

Annex 8

# **Guidelines for Accounting and Reporting Greenhouse Gas Emissions**

## **China Cement Production Enterprises**

### **(Trial)**

# Instructions

## I. Purpose and Significance of the Guidelines

In response to the request for “establishing and improving a system for calculating the Greenhouse Gas (GHG) emissions and gradually creating a carbon emission trading market” as made in the *Outline of the 12th Five-Year Plan*, and in response to the request for “accelerating buildup of the working systems for accounting GHG emissions at national, local and enterprise levels, and implementing a system that allows the key enterprises to directly report their data on GHG emissions and energy consumption”, in the *Work Plan for GHG Emission Control during the 12<sup>th</sup> Five-Year Plan Period* (No. 41 [2011] issued by the State Council), in order to ensure that the target of reducing the intensity of carbon dioxide emissions per unit of GDP by 40%-45% by 2020 relative to 2005 will be achieved, the National Development and Reform Commission (NDRC) has formulated the *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Cement Production Enterprises (Trial)* (the Guidelines), with the aim to help enterprises (i) scientifically calculate and report in a standard format their GHG emissions, (ii) improve the formulation of their GHG emissions control plans or carbon emission trading strategies, (iii) actively participate in carbon trading, and (iv) enhance their social responsibilities. Meanwhile the Guidelines are designed to pave the way for the competent authorities to establish and implement the reporting system for GHG emissions from key enterprises in support of decision-making processes.

## II. Preparation Process

The Guidelines have been developed by experts from the Institute of Energy, Environment and Economy, Tsinghua University, as entrusted by the National Development and Reform Commission. The writing team has taken into account the research findings and practical experiences for calculating and reporting GHG emissions from relevant enterprises both in China and overseas, as well as the *Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial)*, issued by the NDRC General Office. Through on-site investigations, in-depth studies and experimental accounting based on individual cases, the writing team completed the development of the *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Cement Production Enterprises (Trial)*. Efforts have been made to ensure that the Guidelines are science-based, comprehensive, standardized and practical. In the course of its preparation, the writing team has received strong support from relevant experts from the China Building Materials Academy, China Building Material Test & Certification Group Co. Ltd, and other industrial associations and research institutes.

### **III. Main Contents**

The Guidelines consist of the main text and two appendices. The seven sections of the main text have clearly defined the application scope of the Guidelines, cited documents and references, terminology and definition, accounting boundary, accounting methodology, quality assurance and documentation, as well as the basic framework of enterprise-based GHG emission reports respectively. The calculated GHG emissions for the purposes of the Guidelines is carbon dioxide (without calculating emissions of other GHGs), and emission sources include fuel combustion, industrial production processes and consumption of net purchased electricity and heat corresponding to relevant production processes. The application scope covers the enterprises with qualified legal entities and independently accounted units that are treated as legal entities, all being involved in the production of cement clinker and cement products.

### **IV. Issues that Need Clarification**

The application of the Guidelines to account and report GHG emissions within the boundary of cement production enterprises requires related data on the activity levels and emission factors. The Guidelines have taken into consideration related references and data at home and abroad such as the *Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial)*, the *China Energy Statistical Yearbook 2012*, the *IPCC Guidelines for National Greenhouse Gas Inventories* and the *Protocol of Carbon Dioxide Emissions Reduction for Cement Industry*. The Guidelines provide recommended values for emission factors for common fossil fuels and alternative fuels for the enterprises' reference.

Biomass fuel may be found in the fuel oil, alternative fuel used or the co-treated wastes during the production process of cement enterprises. Emissions of carbon dioxide from these kinds of biomass fuel are considered as hazard-free to the climate and thus require no accounting and reporting.

Considering the fact that enterprise-based GHG emission accounting and reporting are a completely new and complicated endeavor, some inadequacies may be found in practical application of the Guidelines, and it is hoped that those application units may provide their individual feedbacks in a timely manner, all aimed at making further revisions in the future.

The Guidelines are published by the National Development and Reform Commission, which is responsible for their interpretation and revision when appropriate.

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## **1. Application Scope**

The Guidelines apply to the accounting and reporting of GHG emissions from cement production enterprises in China. Enterprises operating in cement production within the Chinese territory may calculate and report their GHG emissions, and formulate their individual GHG emission reports by using the methods provided in the Guidelines.

## **2. References**

The references cited or quoted in the Guidelines mainly include:

*Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial); and China Energy Statistical Yearbook 2012.*

The following documents have been taken into consideration in the development process of the Guidelines:

*1996 IPCC Guidelines for National Greenhouse Gas Inventories;*

*2005 Protocol on CO<sub>2</sub> Emission Reduction for Cement Industry: CO<sub>2</sub> Accounting and Reporting Standards;*

*The Inventory of U.S. Greenhouse Gas Emissions and Sinks (EPA 2008); and*

*European Union Emission Trading Scheme (EU-ETS)(The First and Second Reporting Period).*

## **3. Terminology and Definitions**

The following terminology and definitions apply to the Guidelines.

### **3.1 Greenhouse Gases (GHGs)**

A greenhouse gas is natural or man-made atmospheric component in gaseous state that absorbs and emits radiation within the thermal infrared range. The GHGs addressed in the Guidelines refer to the six types of GHGs which are controlled under Annex A of the Kyoto Protocol, and they are: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>).

### **3.2 Reporting entity**

A reporting entity shall be an enterprise with a legal person status or an independently accounted unit that can be deemed a legal person, which has performed

as a GHG emission actor and therefore should calculate and report its GHG emissions on a regular basis.

### 3.3 Emissions from fuel combustion

Emissions from fuel combustion refer to the GHG emissions generated from reaction of fuel to oxygen in a combustion process; for example, emissions generated from the combustion of raw coal, fuel oil and other fossil fuels, as well as the combustion of non-biomass carbon contained in alternative fuel and co-treated wastes.

### 3.4 Emissions from industrial production processes

Emissions from industrial production processes refer to the GHG emissions generated from the physical or chemical changes of raw materials other than fuel combustion during the production processes; for example, emissions from the decomposition of carbonate contained in raw materials and the calcination of non-fuel carbon within raw materials.

### 3.5 Emissions from consumption of net purchased electricity and heat

Emissions from consumption of net purchased electricity and heat refer to the CO<sub>2</sub> emissions from electricity or heat generation process corresponding to the consumption of net purchased electricity and heat (steam and hot water) by a cement production enterprise.

### 3.6 Activity level

Activity level refers to the quantitative amount of production or consumption activities, which lead to GHG emissions or removals, for examples, amount of fossil fuel combustion in the cement production processes, consumption of raw materials, amount of purchased/sold electricity or steam, etc.

### 3.7 Emission factor

Emission factor refers to the factor used to quantify the GHG emissions per unit of activity level; for example, amount of GHG emissions from production of one ton of cement clinker, and the amount of CO<sub>2</sub> emissions corresponding to one kilowatt-hour of on-grid electricity, etc.

### 3.8 Rate of carbon oxidation

Rate of carbon oxidation is the percentage at which carbon in fuel(s) has been oxidized in a combustion process.

## **4. Accounting Boundary**

An enterprise with a legal person status or a unit that can be deemed a legal person with cement production as main business is the boundary for accounting and reporting GHG emissions for the purposes of the Guidelines. A reporting entity should regard the

enterprise as the boundary for calculating and reporting all the GHG emissions from the production facilities within it. The scope of production facilities includes direct production systems, auxiliary production systems and affiliated production systems which directly serve the production service. The auxiliary production system consists of drive, electricity supply, water supply, test, machine maintenance, storehouse and transportation; and the affiliated production system includes production command system (factory headquarters) and departments and units within the factory which serve the production, such as staff canteen, workshop bathroom and healthcare centers.

If a cement production enterprise produces other products that generate GHG emissions in those production activities, it should calculate and report the emissions as requested in the GHG emission accounting and reporting guidelines for the enterprises in the relevant sectors. If no accounting methodology is available, the enterprise should only calculate emissions from fossil fuel combustion in such production activities.

To be specific, key emission sources within the accounting boundary for cement production enterprises include:

#### 4.1 Combustion of fossil fuels

Emissions come from such sources as the combustion of raw coal in the cement kilns and fuel oil in heat treatment and transportation equipment.

#### 4.2 Combustion of non-biomass carbon contained in the alternative fuel and co-processing wastes

Emissions come from the combustion of scrap tires, waste oil, waste plastics and other alternative fuels as well as combustion of non-biomass carbon contained in wastes like sewage and sludge.

#### 4.3 Decomposition of carbonate in raw materials

During the cement production process, CO<sub>2</sub> is emitted from the decomposition of carbonate in clinker, in dust from the kiln vent stack (kiln head) and from the bypass vent.

#### 4.4 Calcination of non-fuel carbon within raw materials

Combustible non-fuel carbon contained in the ingredients applied as raw materials, for example, slag, gangue and high carbon fly-ash, can be converted into CO<sub>2</sub> in the high-temperature calcination process of raw materials.

#### 4.5 Purchased electricity and heat

CO<sub>2</sub> emissions come from the electricity and heat generation process corresponding to the amount of the net purchased electricity and heat (i.e. steam) consumed by the cement enterprise.

#### 4.6 Emissions from the production of other products

If a cement production enterprise produces other products that generate GHG emissions in the production activity, such production processes should be included in the GHG emissions accounting of the enterprise.

### 5. Accounting Methodology

The complete workflow for a reporting entity to account and report its GHG emissions consists of the following steps:

- I. Accounting boundary;
- II. Emission sources;
- III. Data for activity level;
- IV. Data for emission factors;
- V. Calculation of the fuel combustion emissions, industrial production emissions and emissions corresponding to consumption of the net purchased electricity and heat; and
- VI. Calculation of the total GHG emissions of the enterprise.

The total CO<sub>2</sub> emissions of a cement production enterprise are equal to the sum of emissions from all the fuel combustion within the enterprise boundary, emissions of the industrial production process and emissions corresponding to the net purchased electricity and heat. It can be calculated according to Equation (1):

$$\begin{aligned} E_{CO_2} &= E_{combustion} + E_{process} + E_{power\&heat} \\ &= E_{combustion1} + E_{combustion2} + E_{process1} + E_{process2} + E_{power\&heat} \end{aligned} \quad \dots(1)$$

where,

$E_{CO_2}$  represents the total CO<sub>2</sub> emissions with ton (t) as the unit (tCO<sub>2</sub>);

$E_{combustion}$  refers to the CO<sub>2</sub> emissions of fuel combustion activity, with ton (t) as the unit (tCO<sub>2</sub>);

$E_{combustion 1}$  refers to the CO<sub>2</sub> emissions of fossil fuel combustion activity, with ton (t) as the unit (tCO<sub>2</sub>);

$E_{combustion 2}$  stands for the CO<sub>2</sub> emissions of the consumption of alternative fuels or wastes, with ton (t) as the unit (tCO<sub>2</sub>);

$E_{process}$  means the CO<sub>2</sub> emissions of the industrial production process, with ton (t) as the unit (tCO<sub>2</sub>);

$E_{process1}$  refers to the CO<sub>2</sub> emissions of the decomposition of carbonate in raw materials in the production process, with ton (t) as the unit (tCO<sub>2</sub>);

$E_{process2}$  refers to the CO<sub>2</sub> emissions of the calcination of non-fuel carbon within raw materials in the production process, with ton (t) as the unit (tCO<sub>2</sub>); and

$E_{power\&heat}$  refers to the CO<sub>2</sub> emissions corresponding to the net purchased electricity and heat by the enterprise, with ton (t) as the unit (tCO<sub>2</sub>).

## 5.1 Emissions from the combustion of fossil fuels

### 5.1.1 Calculation equation

The fossil fuels, for example, physical coal and fuel oil will be consumed for the cement production. The CO<sub>2</sub> emissions from the combustion of fossil fuels can be calculated according to Equations (2), (3) and (4).

$$E_{combustion} = \sum_{i=1}^n (AD_i \times EF_i) \quad \dots\dots(2)$$

where,

$E_{combustion1}$  refers to the CO<sub>2</sub> emissions from fossil fuel combustion within the accounting and reporting period, with ton (t) as the unit (tCO<sub>2</sub>);

$AD_i$  is the activity level of the  $i$  type of fossil fuel within the accounting and reporting period (unit: GJ);

$EF_i$  is the emission factor of the  $i$  type of fossil fuel (unit: t CO<sub>2</sub>/GJ); and

$I$  represents a type of fossil fuels that is consumed on a net basis.

The activity level of the  $i$  type of fossil fuel consumed for the accounting and reporting period can be calculated according to Equation (3).

$$AD_i = NCV_i \times FC_i \quad \dots\dots(3)$$

where,

$NCV_i$  is the average lower calorific value of the  $i$  type of fossil fuel for the accounting and reporting period; for solid or liquid fuels, the unit of the value is GJ/t; for gas fuels, the unit of the value is GJ/10<sup>4</sup>Nm<sup>3</sup>; and

$FC_i$  is the net consumption amount of the  $i$  type of fossil fuel for the accounting and reporting period; for solid or liquid fuels, the unit of consumption is ton (t); and for gas fuels, the unit of consumption is 10<sup>4</sup>Nm<sup>3</sup>.

The CO<sub>2</sub> emission factor for fossil fuels should be derived from Equation (4).

$$EF_i = CC_i \times OF_i \times \frac{44}{12} \quad \dots\dots(4)$$

where,

$CC_i$  is the carbon content per unit of calorific value of fossil fuel  $i$  (unit: tC/GJ); and  
 $OF_i$  is the rate of carbon oxidation of the  $i$  type fossil fuel (unit: %).

### 5.1.2 Acquisition of data for activity level

The net consumption amount of various fossil fuels can be determined according to the measurement data of various fossil fuels consumed during the accounting and reporting period.

The enterprise can apply the average lower calorific values provided in the Guidelines, as presented in the Table 2.1 of the Appendix. Where possible, enterprises can conduct measurements or entrust qualified professional institutions to implement tests. Alternatively, they may adopt measured values provided in the voucher of clearing written with the interested party. In the case of actual measurements, lower calorific values of fossil fuels should be identified according to related standards, for example, *Determination of Calorific Value of Coal (GB/T 213)*, *Determination of Calorific Value of Petroleum Products (GB/T 384)* and *Energy Determination for Natural Gas (GB/T 22723)*.

### 5.1.3 Acquisition of data for emission factor

Enterprises may use the default carbon content per unit of calorific value and the rate of carbon oxidation provided in the Guidelines, for example, as shown in Table 2.2 and Table 2.3 under Appendix.

## 5.2 Emissions from the combustion of non-biomass carbon contained in the alternative fuel or wastes

Some cement enterprises use alternative fuel or co-treated wastes in their production. Emissions from the combustion of non-biomass carbon contained in the alternative fuel or wastes can be calculated according to Equation (5).

$$E_{combustion2} = \sum_i Q_i \times HV_i \times EF_i \times \alpha_i \quad \dots\dots(5)$$

where,

$E_{Combustion 2}$  refers to the CO<sub>2</sub> emissions of the combustion of non-biomass carbon contained in the alternative fuel or wastes for the accounting and reporting period (unit: tCO<sub>2</sub>);

$Q_i$  is the consumption of various alternative fuel or wastes (unit: t);

$HV_i$  is the weighted average lower calorific value of various alternative fuels or wastes (unit: GJ/t);

$EF_i$  means the CO<sub>2</sub> emission factor for combustion of various alternative fuel or wastes (unit: tCO<sub>2</sub>/GJ);

$\alpha_i$  is the non-biomass carbon content in various alternative fuel or wastes (unit: %);  
and

*l* represents the type of alternative fuels or wastes.

The consumption amount of various alternative fuel or wastes should be accounted according to production records within the accounting and reporting period, or the measurement data of the amount of alternative fuel or wastes imported into the enterprise.

The average lower calorific value, CO<sub>2</sub> emission factor and non-biomass carbon content may be accounted according to the data provided in the Guidelines as shown in Table 2.4 of Appendix II.

### 5.3 Emissions from the decomposition of raw materials

The CO<sub>2</sub> emissions from the decomposition of raw materials are comprised of three parts: the CO<sub>2</sub> emissions corresponding to the clinker; the CO<sub>2</sub> emissions corresponding to the dust from the kiln vent stack (kiln head); and the CO<sub>2</sub> emissions corresponding to dust from the bypass vent. The CO<sub>2</sub> emissions of the decomposition of raw materials can be derived from Equation (6).

$$E_{process1} = \left( \sum_i Q_i + Q_{ckd} + Q_{bpd} \right) \times \left[ (FR_1 - FR_{10}) \times \frac{44}{56} + (FR_2 - FR_{20}) \times \frac{44}{40} \right] \dots (6)$$

where,

$E_{process1}$  represents the CO<sub>2</sub> emissions from the decomposition of raw materials within the accounting and reporting period (unit: tCO<sub>2</sub>);

$Q_i$  is the output of clinker (unit: t);

$Q_{ckd}$  is the weight of dust from the kiln vent stack (kiln head) (unit: t);

$Q_{bpd}$  is the weight of dust from the kiln bypass vent (unit: t);

$FR_1$  is the calcium oxide (CaO) content in the clinker (unit: %);

$FR_{10}$  is the content of calcium oxide (CaO) that is not generated from decomposition of carbonate in the clinker (unit: %);

$FR_2$  is the magnesium oxide (MgO) content in the clinker (unit: %);

$FR_{20}$  is the content of magnesium oxide (MgO) that is not generated from decomposition of carbonate in the clinker (unit: %);

$44/56$  is the conversion of molecule weight of CO<sub>2</sub> to CaO; and

$44/40$  shows the conversion ratio of molecule weight of CO<sub>2</sub> to MgO molecule weight.

The clinker output of a cement enterprise can be accounted according to production records within the accounting and reporting period. The weight of dust from the kiln vent stack (kiln head) and the weight of the dust from kiln bypass vent

may be accounted according to the production records by using the material balance method, or according to the measurement data of the enterprise.

The data of CaO and MgO content in the clinker and the data of the content of CaO and MgO that are not generated from decomposition in the clinker may use the measurement data of the enterprise.

#### 5.4 Emissions from the calcination of non-fuel carbon within raw materials

The CO<sub>2</sub> emissions of the calcination of non-fuel carbon within raw materials can be calculated according to Equation (7).

$$E_{process2} = Q \times FR_0 \times \frac{44}{12} \quad \dots\dots(7)$$

where,

$E_{process2}$  refers to the CO<sub>2</sub> emissions of the calcination of non-fuel carbon within raw materials within the accounting and reporting period (unit: tCO<sub>2</sub>);

$Q$  is the amount of raw materials (unit: t), which can be accounted according to the production records data within the accounting and reporting period;

$FR_0$  is the content of non-fuel carbon in the raw materials (unit: %); if measurement data is not available, it can be either the higher value in the range of 0.1%~0.3% (on dry basis) when the ingredients of raw materials are gangue and high carbon fly-ash, or the otherwise.

44/12 shows the conversion ratio of CO<sub>2</sub> to carbon molecule weight.

#### 5.5 Emission in correspondence with the consumption of net purchased electricity and heat

##### 5.5.1 Calculation equation

The CO<sub>2</sub> emissions from the production in correspondence with the consumption of net purchased electricity and heat (i.e. steam) can be calculated according to Equation (8).

$$E_{power \& \ heat} = AD_{power} \times EF_{power} + AD_{heat} \times EF_{heat} \quad \dots\dots(8)$$

where,

$E_{power \& \ heat}$  represents the CO<sub>2</sub> emissions from the production corresponding to the consumption of net purchased electricity and heat (unit: t);

$AD_{power}$  and  $AD_{Heat}$  are the net purchased electricity and heat (i.e. the amount of steam) amount within the accounting and reporting period respectively, with MWh and GJ as the respective unit; and

$EF_{Power}$  and  $EF_{Heat}$  are the CO<sub>2</sub> emission factors for electricity and heat (i.e. steam) respectively, with tCO<sub>2</sub>/MWh and tCO<sub>2</sub>/GJ as the respective unit.

### 5.5.2 Acquisition of activity level data

Based on purchase and sale vouchers of clearing as well as the energy balance sheet within the accounting and reporting period archived by the electricity (or heat) supplier(s) and the cement production enterprise, the activity level can be calculated according to Equation (9).

Net purchased electricity (heat) = Purchased electricity (heat) – Electricity(heat) consumed for the production of non-cement products – Sold electricity (heat) .....(9)

### 5.5.3 Acquisition of emission factor data

In accordance with the location of an enterprise and in light with the current geographical divisions of electricity grids, i.e. those in the Northeast, North China, East China, Central China, Northwest, and Southern China, the enterprise should choose its electricity supply emission factor among those published most recently by the competent national authority. The CO<sub>2</sub> emission factor for heat supply shall adopt the value 0.11 tCO<sub>2</sub>/GJ for the time being for the GHG emission accounting, and should be updated with the official data released by the competent government department.

## 6. Quality Assurance and Documentation

A reporting entity should establish a quality assurance and documentation system for its annual GHG emissions accounting and reporting, the content of which mainly includes:

- Establishment of rules and regulations for the accounting and reporting of GHG emissions, including the responsible organizations and staff, workflow and content, work cycle and timeline; and the designation of special staff responsible staff for accounting and reporting GHG emissions;
- Establishment of a GHG emission source list for cement production enterprises, with appropriate accounting methods for each source, which shall be documented and archived;
- Establishment of a sound statistical record system for enterprise GHG emissions and energy consumption;
- Establishment of a sound monitoring programme for the GHG emission parameters. Where appropriate, enterprises should regularly monitor parameters that have great influence over their GHG emissions, for example, the lower calorific value of fossil fuels and alternative fuels. In principle, for every batch of purchased fossil fuels, the lower caloric values should be monitored;
- Establishment of internal auditing for GHG emission reports; and

- 6.6 Establishment of a management mechanism for documenting GHG emissions and maintaining the emissions reports and related data.

## **7. Content and Format of Report**

The reporting entity from the cement production industry should report the following information in line with the format provided in the Appendix I:

### **7.1 Basic information of the reporting entity**

The basic information of the reporting entity should include the name or title, business nature, reporting year, industrial sector, Organization Code Certificate, legal representative, person responsible for filling in the report, and focal point of the reporting entity.

### **7.2 Amount of GHG emissions**

A reporting entity should report the total GHG emissions of the enterprise for the accounting and reporting period. It should also report emissions from fuel combustion, emissions from the industrial production process and emissions corresponding to the net purchased electricity and heat respectively.

### **7.3 Activity level and their sources**

A reporting entity should report net consumption amounts of various fossil fuels consumed by the enterprise for the reporting period as well as their corresponding lower calorific value; consumption of various alternative fuels or wastes and their corresponding lower calorific value; output of cement clinker, weight of the kiln vent stack dust and the weight of the kiln bypass dust; weight of raw materials and the non-fuel carbon content in raw materials; net purchased electricity and net purchased heat; and the corresponding data sources (with the adoption of recommended values in the Guidelines or measurement values).

If a cement production enterprise produces other products apart from cement, it should report its activity level and sources as requested in the GHG emission accounting and reporting guidelines for the enterprises in the relevant sectors.

### **7.4 Emission factors and their sources**

A reporting entity should report the carbon content per unit of calorific value, and data about carbon oxidation rate of various fossil fuels consumed by its enterprise for the reporting period; the CO<sub>2</sub> emission factors and the ratio of non-biomass carbon of various alternative fuels or wastes; the CaO content and non-decomposed CaO content as well as the MgO content and non-decomposed MgO in the clinker; and also emission factors adopted by the enterprise for calculating its electricity and heat consumption

and their data sources (with the adoption of recommended values in the Guidelines or measurement values).

If a cement production enterprise produces other products, it should report its emission factor data and sources as requested in the GHG emission accounting and reporting guidelines for the enterprises in the relevant sectors.

## **Appendix I: Report Format Template**

# **Greenhouse Gas Emission Report China Cement Production Enterprises**

**Reporting Entity (Official Seal):**

**Reporting Year:**

**Date of Production:** (Day/Month/Year)

In accordance with the *Guidelines for Accounting and Reporting Greenhouse Gas Emission from China Cement Production Enterprises(Trial)* issued by the National Development and Reform Commission, this reporting entity has accounted the total GHG emission amount of its enterprise for the year \_\_\_\_\_, and filled in the data in the relevant tables. The reporting entity herewith reports the relevant information as follows:

**I. Basic Information of Enterprise**

**II. Greenhouse Gas Emissions**

**III. Explanatory Description of Activity Level Data and Sources**

**IV. Explanatory Description of Emission Factors and Sources**

This report is true and reliable. If the information provided in this report fails to reflect the reality, this enterprise represented by its legal person will bear the corresponding legal responsibility.

Legal Person (Signature):  
(Day/Month/Year)

**Attachments:**

**Table 1-1:** Carbon Dioxide Emission Report of a Reporting Entity in Year\_\_\_\_

**Table 1-2:** Emission Activity Level Data of a Reporting Entity

**Table 1-3:** Emission Factors and Calculation Co-efficient of a Reporting Entity

**Table 1-1: Carbon Dioxide Emission Report of a Reporting Entity in Year**

<b>Total CO<sub>2</sub> Emissions (tCO<sub>2</sub>) of the Reporting Entity</b>	
Emissions (tCO <sub>2</sub> ) from fuel combustion	
Emissions (tCO <sub>2</sub> ) from combustion of non-biomass carbon contained in the alternative fuel and wastes	
Emissions (tCO <sub>2</sub> ) from decomposition of carbonate in raw materials	
Emissions (tCO <sub>2</sub> ) from calcination of non-fuel carbon within raw materials	
Emissions (tCO <sub>2</sub> ) from consumption of net purchased electricity	
Emissions (tCO <sub>2</sub> ) from consumption of net purchased heat	

**Table 1-2: Emission Activity Level Data**

		Net consumption (t, 10 <sup>4</sup> Nm <sup>3</sup> )	Lower calorific value (GJ/t, GJ/10 <sup>4</sup> Nm <sup>3</sup> )
<b>Fuel combustion*</b>	Anthracite		
	Bituminous coal		
	Lignite (brown coal)		
	Cleaned coal		
	Other washed coal		
	Other coal products		
	Coke		
	Crude oil		
	Fuel oil		
	Gasoline		
	Diesel		
	General Kerosene		
	LNG		
	LPG		
	Tar		
	Crude benzene		
	Cokeoven gas		
	Blast furnace gas		
	Linz Donaniz Converter Gas (LDG)		
	Other gases		
Natural gas			
Refinery gas			
Alternative fuel or waste			
<b>Industrial processes</b>		<b>Data</b>	<b>Unit</b>
	Clinker output		t
	Weight of dust from kiln head		t
	Weight of dust from the kiln bypass vent		t
	Weight of raw materials		t
	Content of non-fuel carbon contained in raw material		%
<b>Consumption of net purchased electricity &amp; heat</b>		<b>Data</b>	<b>Unit</b>
	Net-purchased electricity		MWh
	Net-purchased heat		GJ

\* The enterprise should add on its own the other types of energy actually used by the enterprise in its operations, which are not listed in this table.

**Table 1-3: Emission Factors and Calculation Coefficients**

		Carbon content per unit of calorific value (tC/GJ)	Rate of carbon oxidation (%)
<b>Fuel Combustion*</b>	Anthracite		
	Bituminous coal		
	Lignite (brown coal)		
	Cleaned coal		
	Other washed coal		
	Other coal products		
	Coke		
	Crude oil		
	Fuel oil		
	Gasoline		
	Diesel		
	General Kerosene		
	LNG		
	LPG		
	Tar		
	Crude benzene		
	Cokeoven gas		
	Blast furnace gas		
	Linz Donaniz Converter Gas (LDG)		
	Other gases		
	Natural gas		
	Refinery gas		
			<b>Unit</b>
	Emission factors for alternative fuel or waste		tCO <sub>2</sub> /GJ
	Carbon content of non-biomass in alternative fuel or waste		%
<b>Industrial processes</b>		<b>data</b>	<b>unit</b>
	CaO content in clinker		%
	CaO content in non-carbonates		%
	MgO content in clinker		%
	MgO content in non-carbonates		%
<b>net purchased electricity &amp; heat</b>		<b>data</b>	<b>unit</b>
	Electricity		tCO <sub>2</sub> /MWh
	Heat		tCO <sub>2</sub> / GJ

\* The enterprise should add any other types of energy actually used by the enterprise in its operations, which are not listed in this table.

## Appendix II: Relevant Default Values

**Table 2-1: Calorific Value of Fuels used in China Cement Industry**

Fuel name	Average lower calorific value	Unit
Raw coal	20908	MJ/t
Cleaned coal	26344	MJ/t
Middling coal	8363	MJ/t
Slime	10454	MJ/t
Coke	28435	MJ/t
Crude oil	41816	MJ/t
Fuel oil	41816	MJ/t
Gasoline	43070	MJ/t
General Kerosene	43070	MJ/t
Diesel	42652	MJ/t
LPG	50179	MJ/t
Refinery gas	45998	MJ/t
Natural gas	38.931	MJ/m <sup>3</sup>
Coke oven gas	17.354	MJ/m <sup>3</sup>
Producer gas	5.227	MJ/m <sup>3</sup>
Heavy oil catalytic cracking gas	19.235	MJ/m <sup>3</sup>
Heavy oil thermal cracking gas	35.544	MJ/m <sup>3</sup>
Coke gas	16.308	MJ/m <sup>3</sup>
Pressure gasified gas	15.054	MJ/m <sup>3</sup>
Water gas	10.454	MJ/m <sup>3</sup>
Coal tar	33453	MJ/t

Data sources: 1. China Energy Statistical Yearbook 2012; 2. data from sector-specific investigation

**Table 2-2: Carbon Content of Fuels used in China Cement Industry**

Fuel name	Carbon content (tC/TJ)
Raw coal	26.37
Anthracite	27.49
Common bituminous coal	26.18
Lignite (brown coal)	27.97
Cleaned coal	25.41
Mould coal	33.56
Coke	29.42
Crude oil	20.08
Fuel oil	21.10
Gasoline	18.90
Diesel	20.20
General Kerosene	19.41
LPG	16.96
Refinery gas	18.20
Other petroleum products	20.00
Natural gas	15.32
Coke oven gas	13.58
Others	11.96

Data sources: 1. Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial);

2. Data from sector-specific investigation

**Table 2-3: Rates of Combustion Oxidation for Fuels used in China****Cement Industry**

Fuel name	Rate of oxidation
Coal (klins)	98%
Coal (industrial boilers)	95%
Coal (Other combustion facilities)	91%
Coke	98%
Crude oil	99%
Fuel oil	99%
Gasoline	99%
General Kerosene	99%
Diesel	99%
LPG	99.5%
Refinery gas	99.5%
Natural gas	99.5%
Coke oven gas	99.5%
Producer gas	99.5%
Heavy oil catalytic cracking gas	99.5%
Heavy oil thermal cracking gas	99.5%
Coke gas	99.5%
Pressure gasified gas	99.5%
Water gas	99.5%
Coal tar	99%

Data sources: 1. Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial); 2. Data from classic enterprise investigation

**Table 2.4: Emission Factors for Some Alternative Fuels used in China****Cement Industry**

Types of alternative fuels	Lower calorific value GJ/t	Emission factors tCO <sub>2</sub> /GJ	Mass fraction of fossil carbon (%)	Mass fraction of biological carbon (%)
Waste oil	40.2	0.074	100	0
Waste tires	31.4	0.085	20	80
Waste plastic	50.8	0.075	100	0
Waste solvent	51.5	0.074	80	20

Waste leather	29.0	0.11	20	80
Waste	32.6	0.083	100	0

Data sources: 1. Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial); 2. WBCSD CO<sub>2</sub> Emissions Protocol for the Cement Industry (2005);  
3. Data from classic enterprise investigation.

**Table 2-5: Recommended Emission Factors**

<b>Parameter</b>	<b>Unit</b>	<b>CO<sub>2</sub> emission factor</b>
Electricity consumption	tCO <sub>2</sub> /MWh	The most update value published by authorities
Heat consumption	tCO <sub>2</sub> /GJ	0.11