatory Bureau, Tianjin Legislative Affairs Office, Tianjin Economic and Information Technology Commission, etc.	Competent Authority: Local DRC Relevant organization: '1.economic information technology, construction and traffic, ports, business, tourism, finance and other relevant departments, participating in determining the coverage of covered entities, the allocation of allowance and so on. 2.The Shanghai Energy Conservation Supervisory Center implements the administrative punishment.	Competent Authority: Local DRC Relevant organization: 1. market supervision department is responsible for the identification and record of 3rd party agency; 2. fiscal, financial management, housing construction, environmental protection and other relevant functional departments participate in relevant managing activities within their respective responsibilities.	Competent Authority: Local DRC	Competent Authority: Local DRC Relevant organization: 1.economic information technology, fiscal, housing construction, statistic, finance and other relevant departments implement the carbon emissions trading work according to their responsibilities respectively. 2.The governments in the prefecture-level cities are charge of the carbon emissions trading work in their respective administrative regions.	Competent Authority: Local DRC Relevant organization: Hubei Economy and Information Technology Commission, Hubei Provincial Department of Supervision, Department of Housing and Urban Rural Development of Hubei Province, Department of Transportation of Hubei Province, State owned Assets Supervision and Administration Commission of Hubei Provincial People's Government, Hubei Administration For Industry & Commerce, etc.

Elements		National	ETS Pilots						
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2. Sector scope:	1) Covered sectors	Power Generation, Power T&D, Ceramics, Magnesium smelting, Electrolytic Aluminum, Iron and metal, Chemical, Flat Glass, cement, civil aviation	Power, Heat, Cement, Petrochemical engineering, Other industrial sectors, Service sector	Power and Heat, Iron and Steel, Chemical, Petroleum refinery and ethylene, Oil and gas mining	Industrial sectors: Power and heat, Iron and Steel, Petroleum refinery, Chemical, Non-ferrous metal, Building material, Textile, Paper and Pulp, Chemical fiber; Non-industrial sectors: Airlines, Airport, Harbor, Shopping mall, Hotels, Commercial buildings, Railway station.	Power, Water utility, Manufacturer, Building	Not available	Power, Cement, Iron and Steel, petrochemical engineering	Iron and steel, chemical, cement, automobile manufacturing, power, ferrous metal, glass, paper
	2) Criteria for covered Entities	Reporting: energy consumption above 5000 tce or emission above 13000 tCO2e	Reporting entity: energy consumption above 2000 tce or GHG emission above 5000 tCO2.		Reporting entity: above 10000 tCO2.	Reporting entity: above 3000tCO2e and below 5000tCO2e.	Not available	Reporting Entity: emission above 10000 tCO2 or energy consumption above 5000 tce	
			Compliance entity: Sum of direct emission and indirect emission above 10000 tCO2.	Compliance entity: Direct and indirect emission above 20000 tCO2	Compliance entity: Industrial sector: above 20000 tCO2. Non-industrial sectors: above 10000 tCO2	Compliance entity: Industries: above 5000 tCO2e; Public Buildings: above 20000 m2; Governmental Buildings: above 10000 m2.		Compliance entity: emission above 20000 tCO2 or energy consumption above 10000 tce	Compliance entity: energy consumption above 60000 tce

Elements		National	ETS Pilots						
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3. Basic principles and objectives		Not available.	Emitters Report, Comprehensiveness, Consistency, Comparability, Transparency, Objectiveness	Comprehensiveness, Consistency, Accuracy, Transparency	Comprehensiveness, Consistency, Authenticity, Transparency, Economy	Relevance, Comprehensiveness, Consistency, Accuracy, Transparency	Not available	Relevance, Comprehensiveness, Consistency, Accuracy, Transparency	Comprehensiveness, consistency, transparency, authenticity, accuracy
4. Boundaries:	1) Legal person based or other way	Legal person	Legal Person	Legal Person	Legal Person	Organizational boundary and operational boundary	Not available	Organizational boundary and operational boundary	Legal person
	2) Activities	Production and operating activities	Production and operating activities	Production and operating activities (For power and heat sector, electricity and heat consumption by residence are included)	Production and operating activities	Not specified	Not available	Not specified	Exclude fugitive emission and non productional mobile source
	3) Emission type	Direct emission: fossil fuel combustion and process emissionIndirect emission: emissions caused by electricity and heat consumption	Direct emission: by stationary fossil fuel combustion(mobile source not included), process emission and waste treatment;Indirect emission: electricity consumption	Direct emission: fossil fuel combustion and process emissionIndirect emission: electricity and heat consumption	Direct emission: fossil fuel combustion and process emission;Indirect emission: electricity and heat consumption.	Scope 1: direct emission including combustion, industrial process and fugitive emission scope 2: indirect emission cause by energy consumption, including electricity, heat, cooling and steam.Scope 3: other indirect emission. Report voluntarily.	Not available	Direct emission: combustion; industrial production emission; waste treatment; fugitive emission.Indirect emission: electricity and heat consumptionCO2 transfer: when CO2 is transferred out of boundary as product or raw material, this portion of emission should	Direct emission: all fuel combustions within boundaries, including stationary combustion, productional mobile source and process emission;Indirect emission: electricity, heat and steam

Elements		National	ETS Pilots						
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								be excluded.	
5. GHG type		CO2/CH4/N2O/HFCs/PFCs/SF6	CO2	CO2	CO2	CO2/CH4/N2O/HFCs/PFCs/SF6	Not available	CO2	CO2
6. Accounting methodology:	1) Calculation-based and/or measurement-based methodology	Calculation-based methodology: Standard methodology and mass balance methodology	Calculation-based methodology: Standard methodology and mass balance methodology; Companies may apply measurement-based methodology of which the uncertainty level shall be smaller than calculation-based methodology	Calculation-based methodology: Standard methodology and mass balance methodology;	Calculation-based and measurement-based method both can be used. When measurement-based is opted, the result should be confirmed by calculation-based method.	Should choose methodologies that can minimize uncertainty level and provide accurate, consistent and replicable result: Calculation-based: 1.standard method(emission factor) 2. mass balance 3. modeling 4. equipment correlation Measurement-based: 1.continuing measurement. 2.interval measurement Mixed method of calculation and measurement	Not available	Calculation-based: 1.standard method(emission factor) 2. mass balance Measurement-based: 1.continuing measurement. 2.interval measurement	Calculation-based: standard method and mass balance

Elements		National	ETS Pilots						
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	2) Data requirement	**Data for fossil fuel combustion:** Fuel consumption: Mainly derived from the energy consumption account or statistical statement.NCV: The enterprise can use default value listed on the guideline or test by themselves or other qualified entity.Carbon content: For the power sector, it is required to test the value, for other sector, the enterprise can test or use default value.Oxidation factor: The enterprise can use default value listed on the guideline or test by themselves or	**Different regulation about reporting entity and compliance entity: For the trading entity, it is stricter.** **Data for fossil fuel combustion (for the compliance entity):** Fuel consumption: Derived from the energy consumption account. NCV: For historic emissions, default value can be used. For yearly emissions, NCV of the major fuel must be measured, others can use default value. Carbon content and Oxidation factor: For historic emissions, default value can be used. For yearly emissions, the default value or tested value can be used. For the power sector, it is required to test	**Data for fossil fuel combustion:** Fuel consumption: Derived from the energy balance sheet .NCV: the value of power generating boiler and industrial boiler must be tested, for other equipment, the default value can be used.Carbon content and Oxidation factor: Default value or tested value. **Data for process emission:** Material consumption: Mainly derived from the statistical statement.Carbon content: Tested at least 12 times each year and the average value can be used. **Indirect emission:** Power and heat consumption: from the sales receipt or invoicesEmission	**Data for fossil fuel combustion :**Fuel consumption: Derived from the stock change.NCV, Carbon content and Oxidation factor: Default value or tested value. **Data for process emission:** Material consumption: Derived from the stock change.Carbon content: Default value or tested value. **Indirect emission:**Power and heat consumption: from the sales receipt or invoicesEmission factor: Default value in the guideline	Activity data: can be classified into 3 categories and higher level is recommended. 1) continuous measurement: by CEMS 2) intermittent measurement: 3) self-evaluated dataEmission factor: can be classified into 6 categories and higher level is recommended. 1) Measured value; 2) Derived from experience; 3) Provided by equipment supplier 4) Regional emission factor 5) National emission factor 6) International emission factor	Not available	**Data for fossil fuel combustion:** Fuel consumption: From the account or voucher of clearingNCV: Tested each batch for the enterprise, tested each shift on the equipment, which forms the test reportCarbon content: Tested each batch for the enterprise, tested each shift on the equipment, which forms the test report. **Data for process emission:** Material consumption: Derived from the accountCarbon content: Default value or tests value. **Indirect emission:** Power and heat consumption: from the accountEmission factor: Default value in the	Not available.

Elements		National	ETS Pilots						
			Beijing	Tianjin	Shanghai	Shenzhen	Chongqing	Guangdong	Hubei
		other qualified entity. **Data for process emission:** Material consumption: Mainly derived from the energy consumption account or statistical statement.Carbon content: the enterprise can test or use default value. **Indirect emission:** Power and heat consumption: from the sales receipt or invoicesEmission factor: Default value in the guideline	the value of import emission equipment, for other sector, the enterprise can test or use default value. **Data for process emission:** Material consumption: Mainly derived from the statistical statement.Carbon content: The enterprise can test or use default value.**Indirect emission:**Power consumption: from the sales receipt or invoicesEmission factor: Default value in the guideline	factor: Default value in the guideline				guideline	

Elements		National	ETS Pilots						
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7. Monitoring plan	1) Contents	Not specified	Not required	1. General information 2.Members of monitoring team 3.Monitoring scope 4.Monitoring plan (frequency, method, basis) 5.Monitoring report management	1.Company general information 2.Boundary3.Accounting methodology option and explanation4.Uncertainties and coping measures	Not specified	Not available	1.Company general information 2.GHG emission management personnel and contact details 3.Boundary description 4.CO2 emission reporting scope 5.Relevant data source 6.Data requirement of measurement data 7.Metering equipment of activity data 8.Data collection, quality management, record and archive 9.Other remarks	1.Responsible personnel and contact detail 2.Desciption of organization and operational boundaries 3.Monitoring method for facilities and emission sources 4. Remarks for quantification methodology 5.Remarks for parameters 6.Description of monitoring equipment and its location, precision, calibration frequency and status 7.Remarks for data collection, processing, control. 8.Remedial measures for equipment malfunction leading to data lost 9.Detail monitoring method for exceptional emission source

Elements		National	ETS Pilots						
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	2) Requirements	Not specified	Not required	Company should make monitoring plan and submit to competent authority. During the reporting period, company should follow the monitoring plan, collect relevant data and report implementation status and improve monitoring plan.	Monitor relevant parameters in accordance with methodology chosen.Calculation-based method: activity level such as energy consumption, raw material consumption, product and semi product, based on invoice or stock log; and emission factors such as NCV, carbon content per energy, oxidation factor and process emission factor.Measurement-based: concentration and volume	Not specified	Not available	When content 1~6 have significant change, monitoring plan should be renewed and sent in for review. When other information have changed, company should keep internal record for future verification.	During monitoring period, company should submit revision application if monitoring plan become not fit to use, including following content: time period, reason for revision, revision content, whether affects data quality, whether meet the requirements set out in the guidance

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8. QA & QC	1) Quality assurance	1. Designate specialized personnel for GHG accounting and reporting.2. Establish robust GHG emission monitoring plan.3. Keep good record of GHG emission and energy consumption. 4. Develop data management system and archive.5. Establish internal review for GHG emission report	Regularly calibrate equipment; designate department for GHG management and specify personnel for data collection and management; establish norm for monitoring and data management; develop coping mechanism in case of missing data and activity change; develop data archive norm	Establish carbon information management procedures, including following measures: 1.affirm duty and obligations of the responsible personnel2.prepare training program for relevant staff3.develop carbon information and data collection and monitoring system4.build carbon information record keeping and archive system, preserve data for at least 10 years5.set up internal review team for GHG accounting		Data quality management1.Develop data quality management plan2.Examine data collection, input and process 3.Examine emission factor4.Examine calculation5.Examine spread sheet process step	Not available	1.establish monitoring team2.monitoring personnel capacity building3.data source and evidence4.uncertainty analysis5.data quality management measures	Conduct data quality analysis according with DB42/T 727-2011. Level 1 data can be applied directly; level 2 and 3 data should abide by conservativeness and provide evidence; level 4 and 5 data cannot be used.Preserve relevant records and documents for 5 years, including supporting documents (source of data), permit and revision of monitoring plan, documents for calibration of equipment, monitoring plan and emission report and verification report.Inventory and report quality management:1.set up GHG manangement working group2.set GHG manangement

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									plan, keeping record3.clarify quantification and parameter choice and prepare emergency measures4.develop robust data collection system5. establish document archive procedures.
	2) Quality control	-	-	-	1.Reexamine data by the emitter through horizontal and vertical examination. 2.Emitter should calibrate equipment regularly.	Data quality control 1.qualitative analysis 2.Uncertainty analysis Data quality improvement	Not available	data quality management measures 1.identify errors and omission 2.specify GHG emission management personnel's obligation 3.record keeping and archive 4.implement and assess relevant training for GHG emission accounting 5.develop an information collection system 6.maintain and calibrate equipment 7.regularly assess accuracy	Not available.

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								8.regularly conduct review, improve information management	
	3) Uncertainty level	Not specified	Error propagation method (including multiplication method, addition and subtraction method)	Analyze and report discrepancy between accounting result and true value, taking into consideration 1) low monitoring accuracy, 2)using default value, 3)missing data, 4)misuse of formulas, 5) flaw of accounting guidance	Company should report data uncertainties and corresponding counter measures. Uncertainties derive from 1) lack of comprehensiveness, 2) alternate data, 3)representativeness of data, 4) measurement errors. Uncertainties can be totaled up through law of error propogation or Monte Carlo simulation.	Qualitative analysis: 1. explain following categories of uncertainties: 1) incomplete data due to unknown emission or not fit of measurement method 2) modelling 3) lack of data 4) data representativeness 5) random sampling 6) measurement accuracy 7) report or categorization error 8) data missing Quantitative analysis: Error propagation or Monte Carlo simulation method.	Not available	Referred to "JJF1059-1999 uncertainty assessment and representation"	Not available.

Elements	National	ETS Pilots						
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9. Reporting contents and template	1.General information 2.Total GHG emission 3.Activity data and its source 4.Emission factor and its source.	1.General enterprise information 2.Information of stationary installation and electricity meter 3.Direct emission 4.Indirect emission 5.Total emission 6.Uncertainty analysis 7.GHG control measure 8.Other production information 9.Authenticity statement	1.Accounting basis 2.General information 3.Emission unit and emission source identifications 4.Emission accounting 5.Implementation status of monitoring plan 6.Unertainty analysis and quality control 7.Emission reduction plan	1.Company general info 2.Boundary 3.Production process relevant to GHG emission 4.Monitoring plan and its implementation 5.GHG accounting 6.Cause of uncertainty and mitigation measures 7.Other explanatory remark 8.Authenticity statement	GHG inventory: 1.emission source identification 2.activity data 3.emission factor 4.calculation 5.summary Report 1.Reporter 2.Reporting period 3.Boundaries 4.Quantification of emission 5.Biomass related emission description 6.Emission exclusion description 7.Emission inventory in historic baseline year and baseline year 8.Desciption for emission data change or recalculation 9.Description for Methodology selection 10.Explanation for any changes in quantification 11.Reference	Not available	1.Genernal information 2.Emission summary 3.Emission source identification 4.Acitivity data and emission factor of each source and fuel NCV, CPE, Oxidation rate 5.when calculated with mass balance, report energy and material input and output, storage change and carbon content 6.Report corporate change that lead to emission change and its reason and starting date 7.Specific requirements by each sector	1. general information 2. permitting status of monitoring plan and its conformity 3.desciption of source identification, quantification method and parameters source 4. calculation and result 5.conformity of calibration

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10. Reporting system	1) Format: electronic or other form?	Not available.	Web-based reporting system	Not available.	Web-based reporting system	Web-based reporting system	Not available	Web-based reporting system	Not available.
	2) Relationship with registry system	Not available.	The Reporting system sends final emission number to the Registry	Not available.	Not available.	The Reporting system sends final emission number to the Registry	Not available	Not available.	Not available.
11. Verification	1) Responsible institutions (verification body)	Not available.	Verified by third party verifier; There are 15 verifiers; Paid by DRC	Verified by third party verifier; There are 4 verifiers; Paid by DRC	Verified by third party verifier; There are 10 verifiers; Paid by DRC	Verified by third party verifier; There are 18 verifiers; Paid by DRC	Not available	Verified by third party verifier; There are 5 verifiers; Paid by DRC	
	2) Basic principles	Not available.	Independency; impartiality; confidentiality	Not available.	Independence, Impartiality, Authenticity, Confidentiality	Independence, Integrity, Impartiality, Professionalism	Independence, impartiality, integrity, professionalism	independence, impartiality, moral code (integrity, confidentiality, discretion)	Independence, impartiality, integrity, professionalism

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	3) Verification guidelines and regulations	Not available.	Beijing ETS Verifier Interim Regulation; Beijing CO2 Accounting and Reporting Guidance for Enterprises; Relevant laws, standard and norm	Not available.	1.Trial Measures for Shanghai ETS Management 2.Guidance on Verification for Shanghai ETS	ISO 14064-1:2006 gases—Part1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals ISO 14064-3：2006 Greenhouse Gases— Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions	1.Trial measures for Chongqing ETS 2.Detailed rules of GHG accounting, reporting and verifying for Chongqing Enterprises 3.Guidance on GHG accounting and reporting for Chongqing industrial enterprises	GB/T19011-2003 Quality and Environmental management system audit guidance ISO14064-3:2006 GHG part III Specification with guidance for the validation and verification of greenhouse gas assertions	Hubei ETS Regulation; Rules for MRV implementation for Hubei ETS;
	4) Verification reqirements and procedures	Not available.	Preparation: Sign verification contract; Prepare for verification Implementation : Document review; field visit; report writing; internal reviewReport submission; archive	Not available.	Not available.	1.Verification preparation (determine objective, principles, assurance materiality) 2.Verification procedure: 1).Document review: emission report; GHG inventory; GHG information management system; technology flowchart; power metering network;	Requirement: 1.conformity of organization boundaries 2. conformity of emission source boundaries 3. comprehensiveness of emission source 4. accuracy of activity data 5. normative of data quality management Procedures: 1.Consignment 2.Preparation of verification	1.Initiation of verification: a)designate team leader, set up verification team; b)determine objective, scope and principles; c)establish contact with verification subject; d)document review, analyze risks; e)make verification plan, sampling plan and document list for field visit; f)dividing field	1.Verification application and signing contract 2.Choose verification team 3.Division of labor 4.Make verification plan 5.Implementing verification (document review, field visit, summarize founding) 6.Report writing

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						corporate map; corporate structure; industrial corporate energy procurement, consumption and storage table; other relevant document 2).Make sampling plan based on scope, principle, assurance level, data and data type, representative methodology, potential error, overlook and misinterpretation, previous verification result, high risk factor. determine sampling approach: if there are multiple sites, differences between each site should be identified. Each site should be covered if there is large difference; otherwise draw sampling site whose number is square root of	3.Document review 4.Field visit 5.Report writing and internal review 6.Submission verification report	visit tasks 2.field visit: a)first meeting; b) communication; c)duty of the representative of the controlled entity; d)field information collection and verification; e)issue non-compliance and offer rectification options; f)prepare verification conclusion; g)final meeting	

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						total site number.Every sample site should have its own verification plan to determine percentage of the covered sources.c. sampling plan should be adjusted if there is data material bias. 3).Make verification plan: including general information; first phase field visit plan; second phase field visit plan; 4) field visit: check production activity; metering equipment; primary data; relevant evidence; calculation; interview with relevant personnel 3. Assessment 1).GHG information management system assessment			

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						2).GHG data and information assessment 3).Assessment conformity with verification regulation 4).GHG statement assessment			
	5) Contents and formats of verification report	Not available.	Content: 1.objective,scope and principles 2.verification process and method 3.General information of the company 4.Boundary and emission source type 5.Conformity with the Accounting Guidance 6.Assumptions, reference and data difference 7.Conformance to calibration standard 8.Emission calculation and uncertainty level 9.Conclusion 10.Non-compliance issued and rectification 11.Recommendat	Not available.	Not available.	1.Name of Verifier 2.assurance level 3.material deviation 4.scope 5.reporting period 6.principles 7.verification team 8.emission inventory 9.verification method and procedureswheth er all non-compliance have been rectified and cleared 10.Conclusion 11.Reporter 12.Report date	Not available.	1.cover 2.legal statement, objective, scope and principles 3.name,address and registration number of the verification subject 4.name and contact detail of the person responsible for GHG reporting 5.name and address of the verifier 6.informaiton of the verification team 7.facility, emission source and its emission 8.time and persons of the field visit 9.evidence list 10.foundings of the verification 11.conclusion	1. Verification procedures and steps 2.Status of verification 3.Implementation status of monitoring plan 4.Emission calculation and result 5.Conclusion 6.Changes in project

Elements		National	ETS Pilots						
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			ion for future accounting activity 12.Other remark 13.Rerfence					12.signature of verification team member 13.seal of the verifier	
12.Deadlines	1)Time for reporting	Not available.	Before 15th of April	Before 30th of April	Before 31st Of March	Before 31st Of March	Not available.	Not specified	28-Feb
	2) Deadline for submission of verification report	Not available.	Before 30th. April	Before 30th. April	Before 30th. April	Before 30th. April	Not available.	Not specified	
13. Enforcement and penalties for non-compliance		Not available.	Penalty for not reporting GHG emission: warning, cannot apply for preferential support and funding by the government in 2 years, qualification for fixed asset investment in non energy saving and emission reduction area suspend for 2 years, face 50~100 thousand fine.	1. Company who fails to fulfill monitoring, reporting obligation will be disqualified for relevant preferential policies for 3 years. 2. Verifier who provides fraudulent information or reveal confidential information and cause economic lost to the company must compensate the lost and bear legal liability if breach criminal law.	1.Fraudulence, concealment, refusal to report will be subject to 10~30 thousand RMB fine. 2. Obstruction of verification without reasonable cause will face 30~50 thousand RMB fine. 3. Verifiers whose report contain fraudulent information or reveal confidential information will face 30~100 thousand RMB fine.	1.Company fails to submit verification report face 10~50 thousand RMB fine, for gross violation, 50~100 thousand RMB. 2.Verifier who provide fraudulent information faces 10~50 thousand RMB fine, and suspend qualification for verification for 5 years when overdue rectification and faces 100~200 thousand RMB fine. 3.If verifier reveals confidential	Not available.	1.Fraudulence, concealment, refusal to report will be subject to 10~30 thousand RMB fine. 2. Obstruction of on site verification, refusal to provide evidence will face 10~30 thousand RMB fine, 50 thousand RMB for gross violation. 3. Verifiers whose report contain fraudulent information or reveal confidential information will face 30~50 thousand RMB fine.	1.Controlled entity who fails to report GHG emission will face penalty of 5000RMB fine. 2.Company who fails to cooperate with verifiers and provide relevant documents will receive half allowances as previous year. 3.Verifier who fails to abide by the independent, objective and impartial principles will subject to 3 times of the illicit income, up to 150 thousand RMB; in case of no illicit income, fine up

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					information, its qualification will be suspended permanently and face 200~500 thousand RMB fine.			to 50 thousand RMB