

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

China Independent Coking Enterprises

(Trial)

Instructions

I. Objectives and Significance of the Guidelines

In order to carry out the task of “establishing and perfecting greenhouse gas accounting system and gradually setting up a carbon emission trading market” as proposed in the *Outline of the 12th Five-Year Plan* and to implement the requirements of “building greenhouse gas emission accounting system at the national, local and enterprise levels and carrying out the system of direct energy and greenhouse gas emission data reporting by key enterprises” as proposed in the *Work Plan for Greenhouse Gas Emission Control during the 12th Five-Year Plan* (GF[2011] No. 41), the National Development and Reform Commission (NDRC) issued the *Notice on Organizing and Implementing Greenhouse Gas Emission Reporting by Key Enterprises (Institutes)* (FGQH [2014] No. 63) and organized research on and preparation of the guidelines on greenhouse gas emissions accounting and reporting of enterprises in key industries. The *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Independent Coking Enterprises (Trial)*(the Guidelines)are prepared to help independent coking enterprises with accurate accounting and standard reporting of greenhouse gas emissions as well as with scientific formulation of the action plan and countermeasures for greenhouse gas emissions control. Meanwhile, the Guidelines lay a foundation for the authority to establish and implement greenhouse gas emission reporting system for key enterprises.

II. Preparation Process

The present Guidelines are prepared by the National Centre for Climate Change Strategy and International Cooperation (NCSC) under the authorization of the NDRC. Using the findings of researches in and abroad on greenhouse gas emission accounting and reporting of enterprises and relevant practical experiences and the *Guideline for Preparation of Provincial Greenhouse Gas List (Trial)* issued by the NDRC

Office as the reference, the preparation team completed the *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Independent Coking Enterprises (Trial)* through field survey and in-depth research. The preparation team strived so that the Guidelines shall be methodologically scientific, comprehensive, standardized and practical. During the preparation of the Guidelines, China Coking Industry Association (CCIA), China Metallurgical Industrial Planning & Research Institute and Ecological Environment Research Center of Shanxi Province offered valuable support.

III. Main Contents

The *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Independent Coking Enterprises (Trial)* consist of the text and two appendices. The text is comprised of seven sections, namely, scope of application, references, terms and definitions, accounting boundary, accounting methods, quality assurance, document archiving and contents of the report. The Guidelines are applicable to all independent coking enterprises eligible as legal persons engaged in coke production in China and independent accounting entities that are considered legal persons. Categories of emission sources and types of gases subject to accounting and reporting mainly include carbon dioxide (CO₂) emissions from fuel combustion, CO₂ emissions from industrial production process, CO₂ recovery and utilization and CO₂ emissions embodied in net purchased electric power and heating power.

IV. Issues that need Clarification

Coking enterprises using the Guidelines shall deem independent corporate enterprises or independent accounting entities considered as legal persons at the lowest level as the boundary to account and report emissions of greenhouse gasses from all production facilities whose operation is under their control. Where the reporting entity is engaged in other product production activities with greenhouse gas emissions apart from production of coking products such as coke (including semi-coke) and by-product coal tar, crude (light) benzene and coke oven gas,

references shall be made to the guidelines on greenhouse gas emission accounting and reporting of enterprises in the relevant industries for accounting and reporting the greenhouse gas emissions of these production activities.

Enterprises shall provide corresponding activity level and emission factor data used for calculation of the discharge amount, which shall be used as the basis for checking and verification. Enterprises shall measure their activity levels and emission factor data as far as possible. For the sake of users, the Guidelines refer to many literatures including *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and *Guidelines for Preparation of Provincial Greenhouse Gas Inventories (Trial)*. The Guidelines also provide parameter and emission factor values for some common fossil fuels for the reference of enterprises unable to conduct direct measurements.

Considering the fact that enterprise-based GHG emissions 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.

Contents

1. Application Scope	1
2. References	1
3. Terminology and Definitions.....	2
4. Accounting Boundary.....	4
5. Accounting Methodology	7
5.1 CO ₂ emissions from fuel combustion	8
5.2 CO ₂ emissions during industrial production process.....	14
5.3 CO ₂ recycled amount.....	16
5.4 Indirect CO ₂ emissions from net purchase of power and heat	17
6. Quality Assurance and Documentation	19
7. Contents of Report.....	20
7.1 Basic information of the reporting entity.....	20
7.2 Emissions of greenhouse gas.....	21
7.3 Activity level data and data sources	21
7.4 Emission factor data and data sources.....	21
7.5 Other explanations.....	21
Appendix I: Report Format Template	22
Appendix II: Relevant Default Values.....	39

1. Application Scope

The Guidelines apply to greenhouse gas emission accounting and reporting of Chinese independent coking enterprises. Independent coking enterprises engaged in coke production in the Chinese territory (excluding Taiwan, Hong Kong and Macao) may account their greenhouse gas emissions according to the methods provided in the Guidelines and prepare the corporate report on greenhouse gas emissions. Where the independent coking enterprises are engaged in other product production activities with greenhouse gas emissions apart from production of coking products such as coke (including semi-coke) and by-product coal tar, crude (light) benzene and coke oven gas, references shall be made to the guidelines of greenhouse gas emission accounting and reporting for enterprises in the relevant industries for accounting and reporting the greenhouse gas emissions of these production activities.

2. References

The following documents are referred to in the Guidelines:

General Guideline of Greenhouse Gas Emission Accounting and Reporting for Industrial Enterprises;

ISO 14064-1 Greenhouse Gases Part 1: Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals;

Guideline of Greenhouse Gas Emission and Reporting for Chinese Chemical Manufacturing Enterprises (Trial);

Guideline for Preparation of Provincial Greenhouse Gas Inventories (Trial);

The People's Republic of China National Greenhouse Gas Inventory 2005;

2006 IPCC Guidelines for China National Greenhouse Gas Inventory;

GB 21342 The Norm of Energy Consumption per Unit Product of Coke;

GB 17167 General Principle for Equipping and Managing of the Measuring Instrument of Energy in Energy Using Organization;

GB/T 213 Determination of Calorific Value of Coal;

GB/T 384 Determination of Calorific Value of Petroleum Products;

GB/T 22723 Energy Determination for Natural Gas;

GB/T 476 Determination of Carbon and Hydrogen in Coal;

SH/T 0656 Standard Test Methods for Instrumental Determination of Carbon, Hydrogen and Nitrogen in Petroleum Products and Lubricants (Element Analyzer Method);

GB/T 13610 Analysis of Natural Gas (by Gas Chromatography Method); and

GB/T 8984 Determination of Carbon Monoxide, Carbon Dioxide and Hydrocarbon in Gases – Gas Chromatographic Method.

3. Terminology and Definitions

For the purpose of the Guidelines, the following terminology and definitions apply.

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. There are six types of GHGs which are listed in Annex A of the *Kyoto Protocol*: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆).

Unless otherwise specified, only CO₂ emissions will be accounted under the Guidelines for coking enterprises.

3.2 Reporting entity

Reporting entity refers to independent corporate enterprises which generate greenhouse gas emissions or independent accounting entities considered as legal persons.

3.3 Independent coking enterprises

Independent coking enterprises refer to coking enterprises that are mainly engaged in coke (semi-coke) production and are not affiliated to any iron and steel complex, nor belong to energy processing and conversion enterprises using coal as the raw material.

3.4 Emissions from fuel combustion

Emissions from fuel combustion refer to emissions of greenhouse gases produced from intentional oxidation of fossil fuels for the purpose of energy utilization¹. Emissions from non-energy utilization shall be included into the industrial production process or other emission categories.

3.5 Emissions from industrial production process

Emissions from industrial production process refer to emissions of greenhouse gases produced from physical or chemical changes of raw materials during the production process except combustion.

3.6 CO₂ recovery and utilization

CO₂ recovery and utilization refers to recovery of CO₂ produced by the reporting entity and use of it as the raw material for production or for sale to other entities as products so as to prevent it from discharging into the atmosphere.

3.7 CO₂ emissions embodied in net purchased electric power and heating power

CO₂ emissions embodied in net purchased electric power and heating power refer to emissions of CO₂ produced from the corresponding electric power or heating power production process of net purchased electric power and heating power (steam, hot water) consumed by an enterprise.

3.8 Activity level

¹It means that the fuel is burned to provide heat or mechanical power to certain process.

Activity level refers to the human activity of the reporting entity during the reporting period, which results in emissions or removal of certain greenhouse gases, such as the combustion of each fossil fuel, usage of fossil fuel as the raw material, purchased or sold electricity quantity, purchased or sold steam quantity, etc.

3.9 Emission factors

Emission factors refer to the amount of greenhouse gas emissions or removals per unit of activity level. Emission factors are generally acquired on the basis of sample measurement or statistical analysis. They indicate the representative emission rates or removal rates at certain activity level under given operational conditions.

3.10 Coal oxidation rate

Coal oxidation rate refers to the rate of carbon oxidized in the process of fuel combustion. It represents the combustion efficiency of fuels.

4. Accounting Boundary

4.1 Enterprise boundary

The reporting entity shall deem an independent corporate enterprise or the independent accounting entity considered as the legal person to be the enterprise boundary for accounting and reporting of greenhouse gas emissions from all production facilities whose operation is under its control. The scope of the facilities includes the basic production system, auxiliary production system and the affiliated production system that directly serves production. Among them, the auxiliary production system includes dynamics, power supply, water supply, heating, refrigeration, machine maintenance, assay, instrumentation, warehouse (raw material stock yard) and transportation in the plant area. The affiliated production system includes the production control and management system (headquarter) and the departments and units (such as the staff cafeteria and workshop bathrooms) serving production in the plant area.

4.2 Emission sources and types of gases

The reporting entity shall account the following categories of emission sources and types of gases:

4.2.1 CO₂ emissions from fuel combustion

CO₂ emissions from fuel combustion refer to emissions of CO₂ produced from combustion of fossil fuels with oxygen in various stationary combustion equipment (e.g. combustion chamber of the coke oven, boiler, kiln, incinerator, heating furnace, smelter, generator engine, etc.) and mobile combustion equipment (e.g. transportation vehicles and handling equipment in the plant) for production within the enterprise boundary. In addition to procured fossil fuels, fuels shall also include self-produced or recovered coke, coke oven gas and other gases that are consumed by the above combustion equipment.

4.2.2 CO₂ emissions from industrial production process

The regular mechanical coke oven (semi-coke oven) produces raw coke oven gas during dry distillation of coal. The CO₂ produced is discharged through the torch system. A small proportion can be discharged into the air in the form of CO₂, CO, CH₄ and other hydrocarbons through the bleeder of the coke oven. As the reporting entity generally lacks flow monitoring and non-CO₂ gases will be finally oxidized into CO₂ after days to around 10 years in the atmosphere, emissions from the industrial production process during coking will be uniformly accounted and reported as CO₂ emissions through the carbon mass balance method. In addition, if the reporting entity further processes the coking products, such as coal tar processing and benzene processing and refinery, or uses coke oven gas for further production of chemical products such as methanol, synthetic ammonia, urea and LNG/CNG, it shall account and report CO₂ emissions from these industrial production processes.

For heat recovery coke oven, as the coal gas burns directly in the oven, temporary flue gas escape may occur only in the state of coke oven accidents. As the occurrence

probability is extremely low, the small amount of emissions produced can be calculated into CO₂ emissions from fuel combustion of coal gas in the heat recovery coke oven by the carbon mass balance method. Therefore, emissions from industrial production processes for coking will not be otherwise calculated.

4.2.3 CO₂ recovery and utilization

CO₂ recovery and utilization include the CO₂ produced from fuel combustion or industrial production process, recovered by the enterprise and used as raw production material and that is supplied to other entities as product. Recovered and utilized CO₂ can be deducted from the total emissions amount of the enterprise.

4.2.4 CO₂ emissions embodied in net purchased electric power and heating power

CO₂ emissions embodied in net purchased electric power and heating power refer to emissions of CO₂ produced from corresponding electric power or heating power production process of net electric power and heating power purchased by an enterprise. The emissions actually occur in electric power and heating power manufacturing enterprises.

See Figure. 1 for the boundary of greenhouse gas emission accounting and reporting for independent coking enterprises.

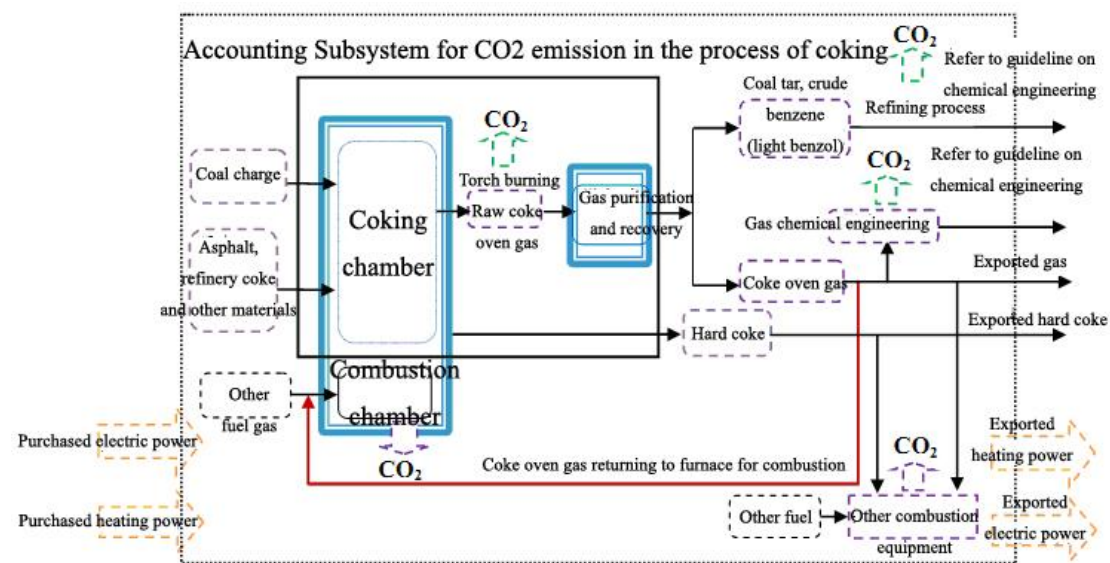


Figure. 1 Diagram of the Boundary of Greenhouse Gas Emission Accounting for Independent Coking Enterprises (taking regular mechanical coke oven for example)

Note: For auxiliary production systems and affiliated production systems of the enterprises not shown in the diagram, their combustion equipment shall also be included in the accounting boundary.

5. Accounting Methodology

The complete workflows for accounting and reporting corporate greenhouse gas emissions from the reporting entity shall include the following:

- (1) Determine the accounting boundary;
- (2) Identify and determine the emission sources and types of gases;
- (3) Specify the calculation formula;
- (4) Collect activity level data;
- (5) Select and acquire emission factor data;
- (6) Account the greenhouse gas emissions of each emission source according to corresponding formula;
- (7) Account the CO₂ emissions embodied in net purchased electric power and heating power; and
- (8) Summarize the total greenhouse gas emissions of the enterprise.

Total greenhouse gas emissions of independent coking enterprises shall be equal to CO₂ emissions from fuel combustion plus CO₂ emissions from industrial production process minus CO₂ recovery and utilization of the enterprise plus CO₂ emissions embodied in net electric power and heating power purchased by the enterprise.

$$E_{GHG} = E_{CO_2 \text{ - 燃烧过程净电净热}} + \sum E_{CO_2 \text{ - 工业生产过程}} - R_{CO_2 \text{ - Recovery}} + E_{CO_2 \text{ - 净电净热}} + E_{CO_2 \text{ - 工业生产过程}}$$

.....(1)

where,

E_{GHG} refers to the total greenhouse gas emissions of the reporting entity. It is expressed in unit ton CO₂;

$E_{CO_2\text{-combustion}}$ refers to emissions of CO₂ produced from combustion of fossil fuel in various types of combustion equipment in the accounting boundary. It is expressed in unit ton CO₂;

$E_{CO_2\text{-Process}}$ refers to emissions of CO₂ produced from various industrial production processes in the accounting boundary. It is expressed in unit ton CO₂;

$R_{CO_2\text{-Recovery}}$ refers to the amount of CO₂ recovered and utilized. It is expressed in unit ton CO₂;

$E_{CO_2\text{-net electric power}}$ refers to the CO₂ emissions embodied in net electric power purchased by the reporting entity. It is expressed in unit ton CO₂; and

$E_{CO_2\text{-net heating power}}$ refers to the CO₂ emissions embodied in net heating power purchased by the reporting entity. It is expressed in unit ton CO₂.

5.1 CO₂ emissions from fuel combustion

CO₂ emissions from fossil fuel combustion of the reporting entity are equal to the sum of CO₂ emissions from fuel combustion in various coke ovens (regular mechanical coke oven, semi-coke oven, heat recovery coke oven) and CO₂ emissions from fuel combustion in other combustion equipment in the accounting boundary.

5.1.1 The equation used to calculate CO₂ emissions from fuel combustion in the combustion chamber of the coke oven

Regular mechanical coke ovens (semi-coke ovens) have separate combustion chamber and the coal gas components and flow are calculable. The CO₂ emissions from fuel combustion can be calculated by the equation below:

$$E_{CO_2\text{-mechanical coke oven}} = \sum_i (AD_i \times CC_i \times OF_i \times \frac{44}{12}) \dots\dots (2)$$

where,

i stands for the category of the fossil fuel;

$E_{CO_2\text{-mechanical coke oven}}$ refers to emissions of CO₂ from fuel combustion in the regular mechanical coke oven (semi-coke oven). It is expressed in unit ton CO₂;

AD_{*i*} refers to the burning capacity of different types of fuel gases *i* (including coke oven gas, blast furnace gas, converter gas, etc.) fed into the combustion chamber of the regular mechanical coke oven (semi-coke oven). It is expressed in 10,000 Nm³;

CC_{*i*} refers to carbon content in the fuel gas *i* and is expressed in unit ton carbon/10,000 Nm³; and

OF_{*i*} refers to coal oxidation rate of fuel gas *i*, which is dimensionless and whose value ranges from 0 to 1.

For the heat recovery coke oven, as its combustion chamber and coking chamber are combined into one, it is difficult to calculate the burning capacity of the fuel gas. As a result, CO₂ produced from coal gas combustion in the heat recovery coke oven (including combustion loss of coke) is estimated by Equation (3) by the carbon mass balance method:

$$E_{CO_2\text{-heat recovery coke oven}} = \left[\sum_r (PM_r \times CC_r) - COK \times CC_{COK} \right] \times \frac{44}{12} \dots\dots (3)$$

where,

$E_{CO_2\text{-heat recovery coke oven}}$ refers to emissions of CO₂ from fossil fuel combustion in the heat recovery coke oven. It is expressed in unit ton CO₂;

PM_{*r*} refers to the mass of raw material *r* (including cled coal used for coking, asphalt, refinery coke and other ingredients) used for coking and fed into the coking chamber of the coke oven. It is expressed in ton;

CC_{*r*} stands for carbon content of the raw material *r* for coking. It is expressed in unit ton carbon/ton;

COK refers to the amount of coke produced by the coke oven. It is expressed in ton; and

CC_{COK} refers to the carbon content of the coke and is expressed in unit ton carbon/ton.

5.1.2 The equation used to calculate CO₂ emissions from fuel combustion in the other combustion equipment

For accounting of CO₂ emissions from fuel combustion in combustion equipment other than the coke oven, the reporting entity shall multiply the burning capacity of different types of fossil fuels in different combustion equipment by corresponding carbon contents of the fuels and coal oxidation rates. The CO₂ emissions equal to cumulative summation of the products. The calculation equation is as below:

$$E_{CO_2\text{-other combustion equipment}} = \sum_j \sum_i (AD_{i,j} \times CC_{i,j} \times OF_{i,j} \times \frac{44}{12}) \quad \dots\dots (4)$$

where,

i stands for the category of the fossil fuel;

j stands for serial number of the combustion equipment;

$E_{CO_2\text{-other combustion equipment}}$ refers to CO₂ emissions from combustion of fossil fuel in other combustion equipment other than the coke oven. It is expressed in unit ton CO₂;

AD_{*i,j*} refers to the burning capacity of the fossil fuel *i* fed into the combustion equipment *j*. For solid and liquid fuels, it is expressed in ton, while for fuel gas, it is expressed in 10,000 Nm³;

CC_{*i,j*} refers to the carbon content of the fossil fuel *i* fed into the combustion equipment *j*. For solid and liquid fuels, it is expressed in unit ton carbon/ton, while for fuel gas, it is expressed in unit ton carbon / 10,000 Nm³; and

OF_{*i,j*} refers to the coal oxidation rate of fossil fuel *i* in the combustion equipment *j*. It is dimensionless and its value ranges from 0 to 1.

5.1.3 Activity level data acquisition

The burning capacity of various fossil fuels for combustion equipment shall be determined based on the original record or statistical ledger of enterprise energy consumption. The fossil fuel to be fed into the combustion equipment and burned as fuel, including home-made coke, coke oven gas, and other gases to be burned in the combustion equipment, shall be specified. For the heat-recovery coke oven, the quantity of raw material into furnace and the coke output shall be considered as the activity level data. Relevant energy measurement shall be conducted in accordance with the requirements of *GB17167 General Principle for Equipping and Managing of the Measuring Instrument of Energy in Organization of Energy Using*.

5.1.4 Emission factor data acquisition

5.1.4.1 Carbon content of fossil fuel

Wherever practical, the enterprise may determine by itself or entrust a competent professional certification institute to determine the carbon content of the fuel on a regular basis. The determination of the carbon content in the raw material (fuel) shall be conducted in accordance with *GB/T 476 Determination of Carbon and Hydrogen in Coal*, *SH/T 0656 Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants (element analyzer method)*, *GB/T 13610 Analysis of Natural Gas Composition—Gas Chromatography*, or *GB/T 8984 Determination of Carbon Monoxide, Carbon Dioxide and Hydrocarbon in Gases—Gas Chromatographic Method*. For coal, the determination of carbon content shall be conducted when every batch of coal is transported into the plant or at least on a monthly basis, and the carbon content in such type of coal shall be determined based on the quantity of incoming coal or monthly coal consumption weighted average. For oil, the determination of carbon content shall be conducted when every batch of oil is transported into the plant or at least on a quarterly basis, and the arithmetic mean value shall be obtained and deemed to be the carbon content in such type of oil. For fuel gas such as natural gas, the determination of gas components shall be conducted when every batch of gas is transported into the plant

or at least on a half year basis, and the carbon content in the gas shall be calculated based on the volume concentration of every type of component and the number of carbon atoms in the chemical equation of such component.

$$CC_g = \sum_n \left(\frac{12 \times CN_n \times V_n}{22.4} \times 10 \right) \dots\dots (5)$$

where:

n : component of gas to be determined;

CC_g : carbon content of gas (g) to be determined, ton carbon/10,000 Nm³;

V_n : volume concentration of every type of component (n) of gas to be determined, with the value range of 0~1, e.g. 0.95 for volume concentration 95%;

CN_n : number of carbon atoms in chemical formula of gas component (n);

12: molar mass of carbon, kg/kmol; and

22.4: ideal molar volume of gas in standard conditions, Nm³/kmol.

For common commercial fuels, the low heating value of the fuel may be determined regularly for estimation of the carbon content in such fuel by Equation (6).

$$CC_i = NCV_i \times EF_i \dots\dots (6)$$

where:

CC_i : carbon content in the fossil fuel (i), with ton carbon/ton fuel as the unit for solid and liquid fuel while ton carbon/10,000 Nm³ for gas fuel;

NCV_i : low heating value of the fossil fuel (i), MkJ (GJ)/Ton for solid and liquid fuel while GJ /10,000 Nm³ for gas fuel;

EF_i : carbon content of unit heat value in fossil fuel (i), ton carbon/GJ. For carbon content of unit heat value in common commercial energies, see Table 2.1 of Appendix II.

The determination of low heating value of fuels shall be conducted in accordance with GB/T 213 *Determination of Calorific Value of Coal*, GB/T 384 *Determination of*

Calorific Value of Petroleum Products, and *GB/T 22723 Energy Determination for Natural Gas*. For coal, the determination of low heating value shall be conducted when every batch of coal is transported into the plant or at least on a monthly basis, and the low heating value of such type of coal shall be determined based on the quantity of incoming coal or monthly coal consumption weighted average. For oil, the determination of low heating value shall be conducted when every batch of oil is transported into the plant or at least on a quarterly basis, and the arithmetic mean value shall be obtained and deemed to be the low heating value of such type of oil. For fuel gas, the determination of low heating value shall be conducted when every batch of gas is transported into the plant or at least on a half year basis, and the arithmetic mean value shall be obtained and deemed to be the low heating value of such gas.

In case the determination is impractical, the enterprise may take directly the default value as the low heating value of some common fossil fuels from Table 2.1 of Appendix II of the Guidelines or the *GB 21342 Norm of Energy Consumption per Unit Product of Coke*. For the low heating value of cleaned coking coal or coke, the enterprise may adopt the suggestions given by the *GB 21342 Norm of Energy Consumption per Unit Product of Coke*: For dry cleaned coal where 10% is taken as the benchmark of ash content, the heat value decreases (or increases) by 334 kJ/kg as the ash content in the cleaned coal increases (or decreases) by 1%; for coke (whole dry coke) where 13.5% is taken as the benchmark of ash content, the heat value decreases(or increases) by 334 kJ/kg as the ash content in the coke increases (or decreases) by 1%.

5.1.4.2 Oxidation rate of fuel carbon

The default value 0.98 may be taken as the oxidation rate of liquid fuel. The default value 0.99 may be taken as the oxidation rate of gas fuel. For solid fuel, the default value may be taken from Table 2.1 of Appendix II as per the type of solid fuels.

5.2 CO₂ emissions during industrial production process

5.2.1 CO₂ emissions during coking

5.2.1.1 Calculation equation

Since it is difficult to determine the gas flow of common mechanical coke oven (semi-coke oven) vent and flare system, it is recommended to adopt carbon mass balance method to calculate the CO₂ emissions during coking. The carbon loss of the independent subsystem, which is from the coking chamber of coke oven to the gas purification and chemical products recovery section, shall be calculated through carbon mass balance based on the coking raw material fed into such system and the coke, coke oven gas, coal tar, and crude (light) benzene discharged from such system, with the assumption that the lost carbon is totally converted to CO₂ which is emitted to the atmosphere. Related equation is given below:

$$E_{CO_2-\text{coking}} = \left[\sum_r (PM_r \times CC_r) - COK \times CC_{COK} - COG \times CC_{COG} - \sum_p (BY_p \times CC_p) \right] \times \frac{44}{12} \quad (7)$$

where:

$E_{CO_2-\text{coking}}$: CO₂ emissions amount during coking process, ton CO₂;

PM_r : mass of coking raw material (r) (including cleaned coking coal, asphalt, refinery coke, and other materials) to be fed into the coking chamber of coke oven, ton;

CC_r : carbon content of coking raw material (r), ton carbon/ton raw material;

COK : coke output produced by coke oven, ton;

CC_{COK} : carbon content of coke, ton carbon/ton coke;

COG : purified and recovered coke oven gas volume (including the coke oven gas returning to furnace for combustion²), 10,000 Nm³

²For common mechanical coke oven and semi-coke oven, CO₂ emissions generated from return and combustion of the coke oven gas in the furnace has been calculated under the fossil fuel combustion category. Therefore, when calculating the CO₂ emissions during the coking process by carbon balance method, it is required to consider the carbon contained in the coke oven gas to be returned into the furnace for combustion, so as to prevent the loss of

CC_{COG}: carbon content of coke oven gas, ton carbon/10,000 Nm³;

BY_p: yield of various by-products (p) recovered during gas purification process, such as coal tar, crude (light) benzene, ton; and

CC_p: carbon content of by-product (p), ton carbon/ton by-product.

5.2.1.2 Activity level data acquisition

The report entity shall determine the quantity of the cleaned coking coal and ingredients to be fed into the coking chamber of coke oven, coal yield, coke oven gas yield, as well as the amount of by-products recovered during coal purification such as coal tar and crude (light) benzene respectively based on the ledger or statistical statements of the enterprise.

5.2.1.3 Emission factor data acquisition

For the acquisition method of carbon content in the coking raw material, coke, coke oven gas, coal tar, and crude (light) benzene, see the “carbon content of fossil fuel” section described above.

Wherever practical, the enterprise may determine by itself or entrust a competent professional certification body to determine the carbon content of other ingredients or carbonaceous substances on a regular basis. If the determination is impossible, the enterprise may take the default value in accordance with relevant references.

5.2.2 CO₂ emissions during other production processes such as extended processing of coking products

If the report entity also engages in coal tar processing, benzene processing and refining or production of chemical products like methanol, synthetic ammonia, urea, and LNG/CNG with coke oven gas, such report entity shall calculate and report the CO₂ emissions generated during these industrial production processes. For the calculation formula and data, please refer to the methods for calculation of CO₂ emissions amount during industrial production process as specified in the *Calculation*

carbon output.

Methods and Reporting Guidelines for Greenhouse Gas Emissions of Chemical Industry Production Enterprises in China (Trial). The CO₂ emissions that are used as production raw material shall also be incorporated into the input amount of raw material. It will not be reiterated here.

5.3 CO₂ recycled amount

5.3.1 Calculation equation

The CO₂ recycled amount of the report entity shall be calculated as per the following equation:

$$R_{CO_2_recycle} = (Q_{external\ supply} \times PUR_{CO_2_external\ supply} + Q_{self-use} \times PUR_{CO_2_self-use}) \times 19.7$$

.....(8)

where:

R_{CO₂_recycle}: CO₂ recycled amount of the report entity, ton CO₂;

Q_{external supply}: volume of CO₂ recovered by the report entity for external supply, 10,000 Nm³;

Q_{self-use}: volume of CO₂ recovered and used by the report entity as production raw material, 10,000 Nm³;

PUR_{CO₂_external supply}: degree of purity (volume concentration) of CO₂ for external supply, with the value range of 0~1;

PUR_{CO₂_self-use}: degree of purity of CO₂ raw gas, with the value range of 0~1; and

19.7: density of CO₂ in standard conditions, ton CO₂/10,000 Nm³.

5.3.2 Activity level data acquisition

The amount of CO₂ recovered for external supply and for self-use as raw material shall be determined in accordance with the ledger or statistical statements of the enterprise.

5.3.3 Emission factor data acquisition

The degree of purity of CO₂ shall be determined in accordance with the ledger and record of the enterprise.

5.4 Indirect CO₂ emissions from net purchase of power and heat

5.4.1 Calculation equation

The indirect CO₂ emissions from net purchase of power and heat by the report entity shall be calculated as per equations (9) and (10) respectively.

$$ECO_{2_net\ power}=AD_{electric\ power}\times EF_{electric\ power} \quad \dots\dots (9)$$

$$ECO_{2_net\ heat}=AD_{heat}\times EF_{heat} \quad \dots\dots (10)$$

where:

ECO_{2_net power}: indirect CO₂ emissions from net purchase of power by the report entity, ton CO₂;

ECO_{2_net heat}: indirect CO₂ emissions from net purchase of heat by the report entity, ton CO₂;

AD_{electric power}: consumption of net electric power purchased by the enterprise, MWh;

AD_{heat}: consumption of net heat purchased by the enterprise, GJ;

EF_{electric power}: CO₂ emission factor of electric power supply, ton CO₂/MWh; and

EF_{heat}: CO₂ emission factor of heat supply, ton CO₂/GJ.

5.4.2 Activity level data acquisition

The consumption of net electric power purchased by the enterprise shall be calculated based on the electric instrument reading for settlement between the enterprise and the power grid company or the ledger or statistical statements for energy consumption of the enterprise, and shall be equivalent to the net difference between the power purchased and the power for external supply.

The consumption of net heat purchased by the enterprise shall be calculated based on the settlement document for purchase of heat or the ledger or statistical

statements for energy consumption of the enterprise, and shall be equivalent to the difference between the total heat of purchased steam and hot water and the total heat of the steam and hot water for external supply.

The hot water measured in mass unit may be converted to that in heat unit as per Equation (11):

$$AD_{\text{hot water}} = Ma_w \times (T_w - 20) \times 4.1868 \times 10^{-3} \quad \dots (11)$$

where:

$AD_{\text{hot water}}$: heat of hot water, GJ;

Ma_w : mass of hot water, ton hot water;

T_w : hot water temperature, °C;

4.1868: specific heat of water at normal temperature and pressure, kJ/(kg•°C);

The steam measured in mass unit may be converted to that in heat unit as per Equation (12):

$$AD_{\text{steam}} = Ma_{\text{st}} \times (En_{\text{st}} - 83.74) \times 10^{-3} \quad \dots (12)$$

where:

AD_{steam} : heat of steam, GJ;

Ma_{st} : mass of steam, ton steam; and

En_{st} : corresponding temperature of steam, enthalpy per kg of steam under pressure, kJ/kg. For the enthalpy of saturated steam and superheated steam, see Table 2.2 and Table 2.3 of Appendix II respectively.

5.4.3 Emission factor data acquisition

The CO₂ emission factor of electric power supply shall be the CO₂ emission factor of average power supplied by power grid in the area where the production site of the enterprise is located, and shall be valued in accordance with the latest data issued by the competent department.

The CO₂ emission factor of heat supply shall prioritize the CO₂ emission factor

provided by the heat supply entity; if this value is unavailable, 0.11 ton CO₂/GJ may be employed as the CO₂ emission factor.

6. Quality Assurance and Documentation

The report entity shall establish the quality assurance and document archiving system for the greenhouse gases emissions report of the enterprise, including:

6.1 Establish the rules and regulations for quantification and reporting of greenhouse gases of the enterprise, including the organization mode, responsible organ, workflows, etc.

6.2 Develop the list of main greenhouse gases emission sources of the enterprise, determine, document, and archive the appropriate quantification method of greenhouse gases.

6.3 Make feasible monitoring plan for parameters involved in the calculation process. The monitoring plan shall include: Parameters to be measured, specific location of sampling point or measuring equipment, sampling method and procedure, monitoring method and procedure, monitoring frequency or time point, data collection or delivery process, responsible department, quality assurance and quality control (QA/QC) procedure, etc. The enterprise shall appoint relevant department and special personnel for sampling, monitoring, analysis, recording, collection, and archiving of data. If default values are taken as parameters for calculation of some emission factors, the data source of the default values shall be provided and the updated plan shall be checked on a regular basis.

6.4 Make the periodic calibration schedule of the measuring equipment and verify and calibrate all the measuring equipment in accordance with relevant specifications on a regular basis. In case it is found that any equipment performance fails to meet relevant requirements, the enterprise shall take necessary correction and rectification measures promptly.

6.5 Develop the countermeasures for missing of data, change of production activities or reporting methods. In case the activity level or emission factor of specific emissions is missed through calculation, the enterprise shall employ appropriate calculation method to determine the corresponding period and the conservative surrogate data for the missed data.

6.6 Stipulate the specifications for document management, store and maintain the documents and data records of annual report for greenhouse gases, and ensure that relevant documents can be available wherever requested by the third party for checking and reported to the competent department.

6.7 Establish the internal audit and verification procedure for data, summarize the data fluctuation status during the calculation period by means of cross validation of different data sources, compare with historic operation data in past years to determine the main logic audit relationship, and ensure the completeness and accuracy of the activity level data; check the accuracy of the CO₂ emissions calculation result in the report by carbon mass balance method in accordance with the carbon inflow and outflow conditions at the enterprise level, and if any material deviation occurs, analyze and describe the reasons.

7. Contents of Report

The reporting entity shall report the following contents as per the format shown in Appendix I.

7.1 Basic information of the reporting entity

The basic information of the reporting entity shall include the name of the reporting entity, the reporting year, nature of the unit, the industry involved, the organization or branch, the geographical position (including the registered address and the production place), the time of establishment, the development history, the legal representative, the preparer of the report and its contact information.

7.2 Emissions of greenhouse gas

The information about greenhouse gas emissions to be reported shall include the total emissions of greenhouse gas during the reporting period of the enterprise, and the CO₂ emissions from combustion of fossil fuels classified as per emission sources, CO₂ emissions during coking, recycled amount of CO₂, and the CO₂ emissions implied in net amounts of electric power and heating power purchased. If the enterprise also has such industrial production processes as coal tar processing, benzene refining, production of chemical products with coke oven gas, the enterprise shall still report the CO₂ emissions of these industrial production processes.

7.3 Activity level data and data sources

The reporting entity shall report the data of activity level of each emission source calculated respectively while taking into consideration of the accounting boundaries and classification of the emission sources. In addition, the reporting entity shall state the monitoring plans and implementation of these plans in detail, including data sources or monitoring positions, monitoring methods, and recording frequency.

7.4 Emission factor data and data sources

The reporting entity shall report the carbon contents that correspond to each activity level or other emission factor calculating parameters respectively. If the data is actually measured, then the monitoring plan and its implementation shall be introduced, or the data sources, the references, related consumptions and the reasons shall be provided

7.5 Other explanations

If the reporting entity wishes to provide other explanations, the reporting entity can state issues one by one or give comments on how to amend the Guidelines.

Appendix I: Report Format Template

Greenhouse Gas Emissions Report China Independent Coking Enterprises

Reporting entity (seal):

Reporting year:

Date of preparation:

According to the *Guidelines for Accounting and Reporting Greenhouse Gas Emissions from China Independent Coking Enterprises (Trial)*, the enterprise calculated its greenhouse gas emissions of the year _____ and filled out the related data sheets. The reporting entity herewith reports the relevant information as follows:

I Basic information of the reporting entity

II Emissions of greenhouse gas

III Description of data of activity level and the data sources

IV Description of data of emission factor and the data sources

V Description of other explanations

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

Legal person (Signature):

Date

Attachments:

Table 1-1: Summary Sheet of Greenhouse Gas Emissions of the Reporting Entity in

Table 1-2: Data Sheet of Activity Level and Emission Factor for Combustion of Fuels in Conventional Mechanical Coke Oven (Semi-coke Oven)

Table 1-3: Data Sheet of Activity Level and Emission Factor for Combustion of Fuels in Heat Recovery Coke Oven

Table 1-4: Data Sheet of Activity Level and Emission Factor of other Combustion Plants

Table 1-5: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during Coking with Conventional Mechanical Coke Oven (Semi-coke Oven)

Table 1-6: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during Production of Chemical Products with Coke Oven Gas

Table 1-7: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during Production and Processing of Coal Tar

Table 1-8: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during Refine Process of Benzene

Table 1-9: Data Sheet of Amounts CO₂ Recycled by the Enterprises

Table 1-10: Data Sheet of the Activity Levels and Emission Factors of the Net Amounts of Electric Power and Heating Power Purchased by the Enterprise

Table 1-1: Summary Sheet of Greenhouse Gas Emissions of the Reporting Entity in

Type of source		Emissions (Unit: ton CO₂)
CO ₂ emissions from combustion of fuel		
CO ₂ emissions from coking process		
CO ₂ emissions during production of chemical products with coke oven gas		
CO ₂ emissions during production and processing of coal tar		
CO ₂ emissions during refine process of benzene		
Recycled amount of CO ₂		
CO ₂ emissions implied in net amount of electric power purchased		
CO ₂ emissions implied in net amount of heating power purchased		
Total emissions of greenhouse gas of the enterprise	Excluding CO ₂ emissions implied in net amounts of electric power and heating power purchased	
	Including CO ₂ emissions implied in net amounts of electric power and heating power purchased	

Table 1-2: Data Sheet of Activity Level and Emission Factor for Combustion of Fuels in Conventional Mechanical Coke Oven (Semi-coke Oven) ¹

Type of fuel	Combusted amount(10,000 Nm ³)	Carbon content(ton carbon/10,000 Nm ³)	Data source	Lower heating value ² (GJ/10,000 Nm ³)	Data source	Carbon content in unit heat value ² (ton carbon/GJ)	Carbon oxidation rate(%)	Data source
Coke oven gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Blast furnace gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Converter gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Other fuel gases ³			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value

Notes:

- 1 The reporting entity shall copy and fill out this table separately for each conventional mechanical coke oven (semi-coke oven).
- 2 To estimate carbon content of fuel with lower heating value of the fuel and carbon content in unit heat value, please fill out this column.
- 3 Please specify one by one.

Table 1-3: Data Sheet of Activity Level and Emission Factor for Combustion of Fuels in Heat Recovery Coke Oven¹

Type of fuel	Activity level(ton)	Carbon content(ton carbon/ton)	Data source	Lower heating value ² (GJ/ton)	Data source	Carbon content in unit heat value ² (ton carbon/GJ)
Carbon inputted in the heat recovery coke oven						
Cleaned coal for coking			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value	
Asphalt			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value	
Petroleum coke			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value	
Other ingredients			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value	
Carbon outputted from the heat recovery coke oven						
Coke			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value	

Notes:

- 1 The reporting entity shall copy and fill out this table separately for each heat recovery coke oven.
- 2 To estimate carbon content of fuel with lower heating value of the fuel and carbon content in unit heat value, please fill out this column.

Table 1-4: Data Sheet of Activity Level and Emission Factor of other Combustion Plants

Type of fuel	Combusted amount ¹ (10,000 Nm ³)	Carbon content(Unit ton carbon/Ton or Unit ton carbon/10,000 Nm ³)	Data source	Lower heating value ² (GJ/10,000 Nm ³)	Data source	Carbon content in unit heat value ² (Unit ton carbon/GJ)	Carbon oxidation rate(%)	Data source
Anthracite			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Bitumite			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Lignite			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Cleaned coal			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Other washed coal			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Briquette coal			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value

Coke			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Crude oil			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Fuel oil			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Gasoline			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Diesel			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Aviation kerosene			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Common kerosene			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Naphtha			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Petroleum coke			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated		<input type="checkbox"/> Measured value <input type="checkbox"/> Default			<input type="checkbox"/> Measured value <input type="checkbox"/> Default

			value		value			value
Liquefied natural gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Liquefied petroleum gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Other petroleum products			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Coke oven gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Blast furnace gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Converter gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Other gases			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Natural gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value
Refinery dry			<input type="checkbox"/> Measured		<input type="checkbox"/> Measured			<input type="checkbox"/> Measured

gas			value <input type="checkbox"/> Calculated value		value <input type="checkbox"/> Default value			value <input type="checkbox"/> Default value
Other fuels ³			<input type="checkbox"/> Measured value <input type="checkbox"/> Calculated value		<input type="checkbox"/> Measured value <input type="checkbox"/> Default value			<input type="checkbox"/> Measured value <input type="checkbox"/> Default value

Notes:

- 1 The sum of the combusted amount of every type of fuel with all combustion plants other than coke oven.
- 2 To estimate carbon content of fuel with lower heating value of the fuel and carbon content in unit heat value, please fill out this column.
- 3 If the fuel burnt by the reporting entity is not listed in the table, the reporting entity is required to add the fuel on its own.

**Table 1-5: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during
Coking with Conventional Mechanical Coke Oven (Semi-coke Oven)**

Carbon inputted in coking chamber	Name of material	Activity Level(Unit: tonor 10,000 Nm ³)	Carbon content(Unit:ton carbon/tonor ton carbon/10,000 Nm ³)	Data source
	Cleaned coal for coking			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Asphalt			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Petroleum coke			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Other ingredients ¹			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
Carbon outputted from coking chamber	Coke (including semi-coke)			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Coke oven gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Coal tar			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Crude benzene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Light benzene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value

 ²			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
				<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value

Note: For 1 and 2, the reporting entity is required to describe one by one according to the actual input and output conditions.

Table 1-6: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during Production of Chemical Products with Coke Oven Gas

Carbon input	Name of material	Data of activity level(Unit: ton or 10,000 Nm³)	Carbon content(Unit: ton carbon/ton or ton carbon/10,000 Nm³)	Data source
	Coke oven gas			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Other raw materials ¹			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
Carbon output	Methanol			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Synthesis ammonia			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Urea			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	LNG/CNG			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Other chemical products ²			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value

Note: for 1 and 2, the reporting entity is required to describe one by one according to the actual input and output conditions.

Table 1-7: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during Production and Processing of Coal Tar

Carbon input	Name of material	Data of activity level(Unit: ton or 10,000 Nm³)	Carbon content(Unit: ton carbon/ton or ton carbon/10,000 Nm³)	Data source
	Coal tar			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Other raw materials ¹			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
Carbon output	Naphthalene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Phenol			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Anthracene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Phenanthrene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Carbazole			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Asphalt			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Others ²			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value

Note: For 1 and 2, the reporting entity is required to describe one by one according to the actual input and output conditions.

Table 1-8: Data Sheet of Activity Level and Emission Factor of CO₂ Emissions during Refine Process of Benzene

Carbon input	Name of material	Data of activity level(Unit: ton or 10,000 Nm³)	Carbon content(Unit: ton carbon/ton or ton carbon/10,000 Nm³)	Data source
	Crude benzene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Light benzene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Other raw materials ¹			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
Carbon output	Benzene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Methylbenzene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Xylene			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Solvent naphtha			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Stripped benzene residue			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value
	Other Products ²			<input type="checkbox"/> Measured value <input type="checkbox"/> Chemical calculation <input type="checkbox"/> Default value

Note: For 1 and 2, the reporting entity is required to describe one by one according to the actual input and output conditions.

Table 1-9: Data Sheet of Amounts CO₂ Recycled by the Enterprise

Recycled and supplied amount of CO₂ (10,000 Nm³)	Volume concentration of CO₂ supplied (%)	Amount of CO₂ recycled and used as raw material (10,000 Nm³)	Volume concentration of CO₂ as feed gas (%)

**Table 1-10: Data Sheet of the Activity Levels and Emission Factors of the Net Amounts of
Electric Power and Heating Power Purchased by the Enterprise**

Type	Net amount purchased(MWh or GJ)	Amount purchased (MWh or GJ)	Amount supplied (MWh or GJ)	Emission Factor ofCO₂(Unit ton CO₂/MWh or Unit ton CO₂/GJ)
Electric power				
Steam				
Hot water				

Appendix II: Relevant Default Values

Table 2-1: Default Values of Parameters of Common Properties of Fossil Fuels

Type of fuel		Lower heating value	Unit of heat value	Carbon content in unit heat value(Unit ton carbon/GJ)	Carbon oxidation rate of the fuel
Solid fuels	Anthracite*	20.304	GJ/Ton	27.49×10^{-3}	94%
	Bitumite *	19.570	GJ/Ton	26.18×10^{-3}	93%
	Lignite*	14.080	GJ/Ton	28.00×10^{-3}	96%
	Dry-cleaned coal (ash content 10%)	29.727	GJ/Ton	25.40×10^{-3}	93%
	Other washed coal *	8.363	GJ/Ton	25.40×10^{-3}	90%
	Briquette coal	17.460	GJ/Ton	33.60×10^{-3}	90%
	Coke (dry total coke, ash content 13.5%)	28.469	GJ/Ton	29.40×10^{-3}	93%
Liquid fuels	Crude oil	42.620	GJ/Ton	20.10×10^{-3}	98%
	Fuel oil	40.190	GJ/Ton	21.10×10^{-3}	98%
	Gasoline	44.800	GJ/Ton	18.90×10^{-3}	98%
	Diesel	43.330	GJ/Ton	20.20×10^{-3}	98%
	Common kerosene	44.750	GJ/Ton	19.60×10^{-3}	98%
	Petroleum coke	31.998	GJ/Ton	27.50×10^{-3}	98%
	Other petroleum products	41.031	GJ/Ton	20.00×10^{-3}	98%
	Coal tar	33.496	GJ/Ton	22.00×10^{-3}	98%
	Crude (light) benzene	41.869	GJ/Ton	22.70×10^{-3}	98%
Gas fuels	Refinery dry gas	46.050	GJ/Ton	18.20×10^{-3}	99%
	Liquefied petroleum gas	47.310	GJ/Ton	17.20×10^{-3}	99%
	Liquefied natural gas	41.868	GJ/Ton	17.20×10^{-3}	99%

	Natural gas	389.31	GJ/10,000 Nm ³	15.30×10 ⁻³	99%
	Coke oven gas	167.460	GJ/10,000 Nm ³	13.60×10 ⁻³	99%
	Blast furnace gas	31.390	GJ/10,000 Nm ³	70.80×10 ⁻³	99%
	Converter gas	73.270	GJ/10,000 Nm ³	49.60×10 ⁻³	99%
	Gas of full-enclosed calcium carbide furnace	111.190	GJ/10,000 Nm ³	39.51×10 ⁻³	99%
	Other coal gases	52.270	GJ/10,000 Nm ³	12.20×10 ⁻³	99%

*Based on air dried basis

Data sources:

1) As for lower heating value, please refer to *China Energy Statistical Yearbook (2012)*, *The Norm of Energy Consumption per Unit Product of Coke*, and *The People's Republic of China National Greenhouse Gas Inventory*.

2) As for carbon content in unit heat value, please refer to *IPCC Guidelines for National Greenhouse Gas Inventories (2006)* and *Guidelines for Provincial Greenhouse Gas Inventories(Trial)*.

3) As for carbon oxidation rate, please refer to *Guidelines for Provincial Greenhouse Gas Inventories(Trial)*.

Table 2-2: Thermal Enthalpy of Saturated Steam

Pressure (MPa)	Temperature (°C)	Enthalpy (kJ / kg)	Pressure (MPa)	Temperature (°C)	Enthalpy (kJ / kg)
0.001	6.98	2513.8	1.00	179.88	2777.0
0.002	17.51	2533.2	1.10	184.06	2780.4
0.003	24.10	2545.2	1.20	187.96	2783.4
0.004	28.98	2554.1	1.30	191.6	2786.0
0.005	32.90	2561.2	1.40	195.04	2788.4
0.006	36.18	2567.1	1.50	198.28	2790.4
0.007	39.02	2572.2	1.60	201.37	2792.2
0.008	41.53	2576.7	1.40	204.3	2793.8
0.009	43.79	2580.8	1.50	207.1	2795.1
0.010	45.83	2584.4	1.90	209.79	2796.4
0.015	54.00	2598.9	2.00	212.37	2797.4
0.020	60.09	2609.6	2.20	217.24	2799.1
0.025	64.99	2618.1	2.40	221.78	2800.4
0.030	69.12	2625.3	2.60	226.03	2801.2
0.040	75.89	2636.8	2.80	230.04	2801.7
0.050	81.35	2645.0	3.00	233.84	2801.9
0.060	85.95	2653.6	3.50	242.54	2801.3
0.070	89.96	2660.2	4.00	250.33	2799.4
0.080	93.51	2666.0	5.00	263.92	2792.8
0.090	96.71	2671.1	6.00	275.56	2783.3
0.10	99.63	2675.7	7.00	285.8	2771.4
0.12	104.81	2683.8	8.00	294.98	2757.5
0.14	109.32	2690.8	9.00	303.31	2741.8
0.16	113.32	2696.8	10.0	310.96	2724.4
0.18	116.93	2702.1	11.0	318.04	2705.4
0.20	120.23	2706.9	12.0	324.64	2684.8
0.25	127.43	2717.2	13.0	330.81	2662.4
0.30	133.54	2725.5	14.0	336.63	2638.3
0.35	138.88	2732.5	15.0	342.12	2611.6
0.40	143.62	2738.5	16.0	347.32	2582.7
0.45	147.92	2743.8	17.0	352.26	2550.8
0.50	151.85	2748.5	18.0	356.96	2514.4
0.60	158.84	2756.4	19.0	361.44	2470.1
0.70	164.96	2762.9	20.0	365.71	2413.9
0.80	170.42	2768.4	21.0	369.79	2340.2
0.90	175.36	2773.0	22.0	373.68	2192.5

Table 2-3: Thermal Enthalpy of Superheated Steam

(Unit: kJ/kg)

Temperature	Pressure											
	0.01 MPa	0.1 MPa	0.5 MPa	1 MPa	3 MPa	5 MPa	7 MPa	10 MPa	14 MPa	20 MPa	25 MPa	30 MPa
0°C	0	0.1	0.5	1	3	5	7.1	10.1	14.1	20.1	25.1	30
10°C	42	42.1	42.5	43	44.9	46.9	48.8	51.7	55.6	61.3	66.1	70.8
20°C	83.9	84	84.3	84.8	86.7	88.6	90.4	93.2	97	102.5	107.1	111.7
40°C	167.4	167.5	167.9	168.3	170.1	171.9	173.6	176.3	179.8	185.1	189.4	193.8
60°C	2611.3	251.2	251.2	251.9	253.6	255.3	256.9	259.4	262.8	267.8	272	276.1
80°C	2649.3	335	335.3	335.7	337.3	338.8	340.4	342.8	346	350.8	354.8	358.7
100°C	2687.3	2676.5	419.4	419.7	421.2	422.7	424.2	426.5	429.5	434	437.8	441.6
120°C	2725.4	2716.8	503.9	504.3	505.7	507.1	508.5	510.6	513.5	517.7	521.3	524.9
140°C	2763.6	2756.6	589.2	589.5	590.8	592.1	593.4	595.4	598	602	605.4	603.1
160°C	2802	2796.2	2767.3	675.7	676.9	678	679.2	681	683.4	687.1	690.2	693.3
180°C	2840.6	2835.7	2812.1	2777.3	764.1	765.2	766.2	767.8	769.9	773.1	775.9	778.7
200°C	2879.3	2875.2	2855.5	2827.5	853	853.8	854.6	855.9	857.7	860.4	862.8	856.2
220°C	2918.3	2914.7	2898	2874.9	943.9	944.4	945.0	946	947.2	949.3	951.2	953.1
240°C	2957.4	2954.3	2939.9	2920.5	2823	1037.8	1038.0	1038.4	1039.1	1040.3	1041.5	1024.8
260°C	2996.8	2994.1	2981.5	2964.8	2885.5	1135	1134.7	1134.3	1134.1	1134	1134.3	1134.8
280°C	3036.5	3034	3022.9	3008.3	2941.8	2857	1236.7	1235.2	1233.5	1231.6	1230.5	1229.9
300°C	3076.3	3074.1	3064.2	3051.3	2994.2	2925.4	2839.2	1343.7	1339.5	1334.6	1331.5	1329
350°C	3177	3175.3	3167.6	3157.7	3115.7	3069.2	3017.0	2924.2	2753.5	1648.4	1626.4	1611.3
400°C	3279.4	3278	3217.8	3264	3231.6	3196.9	3159.7	3098.5	3004	2820.1	2583.2	2159.1

420°C	3320.96	3319.68	3313.8	3306.6	3276.9	3245.4	3211.0	3155.98	3072.72	2917.02	2730.76	2424.7
440°C	3362.52	3361.36	3355.9	3349.3	3321.9	3293.2	3262.3	3213.46	3141.44	3013.94	2878.32	2690.3
450°C	3383.3	3382.2	3377.1	3370.7	3344.4	3316.8	3288.0	3242.2	3175.8	3062.4	2952.1	2823.1
460°C	3404.42	3403.34	3398.3	3392.1	3366.8	3340.4	3312.4	3268.58	3205.24	3097.96	2994.68	2875.26
480°C	3446.66	3445.62	3440.9	3435.1	3411.6	3387.2	3361.3	3321.34	3264.12	3169.08	3079.84	2979.58
500°C	3488.9	3487.9	3483.7	3478.3	3456.4	3433.8	3410.2	3374.1	3323	3240.2	3165	3083.9
520°C	3531.82	3530.9	3526.9	3521.86	3501.28	3480.12	3458.6	3425.1	3378.4	3303.7	3237	3166.1
540°C	3574.74	3573.9	3570.1	3565.42	3546.16	3526.44	3506.4	3475.4	3432.5	3364.6	3304.7	3241.7
550°C	3593.2	3595.4	3591.7	3587.2	3568.6	3549.6	3530.2	3500.4	3459.2	3394.3	3337.3	3277.7
560°C	3618	3617.22	3613.64	3609.24	3591.18	3572.76	3554.1	3525.4	3485.8	3423.6	3369.2	3312.6
580°C	3661.6	3660.86	3657.52	3653.32	3636.34	3619.08	3601.6	3574.9	3538.2	3480.9	3431.2	3379.8
600°C	3705.2	3704.5	3701.4	3697.4	3681.5	3665.4	3649.0	3624	3589.8	3536.9	3491.2	3444.2