Annex 5

Guidelines for Accounting and Reporting Greenhouse Gas Emissions

China Electrolytic Aluminum Production Enterprises

(Trial)

Instruction

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", as spelled out in the *Work Plan for GHG Emission Control during the 12th 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 Electrolytic Aluminum Production Enterprises (Trial)*(the Guidelines), with the aim to help enterprises (i) scientifically calculate and report in a standard format their GHG emissions, (ii) formulate their GHG emissions control plans, (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 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 NDRC General Office. Through field investigations, in-depth studies and experimental accounting based on individual cases as well as careful consultations with China Nonferrous Metals Industry Association, the writing team has completed the development of the *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Electrolytic Aluminum Production Enterprises (Trial).* Efforts have been made to ensure that the Guidelines are science-based, comprehensive, standardized and practical.

III. Main Contents

The *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Electrolytic Aluminum Production Enterprises (Trial)* 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 GHGs are carbon dioxide and perfluocarbons, and emission sources include fuel combustion, the usage of energy as raw materials, industrial production processes and consumption of net purchased electricity and heat. The application scope covers the enterprises with qualified legal entities and independently accounted units that are treated as legal entities, all being involved in electrolytic aluminum production operations.

IV. Issues that Need Clarification

The Guidelines provide recommended values for such parameters of major fuels as calorific value, carbon content and oxidation efficiency, for the use of related enterprises to account their activity levels and emission factors. The Guidelines have taken into consideration such statistical data as from the *Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial)* and the *China Energy Statistical Yearbook* as well as China Nonferrous Metals Industry Association. Eligible enterprises may apply the standard methods provided in the main text of the Guidelines to their actual measurement of data such as net carbon anode consumption per ton of aluminum, average sulfur content in carbon anode, average ash content in carbon anode, and average duration of anode effect per day per slot.

Considering the fact that enterprise-based GHG emissions accounting and reporting are a completely new 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 and improvements in the future.

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

Contents

1. Application Scope

The Guidelines apply to the accounting and reporting of GHG emissions from China electrolytic aluminum production enterprises. Enterprises operating in electrolytic aluminum 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 as reference:

2006IPCC Guidelines for National Greenhouse Gas Inventories;

1996IPCC Guidelines for National Greenhouse Gas Inventories; and

Aluminum Sector Greenhouse Gas Protocol: Greenhouse Gas Emissions Monitoring and Reporting by the Aluminum Industry.

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 the Annex A of the Kyoto Protocol, and they are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs, collective name for CF_4 and C_2F_6) and sulfur hexafluoride (SF_6).

3.2 Reporting entity

A reporting entity is 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 calculates and reports its GHG emissions.

3.3 Electrolytic aluminum enterprises

Electrolytic aluminum enterprises refer to the enterprises with qualified legal entities and independently accounted units that are treated as legal entities, all being involved mainly in electrolytic aluminum production operations.

3.4 Emissions from fuel combustion

Emissions from fuel combustion are CO_2 emissions generated from the reaction of such fuels as coal, gas and diesel, to oxygen in a combustion process within various stationary or mobile combustion facilities, for example, boiler, calcinator, furnace, smelter, or internal combustion engine.

3.5 Emissions from the usage of energy as raw materials

Emissions from the usage of energy as raw materials are GHG emissions generated from the physical or chemical changes of energy consumed as raw materials in industrial production. Emissions from the usage of energy as raw materials related to electrolytic aluminum enterprises mainly refer to CO_2 emissions resulting from consumption of carbon anode, which is the reducing agent in the production of electrolytic aluminum.

3.6 Emissions from industrial production processes

Emissions from industrial production processes are the GHG emissions generated from the physical or chemical changes of raw materials except for energy. Emissions from industrial production processes mainly refer to the PFCs emissions generated from the anode effect. CO_2 emissions from the calcination and decomposition of limestone should be taken into consideration where limestone calcinators are in use within the boundary of the reporting entity.

3.7 Emissions from consumption of net purchased electricity and heat

Emissions from consumption of net purchased electricity and heat refer to the CO_2 emissions from electricity or heat generation processes corresponding to consumption of net purchased electricity and heat (steam and hot water) by the enterprise.

3.8 Activity level

Activity lever refers to the quantitative amount of production or consumption activities, for example, consumption of various fossil fuels, output of primary aluminum and the amount of purchased electricity and heat, etc.

3.9 Emission factor

Emission factor refers to the factor used to quantify the GHG emissions per unit of activity level, for example, CO_2emissions corresponding to the consumption of per terajoule of fuels, PFCs emissions corresponding to the production of per ton of raw aluminum and CO_2emissions corresponding to per kilowatt-hour of net purchased electricity.

3.10 Oxidation rate

Oxidation rate is the ratio at which carbon in fuel(s) has been oxidized into CO_2 in a combustion process.

4. Accounting Boundary

A reporting entity should regard enterprises with qualified legal entities and independently accounted units that are treated as legal entities as the accounting boundary for accounting and reporting their GHG emissions generated from the production system. The production system includes direct production systems, auxiliary production systems and affiliated production systems which directly serve the production service. The auxiliary production system consists of electricity, electricity supply, water supply, test and examination, machine maintenance, depot and transportation; and the affiliated production system includes production command systems (factory headquarters) and departments and units within the factory which serve the production, such as staff canteen, workshop bathroom and health stations. In principle, emissions generated from energy consumption within the boundary of factory are not considered in the accounting.

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

4.1 Emissions from the combustion of fuels

Emissions from fuel combustion related to electrolytic aluminum enterprises refer to CO_2 emissions from reaction of such fuels as coal, gas and diesel, to oxygen in a combustion process within various stationary or mobile combustion facilities, for example, boiler, calcinator, furnace, smelter or internal combustion engine.

4.2 Emissions from the usage of energy as raw materials

Emissions from the usage of energy as raw materials related to electrolytic aluminum enterprises are mainly CO_2 emissions from consumption of carbon anode, which is the reductant in the production of electrolytic aluminum.

4.3 Emissions from industrial production processes

Emissions from industrial production processes related to electrolytic aluminum enterprises are mainly PFCs emissions from the anode effect. CO_2 emissions from the calcination of limestone should be taken into consideration where limestone calcinators are in use within the boundary of the reporting entity.

4.4 Emissions from consumption of net purchased electricity and heat

Emissions from consumption of net purchased electricity and heat refer to the CO_2 emissions corresponding to consumption of net purchased electricity and heat (steam and hot water) by the enterprise. Such emissions actually take place in electricity and heat production enterprises.

If a reporting entity is engaged in production activities apart from electrolytic aluminum production, and there are emissions that are not covered in the Guidelines, it should calculate and report the emissions as requested in the GHG emission accounting and reporting guidelines for the enterprises in the relevant sectors. Such emissions should be included in the total enterprise GHG emissions.

5. Accounting Methodology

The complete working flow of GHG emission accounting and reporting by a reporting entity includes the following steps:

I. Define the accounting boundary;

II. Identify the emission source;

III. Collect activity level data;

IV. Choose or acquire data for emission factors;

V. Calculate emissions from fuel combustion, emissions from the usage of energy as raw materials, industrial production emissions and emissions corresponding to consumption of net purchased electricity and heat; and

VI. Calculate the total GHG emissions amount of the enterprise.

The total GHG emissions amount of an electrolytic aluminum enterprise is equal to the sum of emissions from fossil fuel combustion, the usage of energy as raw material, industrial production processes and consumption of net purchased electricity and heat in all the production system within the boundary of the enterprise. It is derived from Equation (1):

$$E = E_{Combustion} + E_{Raw\ material} + E_{Process} + E_{Power\ \&\ heat} \quad \text{.....(1)}$$

where,

E is the total CO_2 emission amount (tCO_2e);

$E_{Combustion}$ represents the CO_2 emission amount (tCO_2) of fuel combustion;

$E_{Raw\ material}$ refers to the CO_2 emission amount (tCO_2) of the usage of energy as raw materials;

$E_{Process}$ is the CO_2 emission amount (tCO_2e) of the industrial production process; and

$E_{Power\ \&\ heat}$ is the CO_2 emission amount (tCO_2) corresponding to consumption of net purchased electricity and heat by the enterprise.

The above GHG emissions can be accounted based on the following methods.

5.1 Emissions from fuel combustion

The CO_2 emission amount of fuel combustion is the sum of emission amount of various fuels' combustion within the accounting and reporting period, which can be derived from Equation (2).

$$E_{Combustion} = \sum_{i=1}^{n}(AD_i \times EF_i) \quad \text{……(2)}$$

where,

$E_{Combustion}$ is the CO_2 emission amount (tCO_2) of fossil fuel combustion within the accounting and reporting period;

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

EF_i is the CO_2 emission factor (tCO_2/GJ) of the *i* type of fossil fuel; and

i represents the type of fossil fuels in net consumption.

5.1.1 Acquisition of activity level data

The activity level of fuel combustion is the product of consumption amount of various fuels and their average lower calorific values, derived from Equation (3).

$$AD_i = NCV_i \times FC_i \quad \text{……(3)}$$

where,

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

$NCV_i$is the average lower calorific value of the *i* type of fossil fuel within the accounting and reporting period, based on the default values provided in Appendix II of the Guidelines; for solid or liquid fuels, the unit of the value is GJ/t; for gas fuels, the unit of the value is GJ/$10^4$$Nm^3$; and

FC_i is the net consumption amount of the *i* type of fossil fuel within the accounting and reporting period, with adoption of enterprise econometric data and relevant measurement instrument complying with the *General Principles for Equipping and Managing the Energy-Measuring Instruments in Energy-Using Organizations (GB 17167);* for solid or liquid fuels, the unit of consumption is ton (t); and for gas fuels, the unit of consumption is $10^4$$Nm^3$.

5.1.2 Acquisition of emission factor data

The CO_2 emission factor for fuel combustion should be calculated with Equation (4).

$$EF_i = CC_i \times OF_i \times 44/12 \quad \text{……(4)}$$

where,

EF_i is the CO_2 emission factor (tCO_2/TJ) of the *i* type of fuel;

CC_i is the carbon content (tC/TJ) per unit of calorific value of the *i* type of fuel, with adoption of the recommended values provided in Appendix II of the Guidelines; and

OF_i is rate of carbon oxidation (%), with adoption of the recommended values in Appendix II of the Guidelines.

5.2 Emissions from the usage of energy as raw materials

The CO_2 emission amount of the usage of energy as raw materials should be derived from Equation (5).

$$E_{Raw\ material} = EF_{Carbon\ anode} \times P \quad \text{……(5)}$$

where,

$E_{Raw\ material}$ is the CO_2 emission amount (tCO_2)of the carbon anode consumption for the accounting and reporting period;

$EF_{Carbon\ anode}$ is the CO_2 emission factor (tCO_2/ t-Al) of the carbon anode consumption; and

P is the activity level (t), which is the output of primary aluminum within the accounting and reporting period.

5.2.1 Acquisition of activity level data

The required activity level (t) refers to the output of primary aluminum within the accounting and reporting period, which can be collected from the enterprise econometric data.

5.2.2 Acquisition of emission factor data

The CO_2emission factor for the carbon anode consumption should be derived from Equation (6).

$$EF_{Carbon\ anode} = NC_{Carbon\ anode} \times (1 - S_{Carbon\ anode} - A_{Carbon\ anode}) \times 44/12 \quad \text{……(6)}$$

where,

$EF_{Carbon\ anode}$ is the CO_2 emission factor (tCO_2/t-Al)for the carbon anode consumption;

$NC_{Carbon\ anode}$indicates the net carbon anode consumption per ton of aluminum (tCO_2/t-Al) within the accounting and reporting period, and enterprises may consider0.42 tCO_2/t-Alas this value, which is recommended by China Nonferrous Metals Industry Association; and where possible, enterprises may conduct monthly weighing inspection to obtain the annual average value;

$S_{Carbon\ anode}$ is the average sulfur content of carbon anode (%) within the accounting and reporting period, and enterprises may use 2% as this value, which is recommended by China Nonferrous Metals Industry Association; and where possible, enterprises may conduct sampling inspections to every batch of carbon anode according to the *Carbonaceous Materials Used in the Production of Aluminum- Part 20: Determination* of Sulfur Content (YS/T63.20-2006) and calculate the annual average value; and

$A_{Carbon\ anode}$ is the average ash content (%) of carbon anode within the accounting and reporting period, which enterprises may consider to be 0.4%, as recommended by the China Nonferrous Metals Industry Association; and where possible, enterprises may conduct sampling of every batch of carbon anode according to the *Carbonaceous Materials Used in the Production of Aluminum- Part 20: Part 19: Determination of Ash Content* (YS/T63.19-2006) and therefrom calculate the annual average value.

5.3 Emissions from industrial production processes

The emissions from electrolytic aluminum industrial production processes equal the sum of the emission amount of anode effect and the emission amount of limestone calcination, which can be calculated with Equation (7).

$$E_{Process} = E_{PFCs} + E_{Limestone} \quad \text{……(7)}$$

where,

$E_{Process}$ is the emission amount (tCO_2e) of industrial production processes within the accounting and reporting period;

E_{PFCs} is the PFCs emission amount (tCO_2e) of the anode effect within the accounting and reporting period; and

$E_{Limestone}$ is the emission amount (tCO_2) of limestone calcination within the accounting and reporting period.

5.3.1 Anode effect

When anode effect takes place, two kinds of PFCs, namely CF_4 (PFC-14) and C_2F_6 (PFC-116) are emitted by the electrolytic aluminum enterprises. The GHG emission amount generated by the anode effect can be calculated with Equation (8).

$$E_{PFCs} = (6500 \times EF_{CF4} + 9200 \times EF_{C2F6}) \times P/1000 \quad \text{……(8)}$$

where,

E_{PFCs} is the PFCs emission amount (tCO_2e) of the anode effect within the accounting and reporting period;

6500 is the GWP value of CF_4;

EF_{CF4} is the CF_4 emission factor (kg CF_4/t-Al) of anode effect;

9200 is the GWP value of C_2F_6;

EF_{C2F6} is the C_2F_6 emission factor (kg C_2F_6/t-Al) of anode effect; and

P is the activity level of anode effect (t), which is the output of primary aluminum within the accounting and reporting period.

5.3.1.1 Acquisition of activity level data

The required activity level (t) is the output of primary aluminum within the accounting and reporting period, according to the enterprise econometric data.

5.3.1.2 Acquisition of emission factor data

The emission factor is closely dependent on the technology type of the electrolyzer. At present, the dominant technology of the production of electrolytic aluminum in China is PFPB, which is among the internationally advanced technologies. The emission factors recommended by China Nonferrous Metals Industry Association are0.034 kg CF_4/t-Al and 0.0034 kg C_2F_6/t-Al.

Where possible, enterprises may adopt internationally recognized empirical slope method formula to calculate the emission factor of anode effect according to Equations (9) and (10).

$$EF_{CF4} = 0.143 \times \mathrm{AEM} \quad \text{……(9)}$$

$$EF_{C2F6} = 0.1 \times EF_{CF4} \quad \text{……(10)}$$

where,

EF_{CF4} is the CF_4 emission factor (kg CF_4/t-Al) of anode effect;

EF_{C2F6} is the C_2F_6 emission factor (C_2F_6/t-Al) of anode effect; and

AEM is the supposed average duration (unit: minute) of anode effect per day per slot, which should be based on the real-time monitoring data from the automatic production monitoring system.

5.3.2 Limestone calcination

The CO_2 emission amount (tCO_2) of the calcination and decomposition of limestone is calculated with Equation (11).

$$E_{Limestone} = L \times EF_{Limestone} \quad \text{……(11)}$$

where,

$E_{Limestone}$ is the CO_2 emission amount (tCO_2) of limestone calcination;

L is the consumption amount of limestone (t) within the accounting and reporting period; and

$EF_{Limestone}$ is the CO_2 emission factor (tCO_2/t limestone) for the calcination of limestone.

5.3.2.1 Acquisition of activity level data

The required activity level (t) is the consumption amount of limestone as raw materials within the accounting and reporting period, which can be acquired from the enterprise econometric data.

5.3.2.2 Acquisition of emission factor data

The emission factor should apply the recommended value 0.405 tCO_2/t limestone provided by China Nonferrous Metals Industry Association.

5.4 Emissions from consumption of net purchased electricity and heat

The CO_2 emission amount of the electricity or heat generation process corresponding to consumption of the net purchased electricity or heat can be derived from Equation (12).

$$E_{Power\&heat} = AD_{Power} \times EF_{Power} + AD_{Heat} \times EF_{Heat} \quad \text{……(12)}$$

where,

$E_{Power\&heat}$ is the CO_2 emission amount (tCO_2) of the electricity and heat generation process corresponding to consumption of the net purchased electricity and heat;

AD_{Power} is the net purchased amount (MWh) of electricity within the accounting and reporting period;

AD_{Heat} is the net purchased amount (GJ) of heat within the accounting and reporting period;

EF_{Power} is the emission factor (tCO_2/MWh) for the consumption of electricity; and

EF_{Heat} is the emission factor (tCO_2/MWh) for the consumption of heat.

5.4.1.1 Acquisition of activity level data

The required activity level is the net purchased amount of electricity and heat from measurement and calculation of the enterprise. 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 reporting entity, the net purchased amount of electricity and heat can be calculated with Equation (13).

Net purchased electricity amount (heat amount) = Purchased amount – Sold amount ……(13)

5.4.1.2 Acquisition of emission factor data

The emission factor for electricity consumption can be calculated in accordance with the location of an enterprise in relation to the current geographical divisions of electricity grids, i.e. those in the Northeast, North China, East China, Central China,

Northwest, and Southern China, using the emission factor(s) of the relevant regional electricity grid(s) published by the competent national authority for the most recent year.

The emission factor for heat consumption shall adopt the value 0.11 tCO_2/GJ for the time being for the GHG emission accounting, and the data should be updated with the official data released by the competent governmental authority.

6. Quality Assurance and Documentation

A reporting entity should establish a quality assurance and documentation system for its GHG emission reports, the content of which includes:

- Establishment of rules and regulations for the accounting and reporting of GHG emissions, including the responsible organizations and staff, workflow and content, work period and timeline; and the designation of special staff responsible staff for accounting and reporting GHG emissions;
- Establishment of a GHG emission source list 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 mechanism for the GHG emission parameters. Based on the methods and frequencies provided in Part 5 of the Guidelines, enterprises may monitor such parameters as net carbon anode consumption per ton of aluminum, average sulfur content in carbon anode, average ash content in carbon anode and supposed average duration of anode effect per day per slot, which are important to the enterprise-based GHG emission amount;
- Establishment of internal auditing for GHG emission reports; and
- Establishment of a management mechanism for documenting and maintaining GHG emission accounting and reporting documents and related data.

7. Content and Format of Report

The reporting entity should report the following information in line with the format provided in the Appendix I of the Guidelines:

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 usage of energy as raw materials, emissions from industry production processes and emissions corresponding to net purchased electricity and heat.

7.3 Activity levels and their sources

A reporting entity should report net consumption amounts of various fuels in the industrial production for the reporting year as well as their corresponding lower calorific value, output of primary aluminum, consumption amounts of limestone raw materials, amounts of net purchased electricity and heat and the corresponding data sources (with the adoption of recommended values or measurement values in the Guidelines).

If a reporting entity is engaged in production activities apart from electrolytic aluminum production, and there are emissions that are not covered in the Guidelines, it should report the emissions 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 such data as carbon content per calorific value and carbon oxidation rate in the industrial production for the reporting year as well as net carbon anode consumption per ton of aluminum, average sulfur content in carbon anode, average ash content in carbon anode, the CF_4 emission factor and C_2F_6 emission factor, supposed average duration of anode effect per day per slot, the CO_2 emission factor for limestone calcination, the emission factor for the consumption of electricity and heat in the location of the reporting entity; and also their data sources (with the adoption of recommended values or measurement values in the Guidelines).

If a reporting entity is engaged in the production activities apart from electrolytic aluminum production, and there are emissions that are not covered in the Guidelines, it should report the emissions and data 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 Electrolytic Aluminum 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 Electrolytic Aluminum 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 the Reporting Entity in year ___ (Unit: tCO_2e)

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

Table 1-3: Emission Factor Data of the Reporting Entity

Table1-1: Carbon Dioxide Emission Report of the Reporting Entity in Year (Unit: tCO_2e)

	CO_2	PFCs	Total
Total CO_2 Emissions (tCO_2) of an Enterprise			
Emissions (tCO_2) from fuel combustion		/	
Emissions (tCO_2) from the usage of energy as raw materials		/	
Emissions (tCO_2e) from industrial production processes			
therein, emissions from anode effect	/		
therein, emissions from limestone calcination		/	
Emissions (tCO_2) from consumption of net purchased electricity and heat		/	

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

	Type of fuel	Net consumption（t，10^4 Nm^3）	Lower calorific value（GJ/t，GJ/10^4 Nm^3）
Fuel combustion*	Anthracite		
	Bituminous coal		
	Lignite (brown coal)		
	Cleaned coal		
	Other washed coal		
	Other coal products		
	Petroleum coke		
	Coke		
	Crude oil		
	Fuel oil		
	Gasoline		
	Diesel		
	General Kerosene		
	Liquefied Natural Gas		
	Liquefied petroleum gas		
	Tar		
	Coke oven gas		
	Blast furnace gas		
	Linz Donaniz Converter Gas (LDG)		
	Other gases		
	Natural gas		
	Refinery gas		
	Parameter	**Data**	**Unit**
Usage of energy as raw materials**	Output of primary aluminum		t
Industrial production processes**	Output of primary aluminum		t
	Consumption of limestone raw materials		t
Consumption of net purchased electricity and heat	Amount of purchased electricity from other enterprise(s)		MWh
	Sold amount of electricity		MWh
	Amount of purchased heat from other enterprise(s)		GJ

	Sold amount of heat		GJ

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

**If a reporting entity is engaged in production activities apart from electrolytic aluminum production, and there are emissions that are not covered in the Guidelines, it should add rows to the table to report the emissions.

Table 1-3: Emission Factor Data of the Reporting Entity

	Type of fuel	Carbon content per unit of calorific value (tC/GJ)	Carbon oxidation rate (%)
Fuel combustion*	Anthracite		
	Bituminous coal		
	Lignite (brown coal)		
	Cleaned coal		
	Other washed coal		
	Other coal products		
	Petroleum coke		
	Coke		
	Crude oil		
	Fuel oil		
	Gasoline		
	Diesel		
	General Kerosene		
	Liquefied Natural Gas		
	Liquefied petroleum gas		
	Tar		
	Coke oven gas		
	Blast furnace gas		
	Converter gas		
	Other gases		
	Natural gas		
	Refinery gas		
	Parameter	**Data**	**Unit**
Usage of energy as raw materials** **Industrial production processes****	Net carbon anode consumption per ton of aluminum		tC/t-Al
	Average sulfur content in carbon anode		%
	Average ash content in carbon anode		%
Usage of energy as raw materials**	CF_4 emission factor of anode effect		kg CF_4/t-Al
	C_2F_6 emission factor of anode effect		kg C_2F_6/t-Al
	Supposed average duration of anode effect per day per slot		Min
	Emission factor for		tCO_2/t-Limestone

	limestone calcination		
Consumption of net purchased electricity and heat	Emission factor for electricity consumption		tCO_2/MWh
	Emission factor for heat consumption		tCO_2/ GJ

* The reporting entity 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;

**If a reporting entity is engaged in the production activities apart from electrolytic aluminum production, and there are emissions that are not covered in the Guidelines, it should add rows to the table to report the emissions.

Appendix II：Relevant Default Values

Table 2-1:Recommended Values for Commonly Used Fossil Fuels

Type of fuel		Unit	Lower calorific value（GJ/t，GJ/10^4Nm^3）	Carbon content per unit of calorific value (tC/TJ)	Carbon oxidation rate
Solid fuels	Anthracite	ton	20.304	27.49	94%
	Bituminous coal	ton	19.570	26.18	93%
	Lignite (brown coal)	ton	14.080	28.00	96%
	Cleaned coal	ton	26.344	25.40	90%
	Other washed coal	ton	8.363	25.40	90%
	Other coal products	ton	17.460	33.60	90%
	Petroleum coke	ton	32.018	27.50	100%
	Coke	ton	28.447	29.50	93%
Liquid fuels	Crude oil	ton	41.816	20.10	98%
	Fuel oil	ton	41.816	21.10	98%
	Gasoline	ton	43.070	18.90	98%
	Diesel	ton	42.652	20.20	98%
	General Kerosene	ton	44.750	19.60	98%
	Liquefied Natural Gas	ton	41.868	17.20	98%
	Liquefied petroleum gas	ton	50.179	17.20	98%
	Tar	ton	33.453	22.00	98%
Gaseous fuels	Coke oven gas	10,000 m^3	173.540	12.10	99%
	Blast furnace gas	10,000 m^3	33.000	70.80	99%
	Converter gas	10,000 m^3	84.000	49.60	99%
	Other gases	10,000 m^3	52.270	12.20	99%
	Natural gas	10,000 m^3	389. 31	15.30	99%
	Refinery gas	10,000 m^3	45.998	18.20	99%

Data Source(s):

①*China Energy Statistical Yearbook 2012*;

②*Guidance for Compiling Provincial Greenhouse Gas Emission Inventory (Trial)*; and

③ Industrial survey data.

Table 2-2: Relevant Recommended Values of Emission Factors for the Usage of Energy as Raw Materials

Parameter	Unit	Data
Net carbon anode consumption per ton of aluminum	tC/t-Al	0.42
Average sulfur content in carbon anode		2%
Average ash content in carbon anode		0.4%

Data Source(s)： Statistical data from China Nonferrous Metals Industry Association

Table 2-3: Recommended Values of Emission Factors for Industrial Production Processes

Parameter	Unit	Data
CF_4 emission factor of anode effect	kg CF_4/t-Al	0.034
C_2F_6 emission factor of anode effect	kg C_2F_6/t-Al	0.0034
Emission factor for limestone calcination	tCO_2/t-Limestone	0.405

Data Source(s): Statistical data from China Nonferrous Metals Industry Association

Table 2.4: Recommended Values of Other Emission Factors

Parameter	Unit	CO_2 Emission Factor
Emission factor for electricity consumption	tCO_2/MWh	Using the official emission factor(s) published for the most recent year
Emission factor for heat consumption	tCO_2/GJ	0.11