



**CLEAN DEVELOPMENT MECHANISM  
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)  
Version 03 - in effect as of: 28 July 2006**

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**SECTION A. General description of project activity****A.1. Title of the project activity:**

Project title: Coke oven gas comprehensive utilization for co-generation project in Shandong Jikuang Morningsun Thermal Power Co., Ltd  
Version: 03  
Date: 07/08/2012

**A.2. Description of the project activity:**

The Coke oven gas comprehensive utilization for co-generation project (hereafter referred to as the “Project”) developed by Shandong Jikuang Morningsun Thermal Power Co., Ltd (hereafter referred to as the “Project Developer”) is located in the centre of Jining Chemical Industry Economic & Technological Development Zone (hereafter referred to as “the Zone”) in Jinxiang County, Jining City, Shandong Province, China.

**Scenario prior to the project:**

- ✧ Shandong Jikuang Morningsun Coal Chemical Co., Ltd., a neighbour of Shandong Jikuang Morningsun Thermal Power Co., Ltd, is an existing coking plant, which generates a great amount of coke oven gas (COG) during the coke production process. And the waste COG was flared into the atmosphere at present. Yangguang Yanliao Co., Ltd is a new company in the zone, who need electricity and steam for production.
- ✧ The electricity consumed by the facilities in the Zone is or would be supplied from the North China Power Grid (NCPG).
- ✧ There was no existing boiler prior to the project for steam supplying in the zone to consumers (Shandong Jikuang Morningsun Coal Chemical Co., Ltd. and Yangguang Yanliao Co., Ltd), and the steam demand would be supplied by new built coal-fired boilers in the Zone.

The baseline scenario is the same with the scenario prior to the project.

**The project scenario**

Shandong Jikuang Morningsun Thermal Power Co., Ltd will recover the waste COG from Shandong Jikuang Morningsun Coal Chem. Ltd about 158,604,000 Nm<sup>3</sup> per year. And the project will construct one combined-cycle power plant (CCPP) with the total capacity of 42MW (two sets of 15MW gas turbine generators and one set of 12MW steam turbine generator) to use the recovered waste COG for cogeneration. The project will generate 229,219MWh of electricity and 240,000 tones of steam annually.

The electricity generated will be exported to NCPG to replace equivalent electricity that would have been generated by fossil fuel power plants connected to NCPG. The steam generated by the project will be delivered to steam consumers instead of that otherwise would be generated by coal-fired boilers.

By replacement of electricity from NCPG and steam from coal fired boilers, the emission reduction of the project will be 246,651tCO<sub>2</sub>e per year.

The project is under construction at present.



**Contribution to sustainable development**

- ✧ Reducing the dependence on exhaustible fossil fuel based power sources;
- ✧ Reducing the emission of local pollutants resulting from the burning of fossil fuel, and the associated adverse health effects;
- ✧ Reducing global emissions of greenhouse gases resulting from the burning of fossil fuel, to combat global climate change;
- ✧ Increasing employment opportunities, and increasing incomes for the local people and improving the overall quality of life.
- ✧ Promoting the comprehensive utilization of energy sources, reducing energy waste.

**A.3. Project participants:**

Please list project participants and Party (ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

<b>Name of Party involved (*) (host) indicates a host Party)</b>	<b>Private and/or public entity(ies) project participants (*) (as applicable)</b>	<b>Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)</b>
People's Republic of China (host)	Shandong Jikuang Morningsun Thermal Power Co., Ltd (Private)	No
United Kingdom of Great Britain and Northern Ireland	Lakewood Carbon Corp. (Private)	No

**A.4. Technical description of the project activity:****A.4.1. Location of the project activity:****A.4.1.1. Host Party(ies):**

People's Republic of China

**A.4.1.2. Region/State/Province etc.:**

Shandong province

**A.4.1.3. City/Town/Community etc:**

Huji Town, Jinxiang County, Jining City





**A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):**

The Project activity is located in the centre of Jining Chemical Industry Economic & Technological Development Zone in the southwest of Jining City in Shandong Province. The project's geographical coordinates are east longitude 116°23'31" and north latitude 35°10'29". The detailed information can be seen as follows,



**Figure A.4.1 The location of project activity**

**A.4.2. Category(ies) of project activity:**

The Project activity falls under Scope 1 – Energy Industry (renewable/non-renewable sources) and scope 4 – Manufacturing Industry

**A.4.3. Technology to be employed by the project activity:**





Before the project, the waste COG from Shandong Morningsun Coal Chemical Co., Ltd. was flared to the atmosphere. The electricity demand of the facilities in the zone was supplied by NCPG. There was no exiting steam supplier in the zone, but coal-fired boilers would be constructed to meet the steam demand for production. The baseline scenario is the same with the existing scenario. Relative existing facilities are listed in Table A.4.2.

The project is to install a combined-cycle power plant (CCPP) to recover and utilize the waste COG for cogeneration. The project mainly consists of two gas turbine generators, two complementary combustion heat recovery steam boilers (WHRB), and one set of steam turbine generator. The fuel is the recovered waste COG from the existing coke oven owned by the neighbor company of Shandong Morningsun Coal Chemical Co., Ltd. through the overhead pipeline.

The recovered waste COG would be purified firstly. After that, it was compressed by COG compressor, and then sent to the gas turbine generator to generate electricity. The hot exhaust from the gas turbine would be captured by the WHRB to generate high pressure steam. Then the high pressure steam would spin the steam turbine generator to produce electricity and the extracted steam from the steam turbine can meet the heat demand of the steam customers in the zone.

Additionally, for the stable supplying of steam to consumers, one 75t/h steam boiler would be installed as a standby steam generator in case gas turbine in maintenance or other accidents. The 75t/h steam boiler could be fuelled by raw coal or COG.

The technology flow diagram of CCPP is as Fig. A.4.2

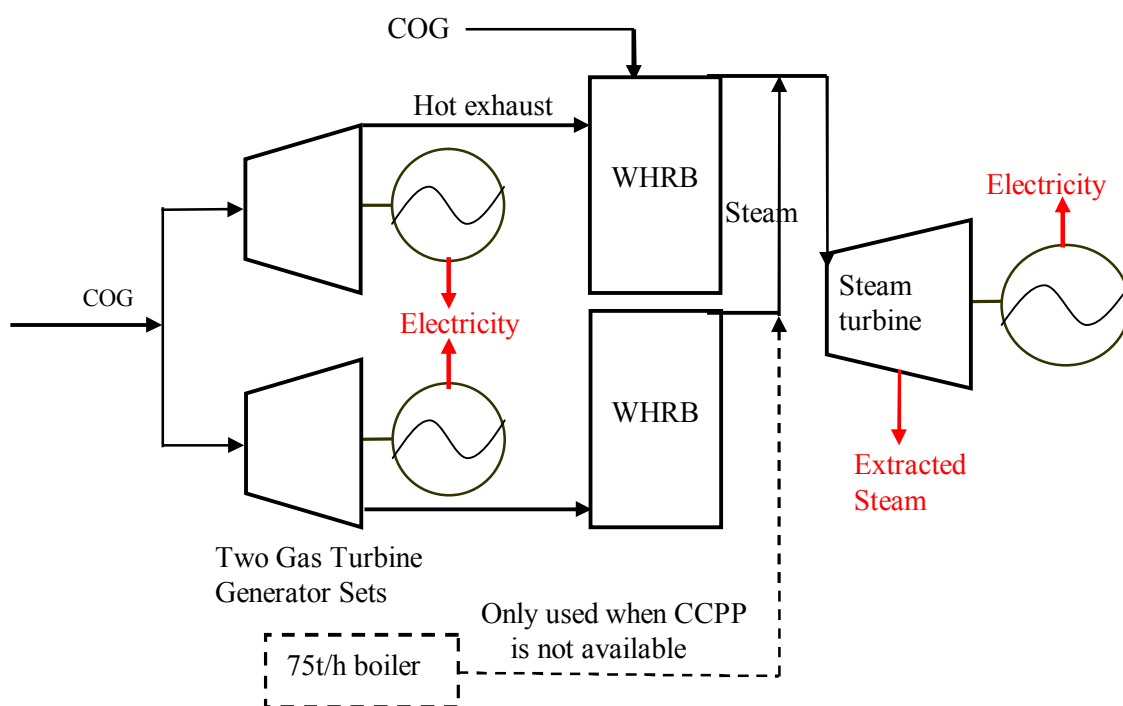


Figure A.4.2 Technology flow diagram of CCPP



**Table A.4.1 Key technology parameter to be employed for project activity**

Gas Turbine Generator Set		
Parameters	Value	Source
Type	Titan™ 130	Nameplate
Producer	Solar Turbines Incorporated	Nameplate
Units	2	FSR
Power	15,000kW	Manufacture's public specification
Lifetime	30 years	Manufacture's public specification
Operational hours per year	6,000	FSR
Complementary combustion waste heat recovery steam boilers (WHRB)		
Parameters	Value	Source
Type	BQ136.2/500-45(4.1)-3.82(0.3)/450(144)	Nameplate
Units	2	FSR
Producer	Nanjing Nanguo Power Equipment Co., Ltd	Nameplate
Rated team Capacity	45 t/h	Nameplate
Feed water temperature	104 °C	Nameplate
Rated Steam Pressure	3.82 MPa	Nameplate
Rated steam Temperature	450 °C	Nameplate
Date of manufacture	Jul., 2010	Nameplate
Lifetime	15 years	Manufacture's specification
Operational hours per year	6,000	FSR
Steam Turbine		
Parameters	Value	Source
Type	C12-3.43/1.27	Nameplate
Producer	Qingdao Jieneng Steam Turbine Group Co., Ltd.	Nameplate
Units	1	Nameplate
Rated power	12MW	Nameplate
Rated input steam pressure	3.43 MPa	Nameplate
Rated input steam temperature	435 °C	Nameplate
Extraction pressure	1.27MPa	Nameplate
Extraction temperature	332 °C	Nameplate
Extraction flow	50t/h	Nameplate
Delivery time	Jul., 2010	Nameplate
Lifetime	15 years	Manufacture's specification
Operational hours per year	6,000	FSR
Steam Turbine Generator		





Parameters	Value	Source
Type	QF-12-2	Nameplate
Producer	Shandong Jinan Generator Equipment Plant	Nameplate
Units	1	Nameplate
Rated power	12MW	Nameplate
Delivery time	Dec., 2010	Nameplate
Lifetime	15 years	Manufacture's specification
Operational hours per year	6,000	FSR
Circulating Fluidized Bed Boiler		
Parameters	Value	Source
Type	UG-75/3.82-M41	Nameplate
Producer	Wuxi Huaguang Boiler Co., Ltd.	Nameplate
Fuel type	COG or Coal	Nameplate
Units	1	Nameplate
Rated steam capacity	75t/h	Nameplate
Rated steam pressure	3.82MPa	Nameplate
Rated steam temperature	450 °C	Nameplate
Date of manufacture	Jun., 2010	Nameplate
Lifetime	15 years	Manufacture's specification
Operational hours per year	Only used at emergencies or maintenance of CCPP	FSR

According to the energy balance and coke oven designing company, the main parameters are as follows

Table A.4.2 Main parameters of the existing facilities/industries

Coke oven of Shandong Morningsun Coal Chemical Co., Ltd.			
Item	Unit	Value	Source
Annual coke production	t/a	800,000	Energy balance
Waste COG	10 <sup>3</sup> m <sup>3</sup>	177,552	Energy balance
Lifetime	Years	25	Manufacture's Clarification
Operation started from		Dec., 2010	Manufacture and facility owner's clarification

The main industrial technology process in the baseline and the project are illustrated in the figure below.



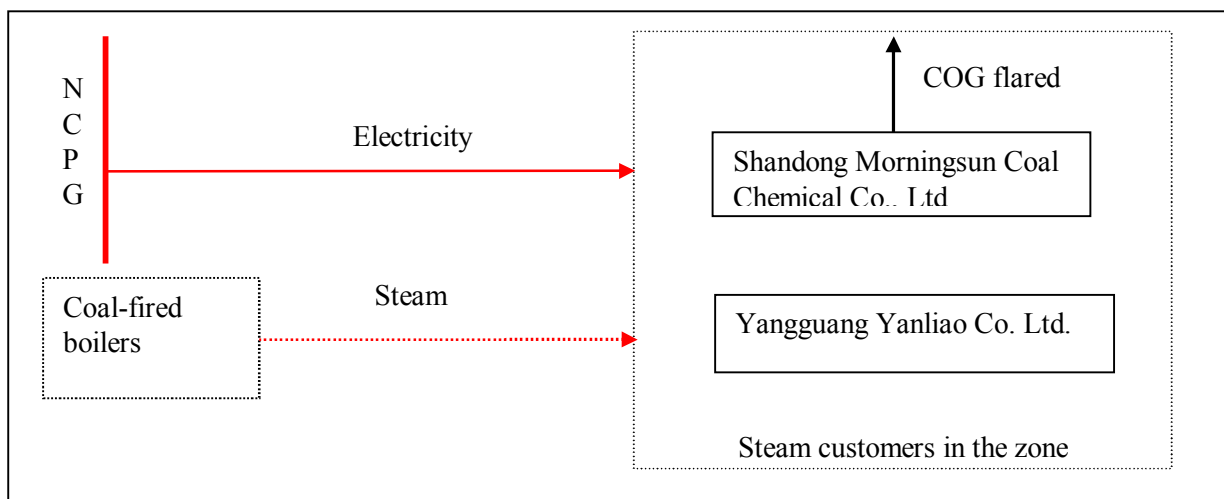


Figure A.4.3 General Process in the baseline

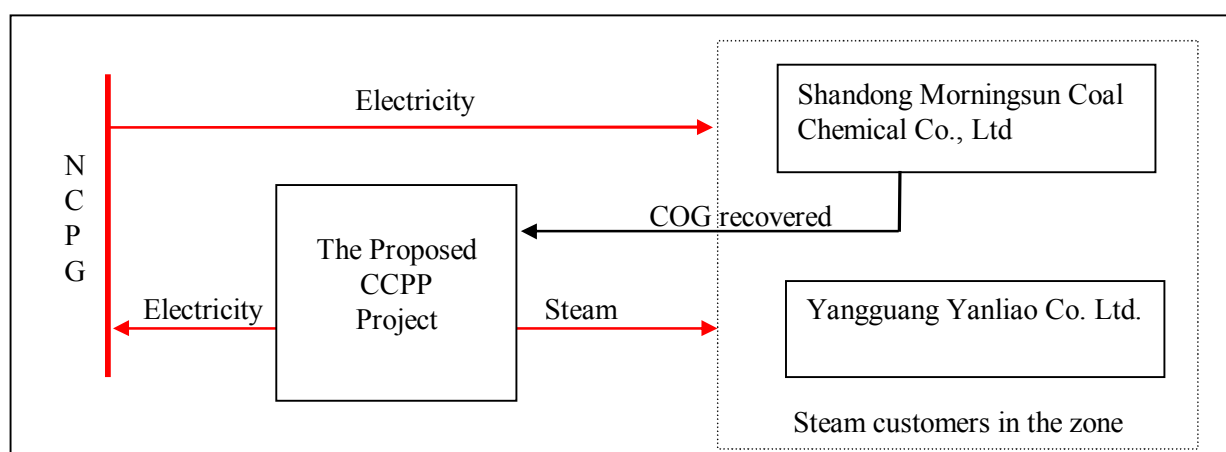


Figure A.4.4 General process after the implementation of the project

**Technology transfer**

The gas turbine generator units are imported from SOLAR TURBINES INTERNATIONAL COMPANY. Technology transfer is not involved in this project.

**A.4.4. Estimated amount of emission reductions over the chosen crediting period:**

The project activity will employ the fixed crediting period (10 years), and the estimation of the emission reductions for the crediting period (from Sep. 1, 2012 to Aug. 31, 2022) is presented in Table A.4. 2. Estimated emission reductions during the crediting period are 2,466,510tCO<sub>2</sub>e.

Table A.4.2 Estimation of the Emission Reductions during the Crediting Period

year	Annual estimation of emission reductions in tones of CO <sub>2</sub> e
01/09/2012-31/12/2012	82,217
2013	246,651
2014	246,651





2015	246,651
2016	246,651
2017	246,651
2018	246,651
2019	246,651
2020	246,651
2021	246,651
01/01/2022-31/08/2022	164,434
Total estimated reductions(tones of CO <sub>2</sub> e)	2,466,510
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO <sub>2</sub> e)	246,651

**A.4.5. Public funding of the project activity:**

The project will not receive any public funding from Parties included in Annex I of the UNFCCC.

**SECTION B. Application of a baseline and monitoring methodology:****B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

The Project activity uses the approved baseline methodology ACM0012 (Version 04.0.0) “Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects”.

This methodology also refers to “Tool for the demonstration and assessment of additionality (version 06.0.0)”, “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion( version02 )”, “Tool to calculate the emission factor for an electricity system (version 02.2.1)”, “Tool to determine the remaining lifetime of equipment (version01)”.

More information about the methodology can be obtained at:

<http://cdm.unfccc.int/methodologies/DB/L731WMCXLT0WE6ALG5AYAGLTJP7KW7>

**B.2. Justification of the choice of the methodology and why it is applicable to the project activity:**

The approved consolidated methodology ACM0012 (version 04.0.0) is applicable to the proposed project due to following reasons summarized in Table B.2.1 below:

**Table B.2.1 Applicability check**

Methodology applicability conditions	Project activity conditions	Applicability
The consolidated methodology is applicable to project activities implemented in an existing or Greenfield facility converting waste energy carried in identified WECM stream(s) into useful energy. The WECM stream may be an energy source for: ■ Generation of electricity;	The proposed project is implemented at an existing facility, and will use waste gas for cogeneration.	Applicable





<ul style="list-style-type: none"> <li>■ Cogeneration;</li> <li>■ Direct use as process heat source;</li> <li>■ Generation of heat in element process;</li> <li>■ Generation of mechanical energy; or</li> <li>■ Supply of heat of reaction with or without process heating.</li> </ul>		
<p>In the absence of the project activity, the WECM stream:</p> <p>(a) Would not be recovered and therefore would be flared, released to atmosphere, or remain unutilized in the absence of the project activity at the existing or Greenfield project facility; or</p> <p>(b) Would be partially recovered, and the unrecovered portion of WECM stream would be flared, vented or remained unutilised at the existing or Greenfield project facility.</p>	<p>In the absence of the project activity, the waste gas is not recovered and is flared into atmosphere.</p>	Applicable
<p>Project activities improving the WECM recovery may (i) capture and utilize a larger quantity of WECM stream as compared to the historical situation in existing facility, or capture and utilise a larger quantity of WECM stream as compared to a “reference waste energy generating facility”; and/or (ii) apply more energy efficient equipment to replace/modify/expand waste energy recovery equipment, or implement a more energy efficient equipment than the “reference waste energy generating facility”.</p>	<p>The proposed project is not to improve the WECM recovery.</p>	N/A
<p>For project activities which recover waste pressure, the methodology is applicable where waste pressure is used to generate electricity only and the electricity generated from waste pressure is measurable;</p>	<p>The project is not to recover waste pressure,</p>	N/ A
<p>Regulations do not require the project facility to recover and/or utilize the waste energy prior to the implementation of the project activity</p>	<p>There are no regulations which require the project facility to recover and/or utilize the waste gas prior to the implementation of the project activity</p>	Applicable
<p>The methodology is applicable to both Greenfield and existing waste energy generation facilities. If the production capacity of the project facility is expanded as a result of the project activity, the added production capacity must be treated as a Greenfield facility;</p>	<p>The Project is the cogeneration plant based on the COG from the existing coking oven. The production capacity of the project facility will not be expanded as a result of the project activity.</p>	Applicable
<p>Waste energy that is released under abnormal operation (for example, emergencies, shut down) of the project facility shall not be included in the emission reduction calculations.</p>	<p>Under abnormal operation, the waste COG will be flared to the atmosphere just as the baseline scenario. And the time span will be recorded. These</p>	Applicable





	emissions will not be accounted for.	
If multiple waste gas streams are available in the project facility and can be used interchangeably for various applications as part of the energy sources in the facility, the recovery of any waste gas stream, which would be totally or partially recovered in the absence of the project activity, shall not be reduced due to the implementation of CDM project activity. For such situations, the guidance provided in Annex 3 shall be followed.	Recovered waste COG is the only gas stream for the project and there is no waste gas is used in the absence of the project activity.	N/ A
The methodology is <b>not</b> applicable to the cases where a WECM stream is partially recovered in the absence of the CDM project activity to supply the heat of reaction, and the recovery of this WECM stream is increased under the project activity to replace fossil fuels used for the purpose of supplying heat of reaction.	Waste COG is not recovered absolutely in the absence of the project activity.	N/ A
This methodology is also <b>not</b> applicable to project activities where the waste gas/heat recovery project is implemented in a single-cycle power plant (e.g. gas turbine or diesel generator) to generate power. However, the projects recovering waste energy from single cycle and/or combined cycle power plants for the purpose of generation of heat only can apply this methodology	The project is a co-generation combined-cycle power plant (CCPP) but not a single cycle power plant.	N/ A
The emission reduction credits can be claimed up to the end of the lifetime of the waste energy generation equipment. The remaining lifetime of the equipment should be determined using the latest version of the “Tool to determine the remaining lifetime of equipment”	The remaining lifetime of the waste energy generation equipment (coke oven) is estimated by “Tool to determine the remaining lifetime of equipment”. The technical lifetime of coke oven production line is 25 years, and it has operated barely one year, so the remaining lifetime of the coke oven production is over 10 years. Therefore, The credits period can be claimed for 10 years.	Applicable
The extent of use of waste energy from the waste energy generation facilities in the absence of the CDM project activity will be determined in accordance with the procedures provided in Annex 1 (for Greenfield project facilities) and in Annex 2 (for existing project facilities) to this methodology.	The waste energy generation facility is existing project facility, so the proposed project applies Annex 2 guidelines to prove the extent of use of waste energy in the absence of the waste energy generation facilities. There is no waste energy recovery and utilization equipment in the streams of WECM prior to the implementation of the CDM project activity. According	Applicable





	to the energy balance of the project facility provided by its designer, there would be 177,552,000m <sup>3</sup> /a COG is useless during the Coke production, which was flared to the atmosphere before the project.	
The applicability conditions included in the tools referred to above apply.	<p>The applicability conditions included in the tools are applicable to the project, as follows:</p> <p>“Tool for the demonstration and assessment of additionality” is included in the applied methodology ACM0012 (version 04.0.0), so its application in the project PDD is mandatory.</p> <p>“Tool to calculate the emission factor for an electricity system (version 02.2.1)” is applicable to the project since the project displace electricity generation by power plant n an electricity System (NCPG), and the NCPG is all located in China, which is not an Annex I country.</p> <p>“Tool to determine the remaining lifetime of equipment (version 01)” is applied by the project because the project include existing facility, i.e., coke oven, and new facilities, i.e., gas turbine generator set, WHRB, and steam turbine generator set.</p> <p>“Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)” is applied to calculate the project emissions from combustion of fossil fues, such as diesel for gas turbine staring, and coal combustion by the backup boiler when the CCPP is not available.</p>	Applicable
The extent of use of waste energy from the waste energy generation facilities in the absence of the CDM project activity will be determined in accordance with the procedures provided in	The waste COG utilized in the project activity was flared into the atmosphere in the absence of the project activity at the existing coking oven production	Applicable





<p>Annex 1 (for Greenfield project facilities) and in Annex 2 (for existing project facilities) to this methodology.</p>	<p>plant. The Energy balance of coke oven provided by the coke oven's designer would demonstrate that.</p> <p>As to why DOE was not invited to conduct the on site checks prior to project implementation, there are several objective reasons. At first, the project started in Apr. 2010, when they signed the main equipment purchase contract. And the real action of construction was followed in May. At that time, the ERPA of the project was not signed, the PDD for GSP was not prepared, the LoA of DNA was not available and the DOE for the project was not contracted. So it was not prepared for the on site validation at that time. Secondly, the requirement of "on-site checks prior to project implementation to confirm that no equipment for waste energy recovery and utilisation had been installed on the specific WECM stream prior to the implementation of the CDM project activity" is stressed by the updated methodology ACM0012 in version 04, which is valid since April, 2011, after the project implementation starting. So it's impractical for the DOE to conduct it prior to the implementation of the project.</p> <p>Additionally, when DOE conducted the on-site visit for validation in Jan., 2012, the proposed project is still undergoing construction. The main equipments are on site and undergoing installation and/or debugging. The COG pipeline was being put up and not connected to the project site. So the flare was still on working to fire the waste COG for lack of utilization.</p>	
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Thus it is appropriate to use ACM0012 for this project.

<b>B.3. Description of how the sources and gases included in the <u>project boundary</u>:</b>
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As per ACM0012, the geographical extent project boundary shall include the relevant WECM stream(s), equipment and energy distribution system in the following facilities:

- (1) The “project facility”;
- (2) The “recipient facility(ies)”, which may be the same as the “project facility”.

The spatial extent of the grid is as defined in the “Tool to calculate the emission factor for an electricity system”.

The relevant equipment and energy distribution system cover:

- In a project facility, the WECM stream(s), waste energy recovery and useful energy generation equipment, and distribution system(s) for useful project energy;
- In a recipient facility, the equipment which receive useful energy supplied by the project, and distribution system(s) for useful project energy.

For the proposed project, the boundary includes:

- The industrial facilities where waste energy is generated. The waste energy contained in the waste COG is generated from the existing coke ovens.
- The facilities where electricity and steam is generated, including the electricity generation facilities such as the gas turbines, WHRBs, steam turbine, the generators and other auxiliary devices.
- The facilities where electricity is exported. The electricity generated by the Project activity is merged into NCPG, so all the power plants physically connected to NCPG affected by the project will be included. According to “2011 Baseline Emission Factor for Regional Grids in China”<sup>1</sup> announced by Department of Climate Change, National Development and Reform Commission (NDRC) of China (DNA of China) on 20<sup>th</sup> October 2011. NCPG is a regional grid in China, including Beijing, Tianjin, Hebei, Shanxi, Shandong and Inner-Mongolia autonomous region.
- The recipient facilities in the Jining Chemical Industry Economic & Technological Development Zone, mainly including Yangguang Ranliao Ltd and Morningsun Coal Chem. Co., Ltd

The boundary of the proposed project is as shown in Figure B.3.1:

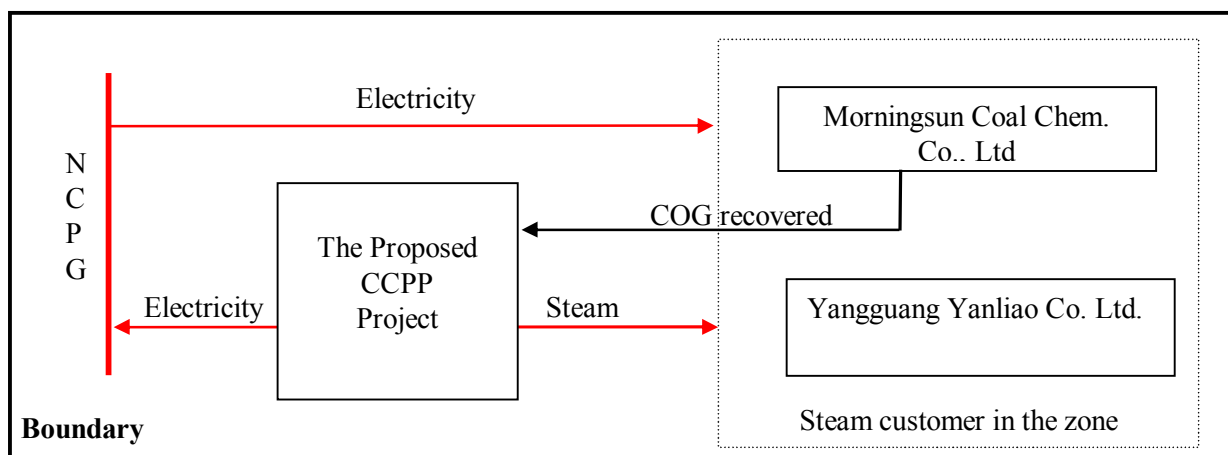


Figure B.3.1 Boundary of the project

<sup>1</sup> <http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239>





Table B.3.1 Description of How the Sources and Gases Included in the Project Boundary

	Source	Gas	Included?	Justification/Explanation
<b>Baseline</b>	Electricity generation, grid or captive source	CO <sub>2</sub>	Included	Main emission source, from NCPG electricity generation
		CH <sub>4</sub>	Excluded	Excluded for simplification. This is conservative
		N <sub>2</sub> O	Excluded	Excluded for simplification. This is conservative
	Fossil fuel consumption in element process for thermal energy	CO <sub>2</sub>	Included	Main emission source, from coal-fired boiler in the zone.
		CH <sub>4</sub>	Excluded	Excluded for simplification. This is conservative
		N <sub>2</sub> O	Excluded	Excluded for simplification. This is conservative
	Fossil fuel consumption in cogeneration plant	CO <sub>2</sub>	Excluded	Main emission source, but there is no cogeneration plant in the baseline scenario as to the project.
		CH <sub>4</sub>	Excluded	Excluded for simplification. This is conservative
		N <sub>2</sub> O	Excluded	Excluded for simplification. This is conservative
	Generation of steam used in the flaring process, if any	CO <sub>2</sub>	Excluded	Main emission source, but there is no steam used in the flaring process as to the project.
		CH <sub>4</sub>	Excluded	Excluded for simplification. This is conservative
		N <sub>2</sub> O	Excluded	Excluded for simplification. This is conservative
<b>Project activity</b>	Fossil fuel consumption for supply of process heat and/or reaction heat	CO <sub>2</sub>	Included	Main emission source, but only occur when CCPP was unavailable and the backup boiler have to be used.
		CH <sub>4</sub>	Excluded	Excluded for simplification. This is conservative
		N <sub>2</sub> O	Excluded	Excluded for simplification. This is conservative
	Supplemental fossil fuel consumption at the project plant	CO <sub>2</sub>	Included	Main emission source
		CH <sub>4</sub>	Excluded	Excluded for simplification





		N <sub>2</sub> O	Excluded	Excluded for simplification
	Supplemental electricity consumption	CO <sub>2</sub>	Included	Main emission source, but has been eliminated when to determine the baseline emission.
		CH <sub>4</sub>	Excluded	Excluded for simplification
		N <sub>2</sub> O	Excluded	Excluded for simplification
		CO <sub>2</sub>	Excluded	There is no captive electricity in the baseline replaced by import electricity
	Electricity import to replace captive electricity, which was generated using waste energy in absence of project activity	CH <sub>4</sub>	Excluded	Excluded for simplification
		N <sub>2</sub> O	Excluded	Excluded for simplification
		CO <sub>2</sub>	Included	Main emission source, but has been included in the supplemental electricity consumption by the project
	Energy consumption for gas cleaning	CH <sub>4</sub>	Excluded	Excluded for simplification
		N <sub>2</sub> O	Excluded	Excluded for simplification
		CO <sub>2</sub>	Included	Main emission source, but has been included in the supplemental electricity consumption by the project

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

As per ACM0012, the baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s). Realistic and credible alternatives should be determined for:

- Waste energy use in the absence of the project activity;
- Power generation in the absence of the project activity for each recipient facility if the project activity involves electricity generation for that recipient facility;
- Heat generation (process heat and/or heat of reaction) in the absence of the project activity, or each recipient facility if the project activity involves generation of useful heat for that recipient facility; and
- Mechanical energy generation in the absence of the project activity, for each recipient facility if the project activity involves generation of useful mechanical energy for that recipient facility.

The baseline methodology ACM0012 (Version 04.0.0) prescribes that the determination of the baseline scenario shall take 3 steps:

- Step 1: Define the most plausible baseline scenario for the generation of electricity using the following baseline options and combinations.
- Step 2 Step 2 and/or step 3 of the latest approved version of the “Tool for the demonstration and





assessment of additionality” shall be used to identify the most plausible baseline scenarios by eliminating nonfeasible options

- STEP 3: If more than one credible and plausible alternative scenario remain, the alternative with the lowest baseline emissions shall be considered as the most likely baseline scenario.

***Step 1: Define the most plausible baseline scenario for the generation of electricity using the following baseline options and combinations.***

According to ACM0012 (version 04.0.0), the baseline candidates should be considered for the following facilities:

- For the waste energy generation facility(ies) where the waste energy is generated; and
- For the recipient facility(ies) where the energy is consumed.

For the project, the waste energy generation facility is the coke oven (800,000 ton/a) of Shandong Morningsun Coal Chemical Co., Ltd. And the recipient facilities of electricity is the grid, i.e., NCPG, and the recipient facilities of steam is the facilities owned by Shandong Morningsun Coal Chemical Co., Ltd. and Yangguang Yanliao Co., Ltd in the zone.

According to the FSR, the project will utilize waste gas (COG) as energy source for cogeneration. Therefore, the realistic and credible alternative(s) for Waste energy use / power generation / heat generation will be made through the analysis of the following alternatives and alternative for mechanical energy generation will be excluded:

**Table B.4.1 The realistic and credible alternative(s) – for the use of waste energy**

	Baseline Scenario	Comments
W1	WECM is directly vented to atmosphere without incineration	Directly venting waste gas to the atmosphere without incineration is prohibited according the GB16171-1996 Emission Standard of Air Pollutants for Coke Oven. Thus W1 is excluded from further consideration.
W2	WECM is released to the atmosphere (for example after incineration) or waste heat is released to the atmosphere or waste pressure energy is not utilized;	Prior to the start of the implementation of the Project, the waste COG was flared to the atmosphere. And it is the common method to deal with waste COG in China <sup>2</sup> . So it is a part of possible baseline scenario.
W3	Waste COG is sold as an energy source	The waste COG might be sold as an energy source for residential users or industry users. But it's not possible to be used for residential users. Because the centralized residential of citizens in Jining City is far from the project site. It may lead to the technical and investment difficulties for the energy transportation. For the local dispersed rural residential, the pipeline distribution system would be very complex and the safety is another key issue should be paid more attention. So it's not possible for the waste COG sold as an energy source for residential.

<sup>2</sup> Survey of Coke Industry Association, [http://hzs.ndrc.gov.cn/newhjzyjb/t20060907\\_83477.htm](http://hzs.ndrc.gov.cn/newhjzyjb/t20060907_83477.htm)





		<p>And there is no other industry that could utilize the waste COG nearby. So if the waste COG would be sold as an energy source to the project developer for cogeneration, it is deemed to be the project activity without applying to CDM project.</p> <p>Hence it is a possible baseline scenario.</p>
W4	Waste energy is used for meeting energy demand at the recipient facility	<p>From the energy balance, we can find that the fuel gas of this project is the waste gas from the coke plant. That means the waste gas can be used for satisfying the energy demand in the project activity, which is the scenario of the project activity without applying to CDM project. This is also in compliance with legal laws and regulations, but is not the compulsory construction under the national or local governmental laws. Therefore, this scenario is at first sight a feasible baseline scenario. In order to confirm the additionality further, it implements the economic analysis as in the step 3 and section B.5.</p>
W5	A portion of the quantity or energy of WECM is recovered for generation of heat and/or electricity and/or mechanical energy, while the rest of the waste energy produced at the project facility is flared/released to atmosphere/ unutilised	<p>In the absence of the project, all of the waste COG is flared to atmosphere without utilization. The proposed project is to utilize all of the waste COG for cogeneration. So, W5 should be excluded as a possible baseline scenario.</p>
W6	All the waste energy produced at the facility is captured and used for export electricity generation or steam	<p>In the absence of the project, all of the quantity or energy of WECM is flared to atmosphere without utilization. The project is to utilize all of the waste COG for export electricity generation and steam. According to the energy balance of the coke oven and the FSR, all the waste COG can be captured except unavoidable process loss, accidental leakages and the quantity of waste COG surpasses the designed installed capacity of the recovery system. So W6 is a possible baseline scenario.</p>

**B.4.2 the realistic and credible alternative(s) --for power generation**

	Baseline Scenario	Comments
P1	Proposed Project activity not undertaken as a CDM Project activity	The project owner will utilize waste COG for cogeneration. It is in compliance with all applicable legal and regulatory requirements, and it is technically feasible. Hence it a possible baseline scenario.
P2	On-site or off-site existing fossil fuel fired cogeneration plant	<p>There is no on-site or off-site existing fossil fuel fired cogeneration plant.</p> <p>So, this option is not a possible baseline scenario.</p>
P3	On-site or off-site Greenfield fossil fuel fired cogeneration plant	According to regulations regarding power production in China, it is forbidden to build a coal-fired thermal power





		<p>station with an installed capacity lower than 135MW<sup>3</sup>. The install capacity of proposed project is 42MW, so greenfield coal-fired cogeneration plant is not in accordance with national policy.</p> <p>As to other kind of fossil fuel, i.e., natural gas, there is no natural gas pipeline in Jining City. So greenfield natural gas-fired cogeneration plant is not a possible baseline scenario.</p> <p>Hence this option is not a part of baseline scenario.</p>
P4	On-site or off-site existing renewable energy based cogeneration plant	<p>There is no existing renewable energy based cogeneration plant on-site or off-site.</p> <p>Therefore, this option is not a possible baseline scenario.</p>
P5	On-site or off-site Greenfield renewable energy based cogeneration plant	<p>The possible renewable energy can be used for on-site or off-site Greenfield cogeneration plant in Jining city is biomass and solar energy. However, the project owner would not have enough biomass sources due to another planed biomass cogeneration plant nearby. As to the solar energy, it's an innovative and high technology to use solar energy for cogeneration to continuously supply steam and electricity for industries. So this alternative is not a possible baseline scenario.</p>
P6	On-site or off-site existing fossil fuel based existing identified captive power plant	<p>There is no existing fossil fuel fired identified captive power plant on-site or off-site.</p> <p>So this option is excluded from a baseline scenario.</p>
P7	On-site or off-site existing renewable energy or other waste energy based captive power plant;	<p>There is no renewable energy or other waste energy based captive power plant on-site or off-site.</p> <p>So this option is excluded from a baseline scenario.</p>
P8	On-site or off-site Greenfield fossil fuel based captive plant	<p>For the same reason as P3, this option is excluded from a baseline scenario.</p>
p9	On-site or off-site Greenfield renewable energy or other waste energy based captive plant;	<p>For the same reason as P5, on-site or off-site Greenfield renewable energy based captive plant should be excluded.</p> <p>And the project owner has no more waste energy source for other waste energy based plant. Furthermore, the proposed project would be a public power plant but not a captive plant.</p> <p>So this option is excluded from a baseline scenario.</p>
P10	Sourced from Grid connected power plants	<p>In the absence of the Project activity, the power would be sourced by the coal-dominated NCPG. So it is one possible baseline scenario.</p>
P11	Existing Captive Electricity generation using waste energy (if project activity is captive generation using waste energy, this scenario represents captive generation with lower efficiency or lower recovery than the project activity.)	<p>There is no captive electricity generation using waste energy.</p> <p>Therefore, this alternative can be excluded from the baseline scenarios.</p>

<sup>3</sup> [http://www.gov.cn/gongbao/content/2002/content\\_61480.htm](http://www.gov.cn/gongbao/content/2002/content_61480.htm)





P12	Existing Cogeneration using waste energy, but at a lower efficiency or lower recovery.	There is no existing cogeneration using waste energy. Hence it is not a part of baseline scenario.
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**B.4.3 the realistic and credible alternative(s) --for heat generation**

	Baseline Scenario	Comments
H1	Proposed project activity not undertaken as a CDM project activity;	The project owner will utilize waste COG for cogeneration. It is in compliance with all applicable laws and regulations. Therefore it is a possible baseline scenario.
H2	On-site or off-site existing fossil fuel based cogeneration plant;	The comment is similar with P2. It's not a possible baseline scenario.
H3	On-site or off-site Greenfield fossil fuel based cogeneration plant;	The comment is similar with P3. It's not a possible baseline scenario.
H4	On-site or off-site existing renewable energy based cogeneration plant;	The comment is similar with P4. It's not a possible baseline scenario.
H5	On-site or off-site Greenfield renewable energy based cogeneration plant;	The comment is similar with P5. It's not a possible baseline scenario.
H6	An existing fossil fuel based element process;	There is no existing fossil fuel based element process. So it can be excluded from the baseline scenarios.
H7	A new fossil fuel based element process;	The available fossil fuel in the area is coal, and coal is commonly as the energy for industry production. In this project, new coal-fired boilers would be installed in the new centralized steam plant in the zone to supply steam for the consumers in the zone in the absence of the project activity. Thus it is a realistic and credible baseline alternative.
H8	An existing renewable energy or other waste energy based element process to supply heat;	There is no existing renewable energy or other waste energy based element process to supply heat. So it can be excluded from the baseline scenarios.
H9	A new renewable energy or other waste energy based element process to supply heat;	The renewable energy available in Jining city includes solar energy and biomass. It's an innovative and high technology to use solar energy to generate medium and/or high temperature steam for industry utilization, so this technology is not available for the project owner. And project owner would not have enough biomass source due to another planned biomass cogeneration plant nearby, which is to supply heat for another industry zone. And the project owner has no more waste energy source for other waste energy based plant. Therefore option H9 is not plausible and realistic alternatives for the proposed Project activity.
H10	Any other source such as district heat;	There is no other existing source such as district heat. Thus it is not a realistic and credible baseline alternative





H11	Other heat generation technologies (e.g. heat pumps or solar energy);	There is no other heat generation technology convenient for the project owner. It's an innovative and high technology to use solar energy to generate medium and/or high temperature steam for industry utilization. This technology is not available for the project owner. And the heat pumps are mainly used for air conditioner, house heating, and hot water and so on. It's rarely used in industry. So H11 can be excluded from the baseline scenarios.
H12	Steam/process heat generation from waste energy, but with lower efficiency or lower recovery	According to the “Energy Conservation Law of the People’s Republic of China <sup>4</sup> ”, the government of China supports the development of energy conservation project. The project owner aims to save energy. However, the heat generation with lower efficiency or lower recovery could not optimize the emission reduction. So this is not a possible baseline scenario.
H13	Cogeneration with waste energy, but at a lower efficiency or lower recovery	According to the “Energy Conservation Law of the People’s Republic of China <sup>5</sup> ”, the government of China supports the development of energy conservation project. The project owner aims to save energy. However, the cogeneration at lower efficiency or lower recovery could not optimize the emission reduction. So it can be excluded from the baseline scenarios.
H14	On-site fossil fuel consumption to supply heat	On-site coal fired boiler would be constructed to supply heat if there is no the project. So it's a possible baseline scenario.

From the above analysis, it can be concluded that there are two combinations of baseline scenarios applicable to this proposed Project activity:

**Table B.4.4 The possible combinations of baseline scenarios**

Scenario	Baseline options			Description of situation
	Waste energy	Power	Heat	
1	W2	P10	H7/H14	The waste COG is flared to the atmosphere after incineration; The equivalent electricity is sourced from Grid-connected power plants; And new coal based boiler in the centralized steam plant supply steam.
2	W3/ W4/ W6	P1	H1	The project will utilize waste COG for cogeneration, but not undertaken as a CDM project activity.

**Step 2. Step 2 and/or step 3 of the latest approved version of the “Tool for the demonstration and assessment of additionality” shall be used to identify the most plausible baseline scenarios by eliminating nonfeasible options**

<sup>4</sup> [http://www.gov.cn/jlfg/2007-10/28/content\\_788493.htm](http://www.gov.cn/jlfg/2007-10/28/content_788493.htm)

<sup>5</sup> [http://www.gov.cn/jlfg/2007-10/28/content\\_788493.htm](http://www.gov.cn/jlfg/2007-10/28/content_788493.htm)





*The project proponents are required to use economic analysis for the identification of the baseline scenario for the following three situations.*

- (1) Where, for an existing project facility, the WECM utilised by the project activity was totally or partially recovered in the absence of the CDM project activity.*
- (2) Where the CDM waste energy recovery project is implemented in a Greenfield project facility. The investment analysis for the Greenfield projects include the cost of the fuel that would have been used by the recipient facility(ies) in the absence of the CDM project. The fuels for such analysis should include all the fuels available in the host country, including those which can be imported in the host country.*
- (3) Where the CDM waste energy recovery project is implemented in an existing facility to supply the useful energy generated to a Greenfield recipient, and therefore the likely baseline scenario is based on a “reference energy generation facility”. The energy generation for such a reference facility, including the fuel (either available in host country or imported without any supply constraint), should be determined based on the investment analysis.*

As to the project, the project is implemented in an existing facility to supply Power (electricity) and Heat (steam) to NCPG and industry in the zone respectively. The NCPG is existing recipient of electricity, and the industry in the zone is Greenfield recipient of steam. So the heat generation for the reference facility is to be determined based on the investment analysis.

*According to the definition of reference energy generation facility, it is the most plausible facility generating the useful energy that would be used by a Greenfield recipient facility, in the absence of energy available from the proposed CDM project. The reference energy generation facility should be identified through economic analysis (including benchmark (e.g. IRR/NPV) analysis, cost-benefit analysis, or analysis of levelised cost of energy), subject to assessment of availability of such source. The reference energy generation facility should also be demonstrated to be commonly used in the relevant industry sector of the host country.*

Firstly, the energy generation facility is determined among the commonly used in the heat production sector. As analyzed in the above table B.4.1 to B.4.3, the cogeneration facilities have been omitted to be a possible baseline scenario, so the reference generation facility should be boilers.

Secondly, the fuels for heat production mainly include coal, natural gas and biomass. For the zone where the steam recipients are located, the natural gas and biomass are not available as analysis in above table B.4.1 to B.4.3. So the only fuel would be used for heat production is coal. Coal-fired boiler is a kind of widely used technology in China for heat generation. There is no policy or regulation prohibits the utilization of coal-fired boilers. And the fuel coal is rich in China and is convenient for achievement.

Finally, the investment analysis of one coal-fired boiler is carried out. The indicator of levelised cost of steam is derived and compared with that of the proposed project. The levelised cost of steam by the CCP project is calculated after the thermal and power apportionment in the cogeneration plant. The steam generation cost accounts for 34% of the total cost of steam and electricity generation cost<sup>6</sup>. The detailed input for the investment analysis of coal-fired boiler is as follows table B.4.5, and the input for the CCP project is shown in table B.5.2.

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<sup>6</sup> The reference for apportionment of steam cost: Discussion of fuel apportionment for combined cycle cogeneration units. Chen Weixing. Thermal Power Engineering Design express. 27, April, 2009.





Table B.4.5 Basic parameters of investment analysis of the reference heat generation facility

Name	Item	Value
Project description	Installed capacity (t/h)	45
	Life time of the project(years)	15
	Expected steam generation (t/a)	240,000
Investment	Total investment(RMB)	30,070,000
Annual Operation & Maintenance Cost	Annual Operation & Maintenance Cost(RMB)	28,517,737
Tax	Income tax	25%
Others	Residue value	5%

The levelised cost of steam is chosen as the indicator for the financial analysis. The levelised cost of the steam generation by coal fired boiler and the proposed project is 102 RMB/t and 158 RMB/t respectively. It's obvious that the steam generation cost of coal fired boiler is much lower than the proposed project.

Table B.4.6: Financial indicator of the reference heat generation facility

	Levelised cost of steam
Coal-fired boiler	102 RMB/t
Proposed project	158 RMB/t

In summery, the coal-fired boiler is a kind of common used facility for heat generation in China. And it is economically attractive than the CCPP technology. So the coal-fired boiler is determined to be the reference energy generation facility and the baseline scenario for heat generation.

Additionally, as detailed in the Step 2 of Section B.5 below, the project IRR of the Scenario 2 “Project without CDM, using COG for cogeneration” is 3.8%, which is lower than the benchmark of 8%, so the Scenario 2 is not attractive from the financial point that making it practically prohibitive. Hence Scenario 2 is not a part of the baseline scenarios.

The Scenario1: “The waste COG is flared to the atmosphere. The equivalent electricity is sourced from Grid-connected power plants. The new fossil fuel based boilers supply steam” doesn't face any other barriers. So it is the credible baseline scenario.

***STEP 3: If more than one credible and plausible alternative scenario remain, the alternative with the lowest baseline emissions shall be considered as the most likely baseline scenario.***

After the steps taken above, there is only one credible and plausible alternative scenario remains, so this step is not necessary.

From the above analysis, it can be concluded that Scenario 1 is applicable to the project. The baseline scenario is “The waste COG is flared to the atmosphere. The equivalent electricity is sourced from Grid-connected power plants. The new fossil fuel based boilers to be installed for steam supply.”

The identified baseline: The waste COG is flared to the atmosphere. The equivalent electricity is sourced from Grid-connected power plants. And the new fossil fuel based boilers in the centralized steam plant for steam supply is “Baseline Scenario-2” of the methodology.





**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):**

Project owner has considered the benefits brought by CDM in the Feasibility Study Report (FSR) which was prepared in January 2010. Particular, the report has analysed the impact of the CDM revenue on the project, and obtained conclusion that project was financially feasible only if supported by CDM funding. After taking full consideration of the FSR, the Board of the Project Developer held a meeting and all the board of directors then reached consensus on the development of the Project and the introduction of CDM to ensure the successful construction and operation of the Project on 16 February 2010. The project activity signed the purchase contract of main equipment on 12 April, 2010. Then within 6 months after that, the project proponent noticed EB and NDRC for the prior consideration of CDM. An overview of key events is given in Table B.5.1

**Table B.5.1 Timeline of the project**

Date	Event	Document
02/12/2009	Advisory Agreement on CDM with Third Party (Uniuфа)	CDM development contract
01/2010	Feasibility Study Report (FSR) Prepared	FSR
25/01/2010	Stakeholder Survey on the project construction	Stakeholder perception questionnaires
02/2010	Environmental Impact Assessment (EIA)	EIA
16/02/2010	Board of Directors Resolutions (Decision Made on project implementation)	Minutes of the meeting of the board of directors
26/03/2010	The EIA was approved	LuHuanBaoGaoBiao[2010] 61
06/04/2010	Preliminarily approved by the Development and Reform Commission of Jining City	JiFaGaiNengJiao[2010] 116
12/04/2010	Purchase Contract on Main Equipment	Contract
15/07/2010	The ERPA was Signed	ERPA
18/08/2010	Submitted the notification of the commencement of the project activity and the notification of prior consideration of CDM to EB	Public information on the UNFCCC-CDM website.
13/09/2010	Submitted the notification of the commencement of the project activity and the notification of prior consideration of CDM to NDRC	CDM Project Notification Form
30/09/2010	Approved by Development and Reform Commission of Shandong Province	LuFaGaiNengJiao[2010]1258
19/04/2011	Approved by the NDRC (DNA of China)	FaGaiQiHou[2011]801

In accordance with ACM0012, the additionality of this project is to be demonstrated and assessed by the latest version of “Tool for the Demonstration and Assessment of Additionality (Version 06.0.0)” agreed by CDM Executive Board and available on the UNFCCC website.

**Step1. Identification of alternatives to the Project activity consistent with current laws and regulations**

***Sub-step1a. Define alternatives to the Project activity:***





The alternatives to the project are analyzed in section B.4, the credible and reasonable alternative of this project would be:

	Alternatives			Description
	Waste energy	Power	Heat	
1	W2	P10	H7/H14	The waste COG is flared to the atmosphere after incineration; The equivalent electricity is sourced from Grid-connected power plants; And new fossil fuel based boilers supply steam
2	W3/W4/W6	P1	H1	The project will utilize waste COG for cogeneration, but not be undertaken as a CDM project activity.

***Sub-step 1b. Consistency with mandatory laws and regulations:***

Both Scenario 1 and Scenario 2 are in compliance with Chinese relevant laws and regulations. They are not the compulsory project scenarios by national or local regulations and laws.

So the proposed project activity is not the only alternative amongst the ones considered by the project participants that is in compliance with mandatory regulations with which there is general compliance, then the project activity is considered to have the assumption of additionality.

**Step 2. Investment Analysis**

The purpose of investment analysis is to determine whether the proposed Project activity is not:

- (a) The most economically or financially attractive; or
- (b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

The investment analysis was done in the following steps:

***Sub-step 2a. Determine appropriate analysis method***

According to the “Tool for the demonstration and assessment of additionality (version 06.0.0)”, three options can be applied to conduct the investment analysis. They are the simple cost analysis (Option I), the investment comparison analysis (Option II) and the benchmark analysis (Option III).

Since the Project will generate financial/economic benefits other than CDM related income, through the sale of generated electricity, Option I (Simple Cost Analysis) is not applicable.

According to guidelines on the assessment of investment analysis (version05), if the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.

The alternative to the project activity is the supply of electricity from NCPG, therefore, benchmark analysis should be appropriate.

***Sub-step 2b. Option III – Application of benchmark analysis***





The financial indicator of the Project is project IRR before tax and the applied benchmark is 8%, which is taken from the feasibility study report (FSR) completed in January 2010 and approved by the local government on 30 September 2009.

The benchmark applied in the FSR and the PDD was derived from the official publication “*Economic evaluation measurements and parameters of constructive projects (third edition)*” It is the required/expected returns on project for each category of business supplied by the National Development and Reform Commission and the Ministry of Construction of the People’s Republic of China. Application of such benchmark is in comply with the “Guidance on the Assessment of Investment Analysis”. This benchmark is widely used for power project investments in China and serves as the sectoral benchmark rate on project investment for Cogeneration Projects.

On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

***Sub-step 2c: Calculation and comparison of financial indicators***

(1) Basic parameters for calculation of financial indicators

The basic parameters for calculation of the financial indicators in the Feasibility Study Report are listed in Table B.5.2

**Table B.5.2 Basic parameters of investment analysis of the Project activity**

Name	Item	Value	Source
Project description	Installed capacity (MW)	42	FSR
	Life time of the project(years)	15	FSR
	Expected power supplied to the grid (MWh)	229,219	FSR
	Electricity tariff (RMB/KWh)(Including VAT)	0.4105	FSR
	Annual steam output(ton)	240,000	FSR
	Steam price(RMB /ton ) (Including VAT)	150	FSR
Investment	Total static investment(RMB)	352,891,700	FSR
Annual Operation & Maintenance Cost	Annual Operation & Maintenance Cost(RMB)	82,014,014	FSR
	Annual COG cost (RMB)	55,511,400	FSR
	Annual labour cost (RMB)	6,511,680	FSR
	Maintenance cost (RMB)	8,475,643	FSR
	Administration cost (RMB)	3,222,586	FSR
	Insurance cost (RMB)	3,226,705	FSR
	Material cost (RMB)	2,996,000	FSR
	Water cost (RMB)	2,070,000	FSR
Tax	Electricity VAT (%)	17	FSR
	Steam VAT (%)	13	FSR
	Urban maintenance and construction tax rate	7%	FSR
	Education additional tax rate	3%	FSR
	Income tax	25%	FSR
Others	Residue value	5%	FSR
	CER price (EUR/tCO <sub>2</sub> e)	8	ERPA

(2) Comparison of IRR for the project and the financial benchmark





In accordance with the benchmark analysis (Option III), the Project activity is considered financially not attractive if the project IRR is lower than the benchmark value. Table B.5.3 shows the results of the calculated project IRR based on the data listed in Table B.5.2

**Table B.5.3: Comparison of financial indicator with and without CER revenue**

	IRR
Without CERs	3.8%
Benchmark IRR	8%
With CERs	11.2%

It could be noted that the IRR of project without the CDM revenues is 3.8%, obviously lower than the benchmark financial indicator 8% of Chinese cogeneration plant. And with the support of CDM revenues, the IRR of total investment could reach 11.2%, higher than the benchmark. Hence the Project activity is not financially attractive to the project owner without the carbon revenue.

***Sub-step 2d: Sensitivity analysis***

The objective of this sub-step is to check whether the conclusion regarding the above financial unattractiveness is robust to reasonable variations in critical assumptions. Four parameters are considered in the following sensitivity analysis:

- 1) Electricity revenue
- 2) Steam revenue
- 3) Investment cost
- 4) Operation cost

Assuming the above factors vary within the range of -10%–+10%, the IRR of the Project activity without CERs revenue varies to different extent, as shown in the Table B.5.4 and Fig.B.5.1:

**Table B.5.4 Sensitivity analysis of the Project activity without CDM**

Item	-10%	0%	10%
Electricity revenue	0.30%	3.80%	6.90%
Steam revenue	2.40%	3.80%	5.10%
Investment cost	5.70%	3.80%	1.90%
Operation cost	7.10%	3.80%	0.10%
Benchmark	8%		



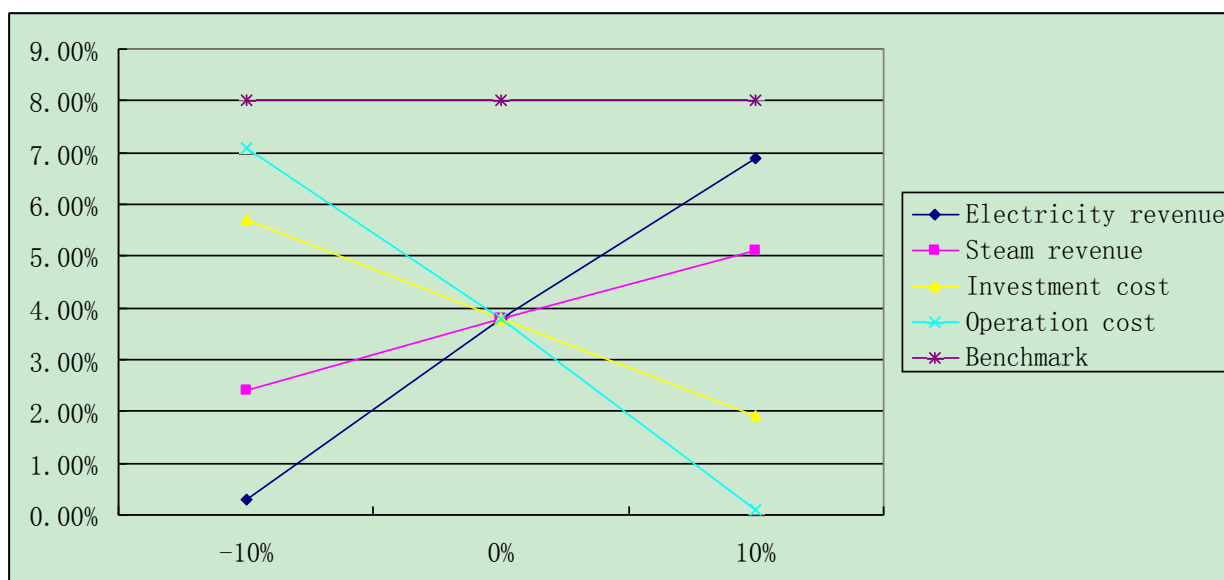


Fig. B.5.1 Sensitivity analysis of the Project activity

As shown in the above table and figure, in none of the above cases, the IRR goes above the benchmark IRR of 8%, thus the Project is not financially attractive even if the major parameters varies in the reasonable range of  $\pm 10\%$ . Therefore, it is proved that the project is not be financially attractive without CDM revenue.

Table B.5.5 summarizes the results of the extreme fluctuations analysis, showing the variation of each parameter needed to reach the 8% benchmark.

Table B.5.5 Extreme fluctuation analysis

	Variation	IRR
Electricity revenue	+14%	8.1%
Steam revenue	+35%	8.1%
Investment cost	-21%	8.0%
Operation cost	-13%	8.0%

The sensitivity analysis shows that IRR is most sensitive to the operation cost and Electricity revenue. And only when the electricity revenue increase 14%, the steam revenue increase 35%, the investment cost decrease 21%, the operation cost decrease 13%, the IRR of the project activity could reach the benchmark of 8%. But, these magnitudes of the change are very unlikely to occur because:

- Electricity revenue:** This parameter is composed of electricity output and electricity tariff. 1) Electricity output is determined by the installed capacity and operational hours. As to the project, the installed capacity has been fixed to be 42MW during the credit period. The expected number of operational hours (6,000 hours per year) for a grid connected power plant is already a very aggressive assumption under the limitation of grid connection hours. So, it is impossible that the electricity output could increase 14%. 2) Electricity tariff: According to the tariff approval by the Shandong Province Price Bureau, the tariff is fixed to be 0.435Yuan/kWh, which is only 6% higher than that estimated price 0.4105 Yuan/kWh in the FSR. Additionally, the electricity tariff is controlled by the government





in China to keep its stable. So it's not possible for the tariff to increase 14%. In conclusion, the electricity revenue could not reach a 14% increase.

- **Steam revenue:** this parameter is influenced by steam output and steam price. 1) The annual steam output is determined by the steam demand and the steam generation capacity of the project. According to the contracts with the customers, the total demand of steam is 40t/h, which is applied in the FSR and financial analysis. And the rated steam extraction capacity of turbine extraction is 50t/h, 25% higher than the demand, still could not reach a 35% incensement of the steam output. 2) The steam price has been determined by the Jining City Price Bureau to be 150 Yuan /t, and could fluctuate only within 10% of that. So it's impossible for the steam price to increase 35%. In conclusion, the steam revenue could not increase 35%.
- **Investment cost:** The construction of the project has been completed, and the total investment is almost equal to the approved investment in the FSR. So, it's not possible for the investment cost to decrease 21%.
- **Operation cost:** Annual O&M cost mainly includes the materials cost, labour costs and other fees. According to Statistical Yearbook of Shandong (2007-2011), over the past 5 years, the average annual growth rate of raw material purchase price index is 5.4%; and the average annual growth rate of labour costs is 15.2%. Therefore, it is impossible that the annual O&M cost would decrease 13%.

Based on the above analysis, without support from CERs income, the Project activity is not financially attractive. Therefore the Project activity is additional.

### Step 3. Barrier Analysis

Not applicable.

### Step 4. Common Practice Analysis

According to the tool *for demonstration and assessment of additionality* (version06.0.0), projects taking measures listed in paragraph 6, should employ this step according to paragraph 47 of the tool. The proposed project would be classified to measure (b) in paragraph 6, i.e., *switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies)*. So the stepwise approach for common practice analysis in the tool should be applied as follows.

**Applicable geographical area:** China is a very large country. The investment environment for each province in China is different. This is due to variation of available natural resources such as coal, the economic development level, the industrial structure, the fundamental infrastructure, development strategy and the policy framework. These all affect the demand for the products in terms of amount as well as the types of products and technologies. As such a number of key economic factors vary from province to province, Shandong province is selected as the applicable geographical region for common practice.

*Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.*

The proposed project is to instruct one CCGT plant for cogeneration using the recovered wasted COG. The rated output of the project is 42MW. So the applicable output range as +/-50% is 21MW~63MW.

*Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started*





commercial operation before the start date of the project. Note their number  $N_{all}$ . Registered CDM project activities and projects activities undergoing validation shall not be included in this step.

There are only 3 enterprises are similar to the proposed project activity as shown in Table B.5.6.

Table B.5.6 All CCPP plants in Shandong Province

No.	Project	Capacity	Commercial operation	Apply for CDM?	Included or exclude?
1	Jinan Iron and Steel Work <sup>7</sup>	544MW	2007 year	Yes, registered	Excluded
2	Shandong Jinneng Coal Gasification Company, Ltd. <sup>8</sup>	37MW	2009 year	Yes, but no information in detail	Included
3	Laiwu Iron & Steel Group Corp. <sup>9</sup>	61MW	2008 year	Yes, undergoing validation	Excluded

In the 3 projects listed above, only the second project complies all the conditions of this step.

So,  $N_{all} = 1$ .

*Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number  $N_{diff}$ .*

$N_{diff}=0$ .

*Step 4: Calculate factor  $F=1-N_{diff}/N_{all}$  representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.*

*The proposed project activity is a .common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:*

- (a) the factor  $F$  is greater than 0.2, and*
- (b)  $N_{all}-N_{diff}$  is greater than 3.*

As stated in step 4,  $F=1-0/1=1$ , but  $N_{all}-N_{diff}=1<3$ . Therefore, this project is not a common practice.

Based on the above analysis, it can be concluded that this project activity is not a common practice activity and is clearly additional.

#### **B.6. Emission reductions:**

<sup>7</sup> <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1166194116.62/view>

<sup>8</sup> <http://www.sdetn.gov.cn/portal/jmzn/jnjp/webinfo/2008/09/1220332320245248.htm>

<sup>9</sup> <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1265810080.32/view>



**B.6.1. Explanation of methodological choices:****Step 1. Baseline emission**

The baseline emissions is determined as per the “flow chart for determination of baseline emissions” of the methodology ACM0012 (version 04.0.0). And the baseline scenario of the proposed project is of the baseline scenario 2 referred in table 2 of the methodology ACM0012 (version 04.0.0), so Sec.1.1.1 (case 1 of (a) and (b)), Sec.2 and Sec.3 would be followed to calculate the emission reduction. The detailed calculation is as follows:

The baseline emissions of the year  $y$  shall be calculated as follows:

$$BE_y = BE_{En,y} + BE_{flst,y} \quad (1)$$

Where:

- $BE_y$  The total baseline emissions during the year  $y$  in tCO<sub>2</sub>  
 $BE_{En,y}$  The baseline emissions from energy generated by the project activity during the year  $y$  in tCO<sub>2</sub>  
 $BE_{flst,y}$  Baseline emissions from fossil fuel combustion, if any, either directly for flaring of waste gas or for steam generation that would have been used for flaring the waste gas in the absence of the project activity (tCO<sub>2</sub>), calculated as per equation 26 in the methodology. This is relevant for those project activities where in the baseline steam is used to flare the waste gas.

**Step 1.1 Baseline emission from the generation of steam ( $BE_{flst,y}$ )**

It needs no complementary fossil fuel to flare waste COG in the absence of the Project activity, so the baseline emission from the generation of steam ( $BE_{flst,y}$ ) is zero. So,

$$BE_{flst,y} = 0$$

**Step 1.2 Baseline emissions from energy generated by Project activity during the year  $y$  ( $BE_{En,y}$ )**

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y} \quad (2)$$

Where:

- $BE_{Elec,y}$  Baseline emissions from electricity during the year  $y$  in tons of CO<sub>2</sub>  
 $BE_{Ther,y}$  Baseline emissions from thermal energy (due to heat generation by element process) during the year  $y$  in tons of CO<sub>2</sub>

**Step 1.2.1 Baseline emissions from thermal energy during the year  $y$  ( $BE_{Ther,y}$ )**

$$BE_{ther,y} = f_{cap} * \sum_j \left\{ \left( \sum_n f_{wcm} * HG_{n,j,y} \right) * EF_{heat,j,y} \right\} \quad (3)$$

Where:

- $BE_{Ther,y}$  Baseline emissions from thermal energy (as steam) during the year  $y$  in tCO<sub>2</sub>.  
 $HG_{n,j,y}$  Net quantity of heat supplied to the unit process/element process/reactor  $n$  in recipient facility  $j$  by the project activity during the year  $y$  in (TJ).  
 In this project, it means the quantity of steam supplied to the steam customers in the development zone. It can be estimated following the equation series of (4)





- $EF_{Heat,j,y}$  The CO<sub>2</sub> emission factor of the element process that would have supplied the heat to recipient facility  $j$  in absence of the project activity (tCO<sub>2</sub>/TJ).  
In absence of the project, the steam demanded by the steam customers would be supplied by the coal fired boilers of the centralized steam plant that would be built in the development zone.
- $f_{wcm}$  Fraction of total heat generated in the unit process/element process/reactor  $n$  by the project activity using waste energy. This fraction is 1 if the heat generation in process  $n$  is purely from use of waste energy. As to the project, the steam generation is purely from the use of waste COG, therefore, it is 1
- $f_{cap}$  Factor that determines the energy that would have been produced in project year  $y$  using waste energy generated at a historical level expressed as a fraction of total energy produced using waste source in year  $y$ . The ratio is 1 if the waste energy generated in project year  $y$  is the same or less than that generated at a historical level. The value is estimated using equations in section 3.2. It is 1 for ex-ante estimation, which can be seen in equation (10). And the ex-post data will be calculated with monitoring data after the project implementation.

$$HG_{n,j,y} = HG_{n,process,j,y} + HG_{n,chemical,j,y} \quad (4)$$

Where:

- $HG_{n,process,j,y}$  Net quantity of heat supplied to the recipient facility  $j$  for element process/heating unit/chemical reactor  $n$  by the project activity for process heating during the year  $y$ . In the case of steam this is expressed as difference of energy content between the steam supplied to the recipient facility and the feed water to the boiler (TJ)  
In this project, it means the quantity of steam supplied to the steam customers in the development zone.
- $HG_{n,chemicals,j,y}$  Net quantity of heat supplied to the recipient facility  $j$  for chemical reactor  $n$  by the project activity for supply of heat of reaction during the year  $y$  (TJ).  
In this project  $HG_{n,chemicals,j,y} = 0$

#### Determination of $HG_{n,process,j,y}$

$$HG_{n,process,j,y} = \sum_p H_{p,n,j,y} - \sum_r H_{r,n,j,y} \quad (5)$$

Where:

- $H_{p,n,j,y}$  Net enthalpy of the product  $p$  in the product mix at the outlet of the process/reactor/element process  $n$  in recipient facility  $j$  during the year  $y$  (TJ).
- $H_{r,n,j,y}$  Net enthalpy of the reactant  $r$  in the reactant mix at the inlet of the process/reactor/element process  $n$  in recipient facility  $j$  during the year  $y$  (TJ)

$$H_{p,n,j,y} = h_{steam,y} * Q_{steam,y} / 1000,000 \quad (6)$$

$$H_{r,n,j,y} = h_{feedwater,y} * Q_{feedwater,y} / 1000,000 \quad (7)$$

Where:

- $h_{steam}$  The Unit enthalpy of the output steam of the project (KJ/kg)
- $h_{feedwater}$  The unit enthalpy of the feed water to the WHRB of the project (KJ/kg)
- $Q_{steam,y}$  Extraction steam quantity of the outlet of the steam turbine in year  $y$  (t/a)





$Q_{\text{feedwater},y}$  Feed water volume of the inlet of the WHRB in year  $y$  (t/a)

### Determination of $EF_{\text{Heat},j,y}$

$$EF_{\text{heat},j,y} = \sum_i \omega_{S_{i,j}} \frac{EF_{CO_2,i,j}}{\eta_{EP,i,j}} \quad (8)$$

Where:

$EF_{\text{heat},j,y}$  The CO<sub>2</sub> emission factor of the element process supplying heat that has or would have supplied the recipient facility  $j$  in absence of the project activity, expressed in tCO<sub>2</sub>/TJ

$EF_{CO_2,i,j}$  The CO<sub>2</sub> emission factor per unit of energy of the baseline fuel (coal) used in  $i^{\text{th}}$  element process used by recipient  $j$ , in tCO<sub>2</sub>/TJ, in absence of the project activity

$\eta_{EP,i,j}$  Efficiency of the  $i^{\text{th}}$  element process that has or would have supplied heat to  $j^{\text{th}}$  recipient in the absence of the project activity

$\omega_{S_{i,j}}$  Fraction of total heat that is used by the recipient  $j$  in the project that in absence of the project activity would have been supplied by the  $i^{\text{th}}$  element process

### Step 1.2.2 Baseline emissions from electricity ( $BE_{\text{Elec},y}$ ) generation

For the Case 1 project: Waste energy is used to generate electricity,

$$BE_{\text{Elec},y} = f_{\text{cap}} * f_{\text{wem}} * \sum_j \sum_i (EG_{i,j,y} * EF_{\text{Elec},i,j,y}) \quad (9)$$

Where:

$BE_{\text{elec},y}$  Baseline emissions due to displacement of electricity during the year  $y$  (tCO<sub>2</sub>)

$EG_{i,j,y}$  The quantity of electricity supplied to the recipient  $j$  by generator, which in the absence of the project activity would have been sourced from source  $i$  (the grid or an identified source) during the year  $y$  in MWh

In this project, it means the quantity of electricity supplied to the NCPG, which in the absence of the project activity would have been sourced from NCPG connected coal fired power plants that is connected with NCPG (the grid or an identified source) during the year  $y$  in MWh. Simplified description  $EG_y$  is used as the substitution of  $EG_{i,j,y}$  in the PDD.

$EF_{\text{elec},i,j,y}$  The CO<sub>2</sub> emission factor for the electricity source  $i$  (gr for the grid, and is for an identified source), displaced due to the project activity, during the year  $y$  (tCO<sub>2</sub>/MWh)

In this project, it means the CO<sub>2</sub> emission factor of NCPG. If the displaced electricity for the recipient facility is supplied by a connected grid system, the CO<sub>2</sub> emission factor of the electricity  $EF_{\text{elec},gr,j,y}$  shall be determined following the guidance provided in the “Tool to calculate the emission factor for an electricity system.”. For the proposed project, the electricity generated would be supplied to the NCPG, so the emission factor the NCPG ( $EF_{\text{grid},CM,y}$ ) would be developed and followed. The relative information is attached in Annex 3.





- $f_{wcm}$  Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy. As to the project, the electricity generation is totally from the waste COG, therefore, it is 1.
- $f_{cap}$  Factor that determines the energy that would have been produced in project year  $y$  using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year  $y$ . The ratio is 1 if the waste energy generated in project year  $y$  is the same or less than that generated at a historical level. The value is estimated using the equations in section 3.2. For Greenfield facilities,  $f_{cap}$  is 1. As calculated in equation (10) below, it is 1.

For the identified existing source of electricity, the proportion of electricity that would have been sourced from the  $i^{th}$  source to the  $j^{th}$  recipient facility ( $EG_{i,j,y}$ ) should be estimated based on historical data of the proportion received during the three most recent years.

### **Capping of baseline emissions**

The ACM0012 Methodology requires the capping of baseline emissions irrespective of planned / unplanned or actual increases in output of plant, change in operational parameters and practices, etc. In case of planned expansion a separate CDM project should be registered for additional capacity. The cap can be estimated using the three methods described below, following this hierarchy: (i) Method-1 can be used to estimate the capping factor if required data is available; (ii) if the project activities implemented in a Greenfield facility, or in existing facilities where the required data is unavailable Method-2 shall be used; (iii) If the project proponents demonstrate technical infeasibility in direct monitoring of waste heat / pressure of waste energy carrying medium (WECM), then Method-3 is used.

The project will use Method-2 to estimate the cap, since the required data by Method-1 is not available.

Method-1 can be used “Where the historical data on energy released by the waste energy carrying medium is available, the baseline emissions are capped at the maximum quantity of waste energy released into the atmosphere under normal operation conditions in the three years previous to the project activity”. As to the proposed project, the historical data of 3 years is not available. So method-1 is not applicable to the project.

Method-2 requires “if three-year historical data is not available, the manufacturer’s data for the facility shall be used to estimate the amount of waste energy the facility generates per unit of product.” The proposed project is implemented in existing facility, and the required manufacturer’s data is available. So Method-2 is applied here to cap the baseline emissions.

Under Method-2, the following equation should be used to determine  $f_{cap}$ :

$$f_{cap} = \frac{Q_{WCM,BL}}{Q_{WCM,y}} \quad (10)$$

$$Q_{WCM,BL} = Q_{BL,product} \times q_{wcm,product} \quad (11)$$

Where:

$Q_{WCM,BL}$  Quantity of waste energy generated prior to the start of the project activity ( Nm<sup>3</sup>)





- $Q_{WCM,y}$  Quantity of WECM used for energy generation during year  $y$  ( $Nm^3$ )
- $Q_{BL,product}$  Coke ovens production in the baseline scenario. (t) The minimum of the following two figures should be used: (1) average annual historical production data from start-up of the facility, if the facility's operational history is less than three years, or (2) the most relevant manufacture's data for normal operating conditions.
- For the project, the historical coke production is 800,080t annually, and the designed production for normal operating conditions is 800,000t annually. So the minimum production of 800,000t annually is applied in the project..
- $q_{wcm,product}$  Amount of waste COG per unit of coke generated by the coke oven ( $Nm^3/t$ )
- It's 222  $Nm^3$ COG/t coke for ex-ant estimation in the PDD.

So,

$$Q_{WCM,BL} = Q_{BL,product} \times q_{wcm,product}$$

$$= 800,000t \times 222 Nm^3COG/t \text{ coke} = 177,552,000 Nm^3$$

And, the project will utilize COG 158,604,000  $Nm^3$ /year, e.g.,

$$Q_{WCM,y} = 158,604,000 Nm^3$$

So, the ratio is 1 for the waste energy generated in project year  $y$  is the same or less than that generated at a historical level.

## **Step 2. Project emissions**

Project emissions include (1) combustion of auxiliary fuel to supplement waste gas/heat and (2) electricity emissions due to consumption of electricity for cleaning of gas before being used for generation of energy or other supplementary electricity consumption:

$$PE_y = PE_{AF,y} + PE_{EL,y} \quad (12)$$

Where:

- $PE_y$  Project emissions due to project activity.
- $PE_{AF,y}$  Project activity emissions from on-site consumption of fossil fuels by the cogeneration plant(s), in case they are used as supplementary fuels, due to non-availability of waste gas to the project activity or due to any other reason. The proposed project consume diesel for CCPP start, the emission from the diesel combustion should be counted.
- $PE_{EL,y}$  Project activity emissions from on-site consumption of electricity for gas cleaning equipment other supplementary electricity consumption.

### **(1) Project emissions due to auxiliary fossil fuel combusted to supplement waste energy in the project activity**

These emissions are calculated by using latest approved tool "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)".

$$PE_{AF,y} = \sum (FF_{i,y} \times NCV_i \times EF_{CO2,i}) \quad (13)$$

Where

- $PE_{AF,y}$  Emissions from the project activity in year  $y$  due to combustion of auxiliary fuel in tonnes of  $CO_2$





$FF_{i,y}$	Quantity of fossil fuel type i combusted to supplement waste energy in the project activity during the year y, in energy or mass units In that case, the diesel fuel will be used in the project activity during the year y
$NCV_i$	Net calorific value of the fossil fuel type i combusted as supplementary fuel, in TJ per unit of energy or mass units, obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors
$EF_{CO_2,i}$	CO <sub>2</sub> emission factor per unit of energy or mass of the fuel type i in tons CO <sub>2</sub> obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors

## **(2) Project emissions due to electricity consumption of gas cleaning equipment or other supplementary electricity consumption**

These project emissions are calculated by using latest approved tool “Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01) ”.

$$PE_{EL,y} = EC_{PJ,y} * EF_{grid,CM,y} * (1 + TDL_y) \quad (14)$$

Where

$PE_{EL,y}$	Project emissions due to electricity consumption of gas cleaning equipment or other supplementary electricity consumption
$EC_{PJ,y}$	Electricity consumption of gas cleaning equipment or other supplementary electricity consumption. The consumption of electricity for cleaning of gas has already been deducted from the electricity supplied to the grid $EG_y$ , therefore, the project emission of electricity for cleaning of gas is treated as 0 for the project emission estimation in the PDD and will be monitored ex-post.
$TDL_y$	Average technical transmission and distribution losses for providing electricity to the project in year y

So, for ex-ante estimation of project emissions,

$$PE_y = PE_{AF,y} \quad (15)$$

## **Step3. Leakage**

No leakage is considered, according to ACM0012.

## **Step4. Emission Reductions**

Emission reductions due to the Project activity during the year y are calculated as follows:

$$ER_y = BE_y - PE_y \quad (16)$$

Where:

$ER_y$	the total emissions reductions during the year y in tons of CO <sub>2</sub>
$PE_y$	the emissions from the Project activity during the year y in tons of CO <sub>2</sub>
$BE_y$	the baseline emissions for the Project activity during the year y in tons of CO <sub>2</sub>



**B.6.2. Data and parameters that are available at validation:**

<b>Data / Parameter:</b>	<b>Installed Capacity of the Project activity</b>
Data unit:	MW
Description:	The installed capacity of the Project activity
Source of data used:	FSR
Value applied:	42MW
Justification of the choice of data or description of measurement methods and procedures actually applied :	FSR
Any comment:	/

<b>Data / Parameter:</b>	<b>FC<sub>i,y</sub></b>
Data unit:	10,000 ton
Description:	Amount of fossil fuel type i consumed in the project electricity system in year y
Source of data used:	China Energy Statistics Yearbooks (2008-2010)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

<b>Data / Parameter:</b>	<b>GEN<sub>j</sub></b>
Data unit:	MWh
Description:	The electricity generation by source j in year y of each province connected to the NCPG
Source of data used:	China Energy Statistics Yearbooks (2008-2010)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

<b>Data / Parameter:</b>	<b>ECR<sub>y</sub></b>
Data unit:	%
Description:	The rate of electricity consumption of thermal power plants in NCPG in y year
Source of data used:	China Energy Statistics Yearbooks (2008-2010)
Value applied:	See Annex 3





Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data Source
Any comment:	

<b>Data / Parameter:</b>	<b>NCV<sub>i,v</sub></b>
Data unit:	TJ/t, km <sup>3</sup>
Description:	The net calorific value per mass or volume unit of a fuel i
Source of data used:	China Energy Statistical Yearbook 2010 edition
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistical data; publicly accessible and reliable data source.
Any comment:	

<b>Data / Parameter:</b>	<b>CAP<sub>m,i,y</sub></b>
Data unit:	MW
Description:	The installed capacity of power sources i of province m in NCPG in the years y
Source of data used:	China Electric Power Yearbook 2008-2010
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values.
Any comment:	

<b>Data / Parameter:</b>	<b>EF<sub>Coal,Adv,v</sub></b>
Data unit:	%
Description:	The fuel consumption rate of coal-fired power plants which are applied by the most advanced commercially technology
Source of data used:	Baseline Emission Factor of China's Grid in 2011. (updated on 20/10/2011)
Value applied:	39.45
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the official statistics.
Any comment:	

<b>Data / Parameter:</b>	<b>EF<sub>Gas,Adv,v</sub></b>
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Data unit:	%
Description:	The fuel consumption rate of gas-fired power plants which are applied by the most advanced commercially technology
Source of data used:	Baseline Emission Factor of China's Grid in 2011. (updated on 20/10/2011)
Value applied:	51.77
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the official statistics.
Any comment:	

<b>Data / Parameter:</b>	<b>EF<sub>Oil,Adv,y</sub></b>
Data unit:	%
Description:	The fuel consumption rate of oil-fired power plants which are applied by the most advanced commercially technology
Source of data used:	Baseline Emission Factor of China's Grid in 2011. (updated on 20/10/2011)
Value applied:	51.77
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the official statistics.
Any comment:	

<b>Data / Parameter:</b>	<b>EF<sub>CO2,i,j</sub></b>
Data unit:	tCO <sub>2</sub> /TJ
Description:	Carbon emission factor per unit of energy of the baseline fuel (coal) used in i boiler used by recipient j, in tCO <sub>2</sub> /TJ, in absence of the Project activity.
Source of data used:	2006 IPCC Guideline for National Greenhouse Gas Inventories.
Value applied:	94.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and is reliable.
Any comment:	

<b>Data / Parameter:</b>	<b>Q<sub>BL,product</sub></b>
Data unit:	ton
Description:	The annual coke production
Source of data used:	Energy balance from manufacturer's data.
Value applied:	800,000
Justification of the choice of data or description of	Based on the specification of manufacture, the average annual coke production will be used for ex-ante calculation.





measurement methods and procedures actually applied :	
Any comment:	Used for determination of $f_{cap}$ following method-2.

<b>Data / Parameter:</b>	$q_{wcm\_product}$
Data unit:	Nm <sup>3</sup> /ton
Description:	Specific waste energy production per ton of coke generated as per manufacturer's or external expert's data.
Source of data used:	Energy balance from manufacturer's data.
Value applied:	222
Justification of the choice of data or description of measurement methods and procedures actually applied :	/
Any comment:	Used for determination of $f_{cap}$ following method-2.

<b>Data / Parameter:</b>	$h_{feedwater}$
Data unit:	KJ/kg
Description:	Unit enthalpy of the reactor (feed water) for the WHRB
Source of data used:	From standard data books/ steam tables
Value applied:	440.1776 (104°C, 5.8Mpa)
Justification of the choice of data or description of measurement methods and procedures actually applied :	/
Any comment:	/

<b>Data / Parameter:</b>	$h_{steam}$
Data unit:	KJ/kg
Description:	Unit enthalpy of the production (extraction steam) from the steam turbine
Source of data used:	From standard data books/ steam tables
Value applied:	3,114.42374 (1,27MPa, 332°C)
Justification of the choice of data or description of measurement methods and procedures actually applied :	/
Any comment:	/





<b>Data / Parameter:</b>	$\eta_{EP,i,j}$
Data unit:	tCO <sub>2</sub> /TJ
Description:	Efficiency of the $i^{th}$ element process that has or would have supplied heat to $j^{th}$ recipient in the absence of the project activity. Maximum efficiency would be used according to applied methodology.
Source of data to be used:	According to the methodology ACM0012(version04.0.0), 100% is used for conservativeness.
Value of data applied	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	/
Any comment:	/

### B.6.3. Ex-ante calculation of emission reductions:

As described in B.6.1, the emission reduction calculation of this project is as follows:

#### 1. The calculation of baseline emission

$$BE_y = BE_{En,y} + BE_{flst,y}$$

##### Step 1.1 $BE_{flst,y}$ Calculation

The project recovers waste heat and there is no need to flare. Therefore,

$$BE_{flst,y} = 0$$

##### Step 1.2 $BE_{En,y}$ Calculation

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y}$$

##### Step 1.2.1 $BE_{ther,y}$ Calculation

$$BE_{ther,y} = f_{cap} * \sum_j \left\{ \left( \sum_n f_{wcm,n,y} * HG_{n,j,y} \right) * EF_{heat,j,y} \right\}$$

$$HG_{n,j,y} = HG_{n,process,j,y}$$

$$HG_{n,process,j,y} = \sum_p H_{p,n,j,y} - \sum_r H_{r,n,j,y}$$

$$EF_{heat,j,y} = \sum_i \omega_{S_{i,j}} \frac{EF_{CO2,i,j}}{\eta_{EP,i,j}}$$

Where :





$BE_{Ther,y}$	<b>Baseline emissions from thermal energy (as steam) during the year y in tCO<sub>2</sub>.</b>	<b>60,716 tCO<sub>2</sub>e</b>
$f_{wcm}$	Fraction of total heat generated in the unit process/element process/reactor n by the project activity using waste energy. This fraction is 1 if the heat generation in process n is purely from use of waste energy. As stated in B.6.2, in this project, the steam generation is purely from the use of waste COG, therefore, it is 1.	1
$f_{cap}$	Factor that determines the energy that would have been produced in project year y using waste energy generated at a historical level expressed as a fraction of total energy produced using waste source in year y. As calculated in equation (7), it is 1.	1
$H_{p,n,j,y}$	Net enthalpy of the product p in the product mix at the outlet of the process/reactor/element process n in recipient facility j during the year y (TJ) In this project, it means the enthalpy of extraction steam from the steam turbine in the year y. The steam would be supplied to the steam customers Note: The parameters of steam: $T_{steam}=332^{\circ}C$ , $P_{steam} = 1.27MPa$ , $Q_{steam}= 240,000t/a$ . So, the Unit enthalpy of the output steam of the project ( $h_{steam}$ ) = 3,114.4237 KJ/kg $H_{p,n,j,y} = h_{steam} * Q_{steam,y} / 1000,000$ $= 3,114.4237 \text{ KJ/kg} * 240,000t/a / 1000,000$ $= 747.46 \text{ TJ}$	747.46TJ
$H_{r,n,j,y}$	Net enthalpy of the reactant r in the reactant mix at the inlet of the process/reactor/element process n in recipient facility j during the year y (TJ) In this project, $H_{r,n,j,y}$ is expressed as the net enthalpy of feed water to the WHRB(TJ) The parameters of feed water: $T_{feed\ water}= 104^{\circ}C$ , $P_{feedwater} = 5.8MPa$ , $Q_{feed\ water,y}= 240,000t/h$ . So, the unit enthalpy of the feed water to the WHRB of the project ( $h_{feedwater}$ ) = 440.1776 KJ/kg $H_{r,n,j,y} = h_{feedwater} * Q_{feedwater,y} / 1000,000$ $= 440.1776 \text{ KJ/kg} * 240,000t/a / 1000,000$ $= 105.64 \text{ TJ}$	105.64TJ
$HG_{n,process,j,y} / HG_{n,j,y}$	Net quantity of heat supplied to the recipient facility j for element process/heating unit/chemical reactor n by the project activity for process heating during the year y. In the case of steam this is expressed as difference of	641.82TJ





	energy content between the steam supplied to the recipient facility and the feed water to the boiler (TJ). For steam boiler and the project: This is expressed as the difference of energy content of steam supplied to the recipient facility ( $H_{p,n,j,y}$ ) and energy content of feed water to the boiler ( $H_{r,n,j,y}$ ).	
$\omega_{Si,j}$	Fraction of total heat that is used by the recipient $j$ in the project that in absence of the project activity would have been supplied by the $i^{th}$ element process. That would be supplied totally by the coal-fired boiler.	1
$\eta_{EP,i,j}$	Efficiency of the $i^{th}$ element process that has or would have supplied heat to $j^{th}$ recipient in the absence of the project activity. Maximum efficiency would be used according to applied methodology.	100%
$EF_{CO_2,i,j}$	The CO <sub>2</sub> emission factor per unit of energy of the baseline fuel (coal) used in $i^{th}$ element process used by recipient $j$ , in tCO <sub>2</sub> /TJ, in absence of the project activity. The IPCC default value of Coal would be used.	94.6 t CO <sub>2</sub> /TJ
$EF_{Heat,j,y}$	The CO <sub>2</sub> emission factor of the element process that would have supplied the heat to recipient facility $j$ in absence of the project activity (tCO <sub>2</sub> /TJ). In absence of the project, the steam would be supplied by the coal fired boilers in the centralized steam plant, so it means the emission factor of coal.	94.6t CO <sub>2</sub> /TJ

**Step 1.2.2 BE<sub>Elec,y</sub> Calculation**

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y})$$

Where:

<b><math>BE_{elec,y}</math></b>	<b>Baseline emissions due to displacement of electricity during the year <math>y</math> (tCO<sub>2</sub>e)</b>	<b>186,000 tCO<sub>2</sub>e</b>
$\frac{EG_{i,j,y}}{EG_y}$	The quantity of electricity supplied to the recipient $j$ by generator, which in the absence of the project activity would have been sourced from source $i$ (the grid or an identified source) during the year $y$ in MWh  In this project, it means the quantity of electricity supplied to the NCPG, which in the absence of the project activity would have been sourced from NCPG connected coal fired power plants that is connected with NCPG (the grid or an identified source) during the year $y$ in MWh	229,219MWh
$EF_{elec,i,j,y}$	The CO <sub>2</sub> emission factor for the electricity source $i$ (gr for the grid, and is for an identified source), displaced due to the project activity, during the year $y$ (tCO <sub>2</sub> /MWh)  In this project, it means the CO <sub>2</sub> emission factor of NCPG	0.81145 tCO <sub>2</sub> /MWh





$f_{wem}$	Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy. The electricity generated by the project is totally from the waste COG, therefore, it is 1.	1
$f_{cap}$	Factor that determines the energy that would have been produced in project year $y$ using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year $y$ . As calculated in equation, it is 1.	1

Therefore,

$$\begin{aligned}
 BE_y &= BE_{En,y} = BE_{Elec,y} + BE_{Ther,y} \\
 &= 186,000 \text{ tCO}_2\text{e} + 60,716 \text{ tCO}_2\text{e} \\
 &= 246,716 \text{ tCO}_2\text{e}
 \end{aligned}$$

## Step 2. The calculation of project emission

$$PE_y = PE_{AF,y} + PE_{EL,y} = PE_{AF,y}$$

$$PE_{AF,y} = \sum (FF_{i,y} \times NCV_i \times EF_{CO_2,i})$$

$PE_{AF,y}$	Emissions from the project activity in year $y$ due to combustion of auxiliary fuel in tonnes of CO <sub>2</sub>	<b>65tCO<sub>2</sub>e</b>
$FF_{i,y}$	Quantity of fossil fuel type $i$ combusted to supplement waste energy in the project activity during the year $y$ , in mass units $t$ In that case, the diesel fuel will be used for gas-turbine generator starting during the year $y$ And the coal would be used by the backup 75t/h boiler when CCPP is not available. So, It indicate $FF_{diesel,y}$ and $FF_{coal,y}$	20t/a diesel  0t/a coal
$NCV_i$	The net calorific value of the fuel type $i$ in year $y$ Diesel and coal will be used in the project activity during the year $y$ So, it indicate $NCV_{diesel}$ and $NCV_{coal}$	0.0433TJ/t diesel  0.0305TJ/t coal
$EF_{CO_2,i}$	CO <sub>2</sub> emission factor of fuel type $i$ in year $y$ . Diesel and coal will be used in the project activity during the year $y$ So, it indicate $EF_{CO_2,diesel}$ and $EF_{CO_2,coal}$	74.8 tCO <sub>2</sub> /TJ for diesel  99.7 tCO <sub>2</sub> /TJ for coal

## 3. The leakage calculation

According to the methodology, the leakage is zero, i.e.,  $L_y = 0$

## 4. The calculation of emission reduction





$$ER_y = BE_y - PE_y - LE_y = BE_y - PE_y = 246,716 - 65 = 246,651 \text{ tCO}_2\text{e}$$

**B.6.4. Summary of the ex-ante estimation of emission reductions:**

Year	Estimation of project activity emissions (tonnes of CO <sub>2</sub> e)	Estimation of baseline emissions (tonnes of CO <sub>2</sub> e)	Estimation of leakage (tonnes of CO <sub>2</sub> e)	Estimation of overall emission reductions (tonnes of CO <sub>2</sub> e)
01/09/2012-31/12/2012	22*	82,239*	0	82,217
2013	65	246,716	0	246,651
2014	65	246,716	0	246,651
2015	65	246,716	0	246,651
2016	65	246,716	0	246,651
2017	65	246,716	0	246,651
2018	65	246,716	0	246,651
2019	65	246,716	0	246,651
2020	65	246,716	0	246,651
2021	65	246,716	0	246,651
01/01/2022-31/08/2022	43*	164,477*	0	164,434
<b>Total (tonnes of CO<sub>2</sub>e)</b>	650	2,467,160	0	2,466,510

\* Rounded off to be integer.

**B.7. Application of the monitoring methodology and description of the monitoring plan:****B.7.1. Data and parameters monitored:**

<b>Data / Parameter:</b>	WS <sub>i,j</sub>
Data unit:	%
Description:	Fraction of total heat that is used by the steam consumers in the project that in absence of the project activity would have been supplied by the district heating process.
Source of data:	Estimated from data on heat consumption by steam customers.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
Description of measurement methods and procedures to be applied:	/
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	/
Any comment:	/





<b>Data / Parameter:</b>	$EG_y$
Data unit:	MWh
Description:	Quantity of electricity supplied to the recipient by generator, which in the absence of the project activity would have sourced from the grid.
Source of data to be used:	Data 229,219MWh used in the PDD is obtained from the FSR of the project. Actual value will be obtained after the implementation of the project from relevant meters.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	229,219
Description of measurement methods and procedures to be applied:	The electricity supplied to NCPG can be measured by the electricity meter.
Monitoring frequency:	Measured continuously and recorded monthly.
QA/QC procedures to be applied:	The electricity meters will be calibrated according to the industry standards. Sales records and purchase receipts are used to ensure the consistency (Sales records will be consistent with electricity supplied to NCPG ( $EG_y$ ) minus electricity consumption by the project ( $EC_{PJ,y}$ ).)
Any comment:	Data shall be measured at the recipient facility(ies) and at the project facility for cross check. Sales receipts shall be used for verification. The total energy supplied by the generator should equal to total electricity received by recipient facility(ies).

<b>Data / Parameter:</b>	$EC_{PJ,y}$
Data unit:	MWh
Description:	Electricity consumption of gas cleaning equipment or other supplementary electricity consumption.
Source of data to be used:	Monitoring
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Electricity consumption by the project has been considered when determine the quantity of electricity supplying to NCPG. So this value is deemed to be 0 for ex-ante estimation. The parameter can be monitored in the crediting period through electricity meter.
Monitoring frequency:	Continuously measured and recorded monthly.
QA/QC procedures to be applied:	The electricity meters will be calibrated according to the industry standards.
Any comment:	/

<b>Data / Parameter:</b>	$Q_{WCM,y}$
Data unit:	$Nm^3$
Description:	Quantity of Waste COG used for energy generation during year y
Source of data to be used:	The data is from FSR, and the actual data will be monitored.
Value of data applied for the	158,604,000





purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The flow meter will be installed before the inlet of the COG compressor to measure the waste COG flow continuously.
Monitoring frequency:	Continuously, and record daily,
QA/QC procedures to be applied:	Flow meter will be calibrated yearly according to the industry standards.
Any comment:	/

<b>Data / Parameter:</b>	<b>FF<sub>diesel,v</sub></b>
Data unit:	ton
Description:	Quantity of fossil fuel (diesel) combusted in the project activity during the year y
Source of data to be used:	Monitoring
Value of data applied for the purpose of calculating expected emission reductions in section B.5	20
Description of measurement methods and procedures to be applied:	The fossil fuel will be monitored by flow meter.
Monitoring frequency:	Measured monthly, and aggregated yearly
QA/QC procedures to be applied:	The metering instrument will undergo regular maintenance/calibration according to industry standards.
Any comment:	/

<b>Data / Parameter:</b>	<b>NCV<sub>diesel</sub></b>								
Data unit:	TJ/t								
Description:	Net calorific value of the fossil fuel (diesel) combusted as supplementary fuel when starting of the gas turbine.								
Source of data to be used:	<p>The following data sources may be used if the relevant conditions apply:</p> <table border="1"> <thead> <tr> <th>Data source</th><th>Conditions for using the data source</th></tr> </thead> <tbody> <tr> <td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr> <tr> <td>b) Measurements by the project participants</td><td>If a) is not available</td></tr> <tr> <td>c) Regional or national default values</td><td>If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national</td></tr> </tbody> </table>	Data source	Conditions for using the data source	a) Values provided by the fuel supplier in invoices	This is the preferred source if the carbon fraction of the fuel is not provided (Option A)	b) Measurements by the project participants	If a) is not available	c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national
Data source	Conditions for using the data source								
a) Values provided by the fuel supplier in invoices	This is the preferred source if the carbon fraction of the fuel is not provided (Option A)								
b) Measurements by the project participants	If a) is not available								
c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national								





	energy balances).
	d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
	If a) is not available
	For ex-ante estimation, option d) is applied.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0433
Description of measurement methods and procedures to be applied:	For a) and b): Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency:	For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures to be applied:	Verify if the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Any comment:	/

<b>Data / Parameter:</b>	<b>EF<sub>CO<sub>2</sub>,diesel</sub></b>								
Data unit:	tCO <sub>2</sub> /TJ								
Description:	The CO <sub>2</sub> emission factor per unit of diesel								
Source of data to be used:	The following data sources may be used if the relevant conditions apply: <table border="1"> <thead> <tr> <th>Data source</th><th>Conditions for using the data source</th></tr> </thead> <tbody> <tr> <td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr> <tr> <td>b) Measurements by the project participants</td><td>If a) is not available</td></tr> <tr> <td>c) Regional or national default values</td><td>If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national</td></tr> </tbody> </table>	Data source	Conditions for using the data source	a) Values provided by the fuel supplier in invoices	This is the preferred source	b) Measurements by the project participants	If a) is not available	c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national
Data source	Conditions for using the data source								
a) Values provided by the fuel supplier in invoices	This is the preferred source								
b) Measurements by the project participants	If a) is not available								
c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national								





	energy balances) If a) is not available
	d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
	For ex-ante estimation, option d) is applied.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	74.8
Description of measurement methods and procedures to be applied:	For a) and b): Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency:	For a) and b): The CO <sub>2</sub> emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated. For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures to be applied:	/
Any comment:	Applicable where option B is used. For a): If the fuel supplier does provide the NCV value and the CO <sub>2</sub> emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO <sub>2</sub> factor should be used. If another source for the CO <sub>2</sub> emission factor is used or no CO <sub>2</sub> emission factor is provided, Options b), c) or d) should be used.

<b>Data / Parameter:</b>	<b>FF<sub>coal,y</sub></b>
Data unit:	ton
Description:	Quantity of fossil fuel (coal) combusted in the project activity during the year y
Source of data to be used:	Monitoring
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	The fossil fuel will be monitored by balance.
Monitoring frequency:	Measured monthly, and aggregated yearly.
QA/QC procedures to be applied:	The metering instrument will undergo regular maintenance/calibration according to industry standards.





Any comment:	/
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<b>Data / Parameter:</b>	NCV <sub>coal</sub>										
<b>Data unit:</b>	TJ/t										
<b>Description:</b>	Net calorific value of the fossil fuel (coal) combusted by the backup boiler in the project year y.										
<b>Source of data to be used:</b>	<p>The following data sources may be used if the relevant conditions apply:</p> <table border="1"> <thead> <tr> <th>Data source</th><th>Conditions for using the data source</th></tr> </thead> <tbody> <tr> <td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr> <tr> <td>b) Measurements by the project participants</td><td>If a) is not available</td></tr> <tr> <td>c) Regional or national default values</td><td>If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).</td></tr> <tr> <td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr> </tbody> </table> <p>For ex-ante estimation, option d) is applied.</p>	Data source	Conditions for using the data source	a) Values provided by the fuel supplier in invoices	This is the preferred source if the carbon fraction of the fuel is not provided (Option A)	b) Measurements by the project participants	If a) is not available	c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).	d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If a) is not available
Data source	Conditions for using the data source										
a) Values provided by the fuel supplier in invoices	This is the preferred source if the carbon fraction of the fuel is not provided (Option A)										
b) Measurements by the project participants	If a) is not available										
c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).										
d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If a) is not available										
<b>Value of data applied for the purpose of calculating expected emission reductions in section B.5</b>	0.0305										
<b>Description of measurement methods and procedures to be applied:</b>	For a) and b): Measurements should be undertaken in line with national or international fuel standards										
<b>Monitoring frequency:</b>	For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account										
<b>QA/QC procedures to be applied:</b>	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct										





	additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Any comment:	/

Data / Parameter:	EF <sub>CO<sub>2</sub>,coal</sub>	
Data unit:	tCO <sub>2</sub> /TJ	
Description:	The CO <sub>2</sub> emission factor per unit of coal	
Source of data to be used:	The following data sources may be used if the relevant conditions apply:	
	Data source	Conditions for using the data source
	a) Values provided by the fuel supplier in invoices	This is the preferred source
	b) Measurements by the project participants	If a) is not available
	c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)
	d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If a) is not available
	For ex-ante estimation, option d) is applied.	
Value of data applied for the purpose of calculating expected emission reductions insection B.5	99.7	
Description of measurement methods and procedures to be applied:	For a) and b): Measurements should be undertaken in line with national or international fuel standards	
Monitoring frequency:	For a) and b): The CO <sub>2</sub> emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated. For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account	
QA/QC procedures to be applied:	/	
Any comment:	Applicable where option B is used.	





	For a): If the fuel supplier does provide the NCV value and the CO <sub>2</sub> emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO <sub>2</sub> factor should be used. If another source for the CO <sub>2</sub> emission factor is used or no CO <sub>2</sub> emission factor is provided, Options b), c) or d) should be used.
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<b>Data / Parameter:</b>	$T_{\text{feedwater}}$
Data unit:	°C
Description:	Feed water temperature of the WHRB.
Source of data to be used:	Data used in the PDD is obtained from the manufacture's specification of the Project activity. Actual data will be read from thermometer.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	104
Description of measurement methods and procedures to be applied:	This parameter is monitored by the thermometer.
Monitoring frequency:	Measured daily, and averaged yearly
QA/QC procedures to be applied:	The thermometer will undergo regular maintenance/calibration according to industry standards.
Any comment:	Used for calculation of enthalpy of feed water ( $H_{r,n,j,y}$ )

<b>Data / Parameter:</b>	$P_{\text{feedwater}}$
Data unit:	MPa
Description:	Feed water pressure of the WHRB.
Source of data to be used:	Data used in the PDD is obtained from the manufacture's specification of the Project activity. Actual data will be read from manometer.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	5.8
Description of measurement methods and procedures to be applied:	The manometer is used to measure onsite steam pressure; Pressure data is recorded both in paper and in the electronic way.
Monitoring frequency:	Measured daily, averaged yearly
QA/QC procedures to be applied:	The manometer will undergo regular maintenance/calibration according to industry standards.
Any comment:	Used for calculation of enthalpy of feed water ( $H_{r,n,j,y}$ )





<b>Data / Parameter:</b>	$Q_{\text{feedwater},y}$
Data unit:	t/a
Description:	Feed water volume of the inlet of the WHRBin year y.
Source of data to be used:	Data used in the PDD is obtained from the Feasibility Study Report of the Project activity. Actual data will be read from flow meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	240,000
Description of measurement methods and procedures to be applied:	This parameter is monitored by the flow meter.
Monitoring frequency:	Measured continuously, aggregated annually
QA/QC procedures to be applied:	The flow meter will undergo regular maintenance/calibration according to industry standards.
Any comment:	Used for calculation of enthalpy of feed water ( $H_{r,n,j,y}$ )

<b>Data / Parameter:</b>	$T_{\text{steam}}$
Data unit:	°C
Description:	Steam temperature supplied by the steam turbine.
Source of data to be used:	Data used in the PDD is obtained from the Feasibility Study Report of the Project activity. Actual data will be read from thermometer at the project facility and at the recipient facility for cross check.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	332
Description of measurement methods and procedures to be applied:	Thermometer is used to measure onsite steam temperature; It is recorded in both paper and electronic way.
Monitoring frequency:	Measured daily, averaged yearly
QA/QC procedures to be applied:	The thermometer will undergo regular maintenance/calibration according to industry standards.
Any comment:	Data shall be measured at the recipient facility(ies) and at the project facility for cross check. Used for calculation of enthalpy of steam supplied to recipient facility j ( $H_{p,n,j,y}$ ).

<b>Data / Parameter:</b>	$P_{\text{steam}}$
Data unit:	MPa
Description:	Steam pressure supplied by the steam turbine.
Source of data to be used:	Data used in the PDD is obtained from the Feasibility Study Report of





	the Project activity. Actual data will be read from manometer at the project facility and at the recipient facility for cross check..
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1.27
Description of measurement methods and procedures to be applied:	The manometer is used to measure onsite steam pressure; Pressure data is recorded both in paper and in the electronic way.
Monitoring frequency:	Measured daily, averaged yearly
QA/QC procedures to be applied:	The manometer will undergo regular maintenance/calibration according to industry standards.
Any comment:	Data shall be measured at the recipient facility(ies) and at the project facility for cross check. Used for calculation of enthalpy of steam supplied to recipient facility j ( $H_{p,n,j,y}$ )

<b>Data / Parameter:</b>	$Q_{\text{steam},y}$
Data unit:	t/a
Description:	Steam quantity supplied by the steam turbine in year y.
Source of data to be used:	Data used in the PDD is obtained from the Feasibility Study Report of the Project activity. Actual data will be read from flow meter at the project facility and at the recipient facility for cross check..
Value of data applied for the purpose of calculating expected emission reductions in section B.5	240,000
Description of measurement methods and procedures to be applied:	This parameter is monitored by the flow meter.
Monitoring frequency:	Measured continuously, aggregated annually
QA/QC procedures to be applied:	The flow meter will undergo regular maintenance/calibration according to industry standards.
Any comment:	Data shall be measured at the recipient facility(ies) and at the project facility for cross check. Used for calculation of enthalpy of steam supplied to recipient facility j ( $H_{p,n,j,y}$ )

<b>Data / Parameter:</b>	$HG_{j,y}$
Data unit:	TJ
Description:	Net quantity of heat supplied to the recipient facility j by the project activity during the year y in TJ.
Source of data to be used:	Recipient facility(ies) actual measurement records.





Value of data applied for the purpose of calculating expected emission reductions in section B.5	641.82
Description of measurement methods and procedures to be applied:	<p>The supplied steam will be not recovered, and there is no condensate returning from the outlet of the turbine condensing stage. So, the difference between the enthalpy of extraction steam supplied to recipient facility <math>j</math> (<math>H_{p,n,j,y}</math>) and the enthalpy of feed water (<math>H_{r,n,j,y}</math>) represents <math>HG_{j,y}</math>.</p> <p>The steam enthalpy supplied to recipient will be measured at the contracted receipting point.</p>
Monitoring frequency:	Continuously, aggregated annually or for each time interval.
QA/QC procedures to be applied:	This data item is a calculated value using other data items. No QA/QC required
Any comment:	<p>There is no condensate recovered to the boiler.</p> <p>The enthalpy of extraction steam supplied to recipient facility <math>j</math> (<math>H_{p,n,j,y}</math>) should be determined by the monitored parameter <math>Q_{\text{steam},y}</math>, <math>P_{\text{steam}}</math> and <math>T_{\text{steam}}</math>.</p> <p>The enthalpy of feed water (<math>H_{r,n,j,y}</math>) should be determined by the monitored parameter <math>Q_{\text{feedwater},y}</math>, <math>P_{\text{feedwater}}</math> and <math>T_{\text{feedwater}}</math>.</p>

<b>Data / Parameter:</b>	Abnormal operation of the project facility including emergencies and shut down (AOH <sub>v</sub> )
Data unit:	Hours
Description:	The hours of abnormal operation of parts of project facility that can have an impact on waste energy generation and recovery Operation of project facility
Source of data to be used:	Operation of project facility
Value of data applied for the purpose of calculating expected emission reductions in section B.5	/
Description of measurement methods and procedures to be applied:	/
Monitoring frequency:	Daily, aggregated annually
QA/QC procedures to be applied:	/
Any comment:	This parameter is monitored to demonstrate that no emission reduction is claimed for the hours during the abnormal operation of the part of project facility which have impact on waste energy generation and recovery. The abnormality can be in terms of violation of operational parameters, poor quality product, emergencies or shutdown.

<b>Data / Parameter:</b>	TDL <sub>k,y</sub>
--------------------------	--------------------





Data unit:	-
Description:	Average technical transmission and distribution losses for providing electricity to source k in year y
Source of data to be used:	<p>The electricity consumption is from the NCPG, so choose one of the following options:</p> <ul style="list-style-type: none"> <li>• Use recent, accurate and reliable data available within the host country;</li> <li>• Use as default values of 20% for               <ul style="list-style-type: none"> <li>(a) project or leakage electricity consumption sources;</li> <li>(b) baseline electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies.</li> </ul> </li> <li>• Use as default values of 3% for               <ul style="list-style-type: none"> <li>(a) baseline electricity consumption sources;</li> <li>(b) project and leakage electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is smaller than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies.</li> </ul> </li> </ul>
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	For a): $TDL_{k,y}$ should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed CDM project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial losses/theft). The distribution losses can either be calculated by the project participants or be based on references from utilities, network operators or other official documentation.
Monitoring frequency:	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
QA/QC procedures to be applied:	/
Any comment:	/

#### B.7.2. Description of the monitoring plan:

According to the requirement of ACM0012 (Version 04.0.0), all the monitoring data and parameters will be detailed recorded. All the data should be recorded so as to be rechecked. Data record will be archived until 2 years after the credit period.

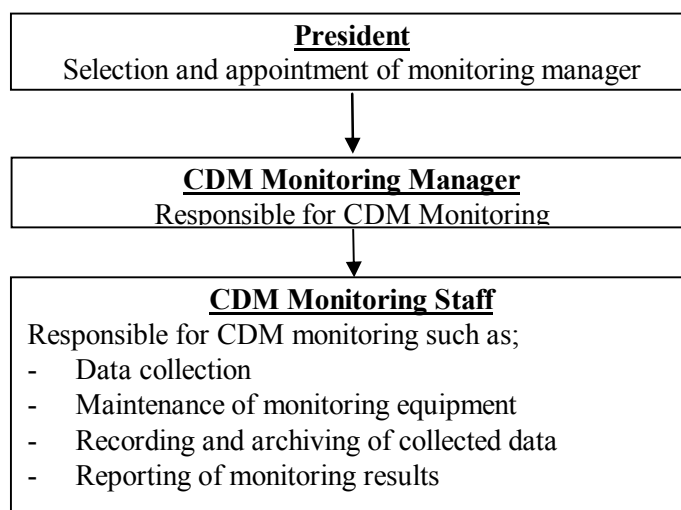




## 1. Monitoring organisation and Staff Training

An organization dedicated for monitoring of CDM project activity will be set up. The president of the company will appoint one CDM monitoring manager and several CDM monitoring staff. The CDM monitoring staff will implement data collection, maintenance and calibration of meters, recording and archiving of collected data, preparation of monitoring report, etc. The managing structure is shown below.

The CDM monitoring manager will be responsible for comprehensive management and data collection, including instruction and training of staff, check for validity, correctness and completeness of data, report to the board and relevant department about CDM monitoring activities, authoring a monitoring report for verification, support of DOE when verification, etc.



## 2. Monitoring data

All data collected as part of monitoring plan should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the comments in the tables below. The following main data shall be monitored.

Project emissions:

- (1) Quantity of fossil fuels used as supplementary fuel ( $FF_{\text{diesel},y}$ ,  $FF_{\text{coal},y}$ );
- (2) Net calorific value of fossil fuel ( $NCV_{\text{diesel}}$ ,  $NCV_{\text{coal}}$ );
- (3) CO<sub>2</sub> emission factor of the fossil fuel ( $EF_{\text{CO}_2,\text{diesel}}$ ,  $EF_{\text{CO}_2,\text{coal}}$ );
- (4) Quantity of electricity consumed by the project operations ( $EC_{\text{PJ},y}$ );
- (5) CO<sub>2</sub> emissions factor of electricity consumed by the project operations ( $EF_{\text{grid,CM},y}$ ); Fixed to be 0.81145 tCO<sub>2</sub>e/MWh in the fixed credit period. Sourced from data published by NDRC in 2011.
- (6) Abnormal operation of the plant ( $AOH_y$ ).

While the quantities of fossil fuels fired are measured using calibrated flow meters, other data items are only factors obtained from reliable local or national data. If local data is not available, the project participant may use default factors published by IPCC.





#### Baseline emissions:

Depending on the baseline scenario, the following data items need monitoring:

- (1) The heat/power/mechanical energy supplied by the project facility to recipient facility(ies) by recovering waste energy from WECM stream(s) ( $EG_y$ ,  $Q_{\text{steam},y}$ ,  $Q_{\text{feedwater},y}$ );
- (2) Energy generation using WECM, in absence of project activity (N/A);
- (3) Quantity and energy content of WECM ( $Q_{\text{wcm},y}$ , and energy content is vacant in the PDD);
- (4) CO<sub>2</sub> emission factor of electricity or heat that would have been consumed by the recipient facility(ies) in the absence of the project activity ( $EF_{\text{grid},\text{CM},y}$ ,  $EF_{\text{CO}_2,i,j}$ );  $EF_{\text{grid},\text{CM},y}$  is fixed to be 0.81145 tCO<sub>2</sub>e/MWh in the fixed credit period following the published data by NDRC in 2011.  $EF_{\text{CO}_2,i,j}$  apply to the IPCC default value.
- (5) Properties of heat (e.g. pressure and temperature of the inlet and outlet of the streams, concentrations of the reactant/product mix etc.) supplied to the recipient facility(s) ( $T_{\text{steam}}$ ,  $P_{\text{steam}}$ ,  $T_{\text{water}}$ );
- (6) Properties of heat return to the element process (e.g. pressure and temperature of the condensate return) supplied by the recipient facility(s) to the project facility (N/A);
- (7) Efficiencies of element process, power plant, cogeneration plant or mechanical conversion equipment that would have been used in the absence of the project activity (100% as default value).

In addition, the relevant variables of applicable tools shall be included in the monitoring plan by the project participants.





### 3. Monitoring equipment and installation

The monitoring equipments location is shown in the following figure.

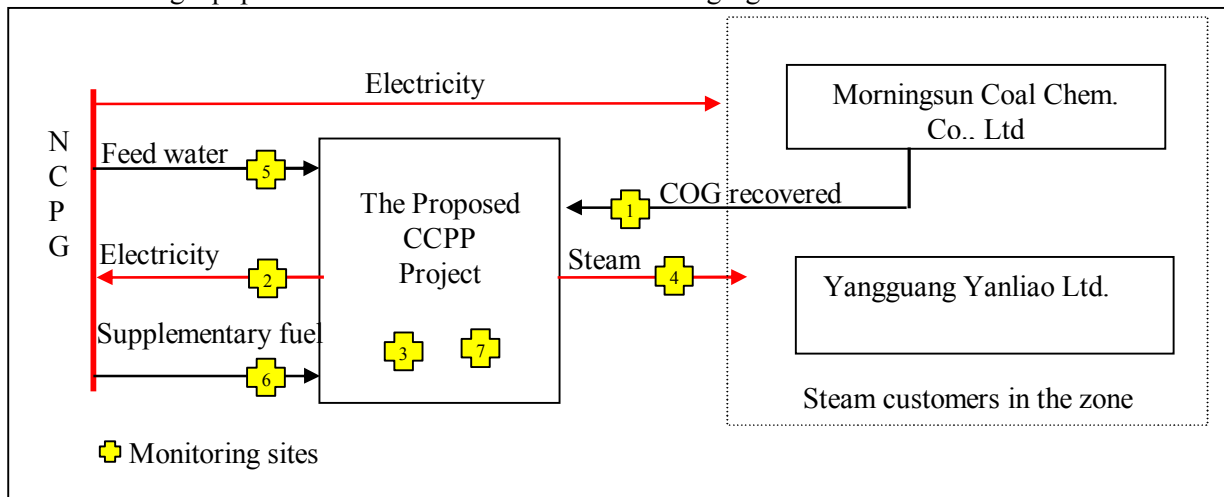


Figure B.7.1 Conceptual diagram of CDM monitoring system





The detailed monitoring equipments and installation can be seen as follows:

Table B.7.1 Details of monitoring equipments and installation

No	Parameters	Description	Equipment	Location	Monitoring frequency	Calibration Frequency	Accuracy*
101	$Q_{wcm,y}$	Quantity of the COG	Flow meter	Before the inlet of COG compressor	Continuously	Annually	2.0
201	$EG_y$	Electricity supplied to NCPG	Electric meter	Main outgoing line of CCPP generator and receipt site of NCPG	Continuously	Annually	1.0
202	$TDL_{k,y}$	Average technical transmission and distribution losses for providing electricity to source k in year y	/	/	Annually	/	/
301	$EC_{PJ,y}$	Internal electricity consumed by the Project activity during year y	Electric meter	Main incoming line of CCPP plant and receipt site of NCPG	Continuously	Annually	1.0
401	$T_{steam}$	Steam temperature	Thermograph	Outlet of steam turbine and receipt site	Continuously	Annually	2.0
402	$P_{steam}$	Steam pressure	Pressure meter	Outlet of steam turbine and receipt site	Continuously	Annually	2.0
403	$Q_{steam,y}$	Steam flow of the extraction steam.	Flow meter	Outlet of steam turbine and receipt site	Continuously	Annually	2.5
501	$T_{feedwater}$	Water temperature of the inlet	Thermograph	Inlet of WHRB	Continuously	Annually	2.0

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		of the WHRB					
502	$P_{\text{feedwater}}$	Feedwater pressure	Pressure meter	Inlet of WHRB	Continuously	Annually	2.0
503	$Q_{\text{feedwater},y}$	Water volume of the inlet of the WHRB	Flow meter	Inlet of WHRB	Continuously	Annually	2.5
601	$FF_{\text{diesel},y}$	Diesel consumption	Flow meter	Diesel inlet for gas-turbine gerator	Monthly	Annually	0.5
602	$FF_{\text{coal},y}$	Coal consumption	Balance	Coal inlet for boiler	Monthly	Annually	0.5
603	$NCV_{\text{diesel}}$	NCV of diesel	Measurement or other reliable reference	/	For each delivery or review appropriateness of the values annually or take into account of any future revision of IPCC value	/	/
604	$NCV_{\text{coal}}$	NCV of coal	Ditto	/	Ditto	/	/
605	$EF_{\text{CO}_2,\text{diesel}}$	Emission factor of diesel	Ditto	/	Ditto	/	/
606	$EF_{\text{CO}_2,\text{Coal}}$	Emission factor of coal	Ditto	/	Ditto	/	/
701	$AOH_y$	Abnormal operation hours in year y	Manual record	CCPP plant	Daily	/	/

\* The accuracy and calibration frequency are only for ex-ant estimation. It should be subject to the actual facilities installed according to national or industry regulations.





#### 4. Data collection, management and archiving

Data collection and archiving is carried out in conformity with the method stated in section B.7.1 and monitoring manual. Dedicated data entry sheets as well as calculation spreadsheets are prepared. If the data is temporarily not available because of breakdown and/or failure of equipment, conservatively estimated value should be used alternatively in transparent and reasonable manner. At the same time, the CDM monitoring manager take actions for prompt recovery from abnormal conditions and minimization of negative impact on production according to the procedures stipulated in the CDM manual. For example, when the generators malfunction, the CDM monitoring chief will soon direct a CDM monitoring staff to take measures for recovery as well as to record the time when the generators stopped and restarted.

Data monitored for CDM purposes will be aggregated, summarized, calculated and recorded as an electronic and a paper form at the end of every month. The paper form record must have at least one copy of backup. The electronic data should be saved in a digital recording media like CD for backup. All relevant written documentation such as monitoring manual, regulatory standards, maps, drawings, etc. are systematically stored in order to use for checking appropriateness of data and data management. The collected data and relevant documents will be made available to the verifier so that the reliability of the information can be checked. All the data shall be kept until two years after the end of crediting period.

#### 5. Quality Assurance and Quality Control

The quality of data generated by this project will be maintained through the development of an overarching monitoring system. This system may include procedures used to double check data, for staff training, meter calibration, accreditation of the facility completing calibration, and the adherence to the relevant standards.

All the meters will be installed in line with the national or industry standards. The metering equipments will be calibrated according to relevant requirements, and the calibration reports will be issued by the party who calibrate the meters.

#### **B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)**

The baseline study and the monitoring methodology was concluded on 07/08/2012 by Uniufa Energy Technology Co., Ltd. (Not a project participant)

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Telephone: 86-10-84505948

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Detailed baseline information is attached in Annex 3

#### **SECTION C. Duration of the project activity / Crediting period**

##### **C.1. Duration of the project activity:**

##### **C.1.1. Starting date of the project activity:**

12/04/2010 (Date of signing Purchase Contract on Main Equipment)



**C.1.2. Expected operational lifetime of the project activity:**

15 years and 0 months

**C.2. Choice of the crediting period and related information:****C.2.1. Renewable crediting period**

Not applicable

**C.2.1.1. Starting date of the first crediting period:****C.2.1.2. Length of the first crediting period:****C.2.2. Fixed crediting period:****C.2.2.1. Starting date:**

01/09/2012 or the registration date, whichever occurs later.

**C.2.2.2. Length:**

10 years and 0 months

**SECTION D. Environmental impacts****D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

According to the relevant environmental laws and regulations, an environmental impact assessment has been carried out and approved by the Shandong Environment Protection Bureau on March 26, 2010. And the main assessment conclusions are provided below:

**1 Impact on the Air Environment Quality**

The proposed project will adopt the technology for using waste COG for cogeneration, and utilize a little diesel for start-up. The waste COG is dust removed and purified before its combustion. The main pollutants would be exhaust gas (CO<sub>2</sub>, only few CO, NO<sub>x</sub>, and unburned alkyl), far lower than the permissible vent limit. Also the waste gas will be vented through a 30m chimney, so it will not cause pollution to the ambient environment.

**2 Impact on the Water Environment**

The wastewater produced by project includes acid waste water, industrial wastewater, recycling water, boiler water and domestic wastewater. Acid waste treated, industrial wastewater, recycling water and boiler





water will be discharged into sewers. The domestic wastewater will be treated in underground integrated sewage treatment plants and be reused after treatment.

### 3 Noise Impact on the Environment

The main noise sources are dynamic power equipments (such as steam turbine, generator, coal gas compressor, fan and water pump, etc). These noises will be decreased by adopting low noise equipments, mufflers, sound insulation and, and wall surface material with good sound absorption, also the measures as appropriate layout of construction vehicle and factory will be used.

### 4 Impact of Solid Waste

Solid waste is mainly domestic waste and chemical sludge from water supply system. The domestic waste will be collected and treated by sanitation sectors. The chemical sludge will be disposed in landfill.

### 5 Impact on the Ecology

The major ecological impact of the proposed project is occupation of the land which will change the original landform and leading to partial change of ecological pattern, also the water and soil loss. But the area occupied by the project is very small which will not lead to the change on ecology system on large area. Meanwhile, the virescence will be done on the road, and the around areas etc, plant green tree with anti ability and absorption function, in order to hold water and soil, prevent wind and sand, improve the environment quality in plant area.

Furthermore, the project is located in Jining Chemical Industry Economic & Technological Development Zone, far away from residential area, and thus will impose little impact on local residents and the ecological environments.

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

According the environmental impact assessment approved by the local environmental protection bureau, the project activity belongs to clean-production and environment-protection project with less environmental impact on the surroundings. The host Party and Project participant both think that the project activity will not cause significant environment impact.

## SECTION E. Stakeholders' comments

### E.1. Brief description how comments by local stakeholders have been invited and compiled:

A special stakeholder consultation meeting on the project was organized on November 25, 2009 to collect opinions of all the potential stakeholders, such as local residents, workers and so on. The purpose of this meeting was to collect opinions concerning the influence the project would have on the local society, environment, economy, daily life etc.

According to local people's education level and survey need, an easy questionnaire including all related questions are designed and allocated to them. The structure of the respondents is shown in table E.1.





Table E.1 Structure of the respondents

	Item	Number of persons	Percentage (%)
Sex	Male	28	70%
	Female	12	30%
Age	(18 – 30)	25	63%
	(31 – 40)	8	20%
	(40 – 50)	6	15%
	>50	1	2%
Identity	Farmer	10	25%
	Worker of Shandong Jikuang Morningsun Company	15	37.5%
	Worker of other Companies in the Zone	10	25%
	Supervisors	5	12.5%

The questions asked in the questionnaires are as follows:

1. What impacts do you think the CDM Project activity will have on the atmosphere?
2. What impacts do you think the CDM Project activity will have on local ecological environment?
3. What impacts do you think the CDM Project activity will have on local people's employment opportunities?
4. What impacts do you think the CDM Project activity will have on the local economic development?
5. What impacts do you think the CDM Project activity will have on your personal life?
6. What general impacts do you think the CDM Project activity will have?
7. What is your attitude towards the construction of the CDM Project? Do you support the construction of the CDM Project?

## E.2. Summary of the comments received:

There were 40 questionnaires were distributed all were collected the feedback. The investigation results are as follows:

Question	Item	Number	Percentage(%)
1. What impacts do you think the CDM Project activity will have on the atmosphere?	Positive impact	40	100%
	Negative impact	0	0%
	No impact	0	0%
	Both positive and negative impact	0	0%
2. What impacts do you think the CDM Project activity will have on local ecological environment?	Positive impact	40	100%
	Negative impact	0	0%
	No impact	0	0%
	Both positive and negative impact	0	0%





Question	Item	Number	Percentage(%)
3. What impacts do you think the CDM Project activity will have on local people's employment opportunities?	Positive impact	40	100%
	Negative impact	0	0%
	No impact	0	0%
	Both positive and negative impact	0	0%
4. What impacts do you think the CDM Project activity will have on the local economic development?	Positive impact	40	100%
	Negative impact	0	0%
	No impact	0	0%
	Both positive and negative impact	0	0%
5. What impacts do you think the CDM Project activity will have on your personal life?	Positive impact	40	100%
	Negative impact	0	0%
	No impact	0	0%
	Both positive and negative impact	0	0%
6. What general impacts do you think the CDM Project activity will have?	Positive impact	40	100%
	Negative impact	0	0%
	No impact	0	0%
	Both positive and negative impact	0	0%
7. What is your attitude towards the construction of the CDM Project? Do you support the construction of the CDM Project?	Support	40	100%
	Object	0	0

From the questionnaires and the stakeholder consultation, we can conclude that all local stakeholders agree with the construction and operation of the project. All stakeholders support the development of the project and its application for CDM support.

The CDM project would actually facilitate the development of the local economy, increase the incomes of local residents, increase local employment opportunities and improve the available energy utilization ratio and reducing energy losses and in general protect the local environment. Therefore, it is supported by both of residents and government.

### **E.3. Report on how due account was taken of any comments received:**

As the survey about this project receive active suggestions that there is no need to take additional measures for this project.



Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

## Project owner

Organization:	Shandong Jikuang Morningsun Thermal Power Co., Ltd
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**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

There is no public fund involved in the Project.





### **Annex 3**

#### **BASELINE INFORMATION**

##### **Emission Factor of the North China Power Grid**

The displaced electricity for recipient plant is supplied by North China Grid, the CO<sub>2</sub> emission factor of the electricity  $EF_{elec,grid,y}$  shall be determined following the guidance provided in the “Tool to calculate the emission factor for an electricity system”.

The Project therefore applies the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

This PDD uses the calculations published by the DNA of P. R. China<sup>10</sup> to determine the Operating Margin (OM) emission factor and the Build Margin (BM) emission factor using the most recent data available.

The description below follows the 6 steps of the latest version of the “Tool to calculate the emission factor for an electricity system” and focuses on the key process of the calculation of the emission factors.

- Step 1. Identify the relevant electricity systems
- Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)
- Step 3. Select a method to determine the operating margin (OM)
- Step 4. Calculate OM emission factor according to the selected method
- Step 5. Calculate the build margin emission factor
- Step 6. Calculate the combined margin (CM) emission factor

##### **Step 1. Identify the relevant electric power systems**

P. R. China is divided into regional electricity systems which are defined by the DNA of P. R. China. The Project is located in Handan City, Hebei Province, which belongs to NCPG. Therefore, the relevant electric power system is identified as the NCPG.

##### **Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)**

Project participants may choose between the following two options to calculate the operating margin and the build margin emission factor:

**Option I:** Only grid power plants are included in the calculation.

**Option II:** Both grid power plants and off-grid power plants are included in the calculation.

Option I corresponds to the procedure contained in earlier versions of this tool. Option I is to be chosen in the PDD.

##### **Step 3. Select a method to determine the operating margin (OM)**

The “Tool to calculate the emission factor for an electricity system” offers four methods to calculate the OM emission factor ( $EF_{grid,OM,y}$ ):

---

<sup>10</sup> <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf>





- a) Simple OM, or
- b) Simple adjusted OM, or
- c) Dispatch data analysis OM, or
- d) Average OM.

Of these procedures, Option (a) (Simple OM) is applied. This is because low-cost / must run resources constitute less than 50% of total grid generation in average of the five most recent years. From 2005 to 2009 respectively, 0.75%, 0.84%, 0.90%, 1.21%, 2.25% of the electricity generated in the NCPG came from low-cost / must run resources.

Power plants registered as CDM project activities are included in the sample group that is used to calculate the OM as long as the criteria for including the power sources in the sample group apply.

The “Tool to calculate the emission factor for an electricity system” offers the choice between two data vintages calculate the Simple OM emission factor ( $EF_{grid,OMsimple,y}$ ):

- Ex-ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex-post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

$EF_{grid,OMsimple,y}$  is calculated ex-ante using the data from 2007 to 2009, available in the China Energy Statistics Yearbooks 2008-2010 and the China Electric Power Yearbooks 2008-2010. This data vintage remains fixed during the crediting period.

#### Step 4. Calculate OM emission factor according to the selected method

The “Tool to calculate the emission factor for an electricity system” offers three options to calculate  $EF_{grid,OMsimple,y}$ .

This simple OM may be calculated:

**Option A:** Based on data on the net electricity generation and a CO<sub>2</sub> emission factor, or

**Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:

- (a) The necessary data for Option A is not available; and
- (b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
- (c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2.2.2).

Detailed data on the individual power plants connected to the Northeast power Grid which are necessary for applying option A is not available. Since quantity of electricity supplied to the grid by nuclear and renewable power generation which is considered as low-cost/must-run power sources in the Northeast





power Grid is known, option B is used to calculate the Simple OM emission factor. Where option B is used, simple OM emission factor is calculated as:

$$EF_{\text{grid,OMsimple},y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{\text{CO}_2,i,y}}{EG_y}$$

Where:

- $EF_{\text{grid,OMsimple},y}$  = Simple operating margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)  
 $FC_{i,y}$  = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)  
 $NCV_{i,y}$  = Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit) (country-specific values are used)  
 $EF_{\text{CO}_2,i,y}$  = CO<sub>2</sub> emission factor of fossil fuel type i in year y (tCO<sub>2</sub>/GJ)  
 $EG_y$  = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)  
*i* = All fossil fuel types combusted in power sources in the project electricity system in year y  
*y* = The relevant year as per the data vintage chosen in Step 3

$EF_{\text{grid,OMsimple},y} = \mathbf{0.9803 \text{ tCO}_2/\text{MWh}}$
--

### Step 5. Calculate the build margin emission factor

In this PDD, project participants choose “Option 1” to calculate BM ex ante and there is no need to update during the crediting period.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure:

- Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ( $SET_{5\text{-units}}$ ) and determine their annual electricity generation ( $AEG_{\text{SET-5-units}}$ , in MWh);
- Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities ( $AEG_{\text{Total}}$ , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of  $AEG_{\text{Total}}$  (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ( $SET_{\geq 20\%}$ ) and determine their annual electricity generation ( $AEG_{\geq 20\%}$ , in MWh);
- From  $SET_{5\text{-units}}$  and  $SET_{\geq 20\%}$  select the set of power units that comprises the larger annual electricity generation ( $SET_{\text{sample}}$ );

Identify the data when the power units in  $SET_{\text{sample}}$  started to supply electricity to the grid. If none of the power units in  $SET_{\text{sample}}$  started to supply electricity to the grid more than 10 years ago, then use  $SET_{\text{sample}}$  to calculate the build margin.

According to the “Tool to calculate the emission factor for an electricity system”,  $EF_{\text{grid,BM},y}$  is the generation-weighted average emission factor of all power units *m* during the most recent year *y* for which power generation data is available. However, due to the fact that data on both electricity generation and emission factor of each power plant / unit in the grid is currently not available in P. R. China (see Step 4), EB guidance on the estimation of the build margin in P.R. China can also be applied for the purpose of estimating the BM emission factor and  $EF_{\text{grid,BM},y}$  is calculated as follows:





$$EF_{\text{grid,BM},y} = \frac{\sum_m EG_{m,y} \times EF_{\text{EL},m,y}}{\sum_m EG_{m,y}}$$

Where:

$EG_{m,y}$  Net quantity of electricity, namely delivered to the grid by power unit  $m$  in year  $y$  (MWh)

$EF_{\text{BL},m,y}$   $\text{CO}_2$  emission factor of power unit  $m$  in year  $y$  ( $\text{tCO}_2/\text{MWh}$ )

The option A2 of the step 4(a) in the method “Tool to calculate the emission factor for an electricity system” (Version 02.2.1) is used to calculate  $\text{CO}_2$  emission factor of the generating plant  $m$  as follows:

$$EF_{\text{EL},m,y} = \frac{EF_{\text{CO}_2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{\text{EL},m,y}$   $\text{CO}_2$  emission factor of power unit  $m$  in year  $y$  ( $\text{tCO}_2/\text{MWh}$ )

$EF_{\text{CO}_2,m,i,y}$   $\text{CO}_2$  emission factor of fuel  $i$  in power unit  $m$  in year  $y$  ( $\text{tCO}_2/\text{MWh}$ )

$\eta_{m,y}$  Power supply efficiency of generating plant  $m$  in year  $y$  (%)

$EF_{\text{Thermal,Adv}}$  is calculated as follows:

$$EF_{\text{Thermal,Adv},y} = \lambda_{\text{Coal},y} \times EF_{\text{Coal,Adv},y} + \lambda_{\text{Oil},y} \times EF_{\text{Oil,Adv},y} + \lambda_{\text{Gas},y} \times EF_{\text{Gas,Adv},y}$$

Where:

$EF_{i,\text{Adv}}$  = The  $\text{CO}_2$  emission factor of fuel  $i$  ( $\text{tCO}_2/\text{MWh}$ ) using the best commercially available technology in P. R. China and taking into account the carbon content and the oxidation factor of fuel  $i$

Coal, Oil and Gas = Solid fuel, liquid fuel and gaseous fuel respectively

$\lambda_i$  = The weight of  $\text{CO}_2$  emissions from fuel  $i$  fired power plants in the total  $\text{CO}_2$  emissions from thermal power, using the most recent available data

And

$$\lambda_{\text{Coal},y} = \frac{\sum_{i,j} F_{i,j,y} \times \text{NCV}_{i,y} \times EF_{\text{CO}_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times \text{NCV}_{i,y} \times EF_{\text{CO}_2,i,j,y}}$$

$$\lambda_{\text{Oil},y} = \frac{\sum_{i,j} F_{i,j,y} \times \text{NCV}_{i,y} \times EF_{\text{CO}_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times \text{NCV}_{i,y} \times EF_{\text{CO}_2,i,j,y}}$$

$$\lambda_{\text{Gas},y} = \frac{\sum_{i,j} F_{i,j,y} \times \text{NCV}_{i,y} \times EF_{\text{CO}_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times \text{NCV}_{i,y} \times EF_{\text{CO}_2,i,j,y}}$$

Where:





$FC_{i,m,y}$ :	Consumption of fuel i for province j in year y (mass or volume unit)
$NCV_{i,y}$ :	Net calorific value (energy content) of fossil fuel type i in year y (GJ/t for solid and liquid fuel and GJ/m <sup>3</sup> for gas fuel)
$EF_{CO_2,i,j,y}$ :	CO <sub>2</sub> emission factor of fuel i in years y (tCO <sub>2</sub> /GJ)
Coal, Oil and Gas:	Subscripts of solid fuel, liquid fuel and gas fuel separately

$$EF_{grid,BM,y} = 0.6426 \text{ tCO}_2/\text{MWh}$$

### Step 6. Calculate the combined margin emission factor

The combined margin (CM) emissions factor ( $EF_{grid,CM,y}$ ) is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,CM,y}$	=	Combined margin CO <sub>2</sub> emissions factor in year y (tCO <sub>2</sub> /MWh)
$EF_{grid,BM,y}$	=	Build margin CO <sub>2</sub> emission factor in year y (tCO <sub>2</sub> /MWh)
$EF_{grid,OM,y}$	=	Operating margin CO <sub>2</sub> emission factor in year y (tCO <sub>2</sub> /MWh)
$w_{OM}$	=	Weighting of operating margin emissions factor, which is 0.5 by default
$w_{BM}$	=	Weighting of build margin emissions factor, which is 0.5 by default

$$EF_{grid,CM,y} = 0.5 \times 0.9803 + 0.5 \times 0.6426 = 0.81145 \text{ tCO}_2/\text{MWh}$$



**Table 1. Annual electricity generation of North China Power Grid 2005-2009**

	2005	2006	2007	2008	2009
Thermal power (GWh)	603,231	718,900	838,100	867,900	700,660
Hydro power and Other (GWh)	4,551	6,100	7,640	10,600	16,149
Total generation (GWh)	607,782	725,000	845,700	878,500	716,809
Proportion of low cost and must run resources. %	0.75%	0.84%	0.90%	1.21%	2.25%

*Data source: China Electric Power Yearbook 2006-2010*

**Table 2. The electricity exchange between electricity grids in 2007**

	MWh
Net electricity importation from North East China Power Grid to North China Power Grid	1,789,750
Net electricity importation from Central China Power Grid to North China Power Grid	803,000
Net electricity importation from Central China Power Grid to East China Power Grid	31,823,310
Net electricity importation from Yangcheng Power Grid to Jiangsu Power Grid	12,773,620
Net electricity imports from Central China Power Grid to China Southern Power Grid	24,237,240
Net electricity imports from Northwest China Power Grid to Central China Power Grid	3,005,400

*Data sources: Electric Power Industry Summary Statistics, 2007*

**Table 3. The electricity exchange between electricity grids in 2008**

	MWh
Net electricity importation from North East China Power Grid to North China Power Grid	5,286,140
Net electricity importation from Central China Power Grid to North China Power Grid	33,200
Net electricity importation from Central China Power Grid to East China Power Grid	35,684,610
Net electricity importation from Yangcheng Power Grid to Jiangsu Power Grid	16,903,640
Net electricity imports from Central China Power Grid to China Southern Power Grid	22,342,090
Net electricity imports from Northwest China Power Grid to Central China Power Grid	3,144,070





*Data sources: Electric Power Industry Summary Statistics, 2008*

**Table 4. The electricity exchange between electricity grids in 2009**

	MWh
Net electricity importation from North East China Power Grid to North China Power Grid	6,982,610
Net electricity importation from North China Power Grid to Central China Power Grid	2,233,290
Net electricity importation from Central China Power Grid to East China Power Grid	36,599,120
Net electricity importation from Yangcheng Grid to Jiangsu Grid	16,626,120
Net power importation from Central China Power Grid to China Southern Power Grid	21,852,270
Net power importation from Northwest China Power Grid to Central China Power Grid	3,262,010

*Data sources: Electric Power Industry Summary Statistics, 2009*





Table 5. Calculation of OM of North China Power Grid (2007)

Fuel types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Carbon content	Oxidation rate	Emissions factor	Net calorific value	CO <sub>2</sub> emissions (tCO <sub>2</sub> e)
									(tC/TJ)	(%)	(kgCO <sub>2</sub> /TJ)	(MJ/t, km <sup>3</sup> )	$L=G \times J \times K / 100000$ (mass unit)
		A	B	C	D	E	F	$G=A+B+C+D+E+F$	H	I	J	K	$L=G \times J \times K / 10000$ (volume unit)
Raw Coal	10 <sup>4</sup> t	816.17	1753.99	7716.13	7510.06	10434.25	11884.83	<b>40115.43</b>	25.8	100	87,300	20,908	732,214,267
Cleaned Coal	10 <sup>4</sup> t						18.43	<b>18.43</b>	25.8	100	87,300	26,344	423,859
Other Washed Coal	10 <sup>4</sup> t	5.76		156.89	478.81	48.57	756.84	<b>1446.87</b>	25.8	100	87,300	8,363	10,563,452
Coke	10 <sup>4</sup> t	7.93					42.86	<b>50.79</b>	26.6	100	87,300	20,908	927,054
Coke Oven Gas	10 <sup>8</sup> m <sup>3</sup>			0.02			4.09	<b>4.11</b>	29.2	100	95,700	28,435	111,843
Other Coal Gas	10 <sup>8</sup> m <sup>3</sup>	0.07	0.72	3.13	25.46	2.58	13.61	<b>45.57</b>	12.1	100	37,300	16,726	2,843,020
Crude Oil	10 <sup>4</sup> t	11.8	7.6	88.38	72.8	28.17	29.64	<b>238.39</b>	12.1	100	37,300	5,227	4,647,821
Gasoline	10 <sup>4</sup> t							<b>0</b>	20	100	71,100	41,816	0
Diesel	10 <sup>4</sup> t			0.01				<b>0.01</b>	18.9	100	67,500	43,070	291
Fuel Oil	10 <sup>4</sup> t	0.33		2.35		0.62	5.08	<b>8.38</b>	20.2	100	72,600	42,652	259,490
LPG	10 <sup>4</sup> t	4.74		0.18			2.35	<b>7.27</b>	21.1	100	75,500	41,816	229,522
Refinery Gas	10 <sup>4</sup> t							<b>0</b>	17.2	100	61,600	50,179	0
Natural Gas	10 <sup>8</sup> m <sup>3</sup>	0.06		2.85			1.65	<b>4.56</b>	15.7	100	48,200	46,055	101,225
Other Petroleum Products	10 <sup>4</sup> t	5.03	0.73		0.54	4.22	0.01	<b>10.53</b>	15.3	100	54,300	38,931	2,225,993
Other Coking Products	10 <sup>4</sup> t	1.72						<b>1.72</b>	20	100	72,200	41,816	51,929
Other Energy	10 <sup>4</sup> tce	4.74						<b>4.74</b>	25.8	100	95,700	28,435	128,986
Raw Coal	10 <sup>4</sup> t	11.94		77.25	360.26	30.75	163.48	<b>643.68</b>	0	0	0	0	0
												<b>Total</b>	<b>754,728,750</b>

Data sources: China Energy Statistical Yearbook 2008





Table 6. Calculation of OM of North China Power Grid (2008)

Fuel types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Carbon content	Oxidation rate	Emissions factor	Net calorific value	CO <sub>2</sub> emissions (tCO <sub>2</sub> e)
									(tC/TJ)	(%)	(kgCO <sub>2</sub> /TJ)	(MJ/t, km <sup>3</sup> )	$L=G \times J \times K / 100000$ (mass unit)
		A	B	C	D	E	F	$G=A+B+C+D+E+F$	H	I	J	K	$L=G \times J \times K / 10000$ (volume unit)
Raw Coal	10 <sup>4</sup> t	755.75	1800.12	7353.33	7854.39	12607.82	12360.75	<b>42732.16</b>	25.8	100	87,300	20,908	779,976,613
Cleaned Coal	10 <sup>4</sup> t						23.88	<b>23.88</b>	25.8	100	87,300	26,344	549,200
Other Washed Coal	10 <sup>4</sup> t	5.05		134.52	582.39	66.2	691.21	<b>1479.37</b>	25.8	100	87,300	8,363	10,800,731
Coal Briquettes	10 <sup>4</sup> t	5.66			32.49		45.38	<b>83.53</b>					1,524,647
Coke	10 <sup>4</sup> t			0.02			6.07	<b>6.09</b>	29.2	100	95,700	28,435	165,723
Coke Oven Gas	10 <sup>8</sup> m <sup>3</sup>	0.11	0.86	8.37	24.55	3.55	16.2	<b>53.64</b>	12.1	100	37,300	16,726	3,346,491
Other Coal Gas	10 <sup>8</sup> m <sup>3</sup>	10.4	9.08	187.54	36	34.32	29.76	<b>307.1</b>	12.1	100	37,300	5,227	5,987,440
Crude Oil	10 <sup>4</sup> t					0.02		<b>0.02</b>	20	100	71,100	41,816	595
Gasoline	10 <sup>4</sup> t							<b>0</b>	18.9	100	67,500	43,070	0
Diesel	10 <sup>4</sup> t	0.15		3.08		0.35		<b>3.58</b>	20.2	100	72,600	42,652	110,856
Fuel Oil	10 <sup>4</sup> t	2.56		0.25				<b>2.81</b>	21.1	100	75,500	41,816	88,715
LPG	10 <sup>4</sup> t							<b>0</b>	17.2	100	61,600	50,179	0
Refinery Gas	10 <sup>4</sup> t	0.44		2.93				<b>3.37</b>	15.7	100	48,200	46,055	74,809
Natural Gas	10 <sup>8</sup> m <sup>3</sup>	11.09	0.7		0.97	2.12		<b>14.88</b>	15.3	100	54,300	38,931	3,145,563
Other Petroleum Products	10 <sup>4</sup> t	1.45						<b>1.45</b>	20	100	75,500	41,816	43,777
Other Coking Products	10 <sup>4</sup> t	7.97		7.61				<b>15.58</b>	25.8	100	95,700	28,435	423,968
Other Energy	10 <sup>4</sup> tce	4.9	2.34	61.02	466	63.72	141.71	<b>739.69</b>	0	0	0	0	0
												<b>Total</b>	806,239,126

Data sources: China Energy Statistical Yearbook 2009





Table 7. Calculation of OM of North China Power Grid (2009)

Fuel types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Carbon content	Oxidation rate	Emissions factor	Net calorific value	CO <sub>2</sub> emissions (tCO <sub>2</sub> e)
									(tC/TJ)	(%)	(kgCO <sub>2</sub> /TJ)	(MJ/t, km <sup>3</sup> )	$L=G \times J \times K / 100000$ (mass unit)
		A	B	C	D	E	F	$G=A+B+C+D+E+F$	H	I	J	K	$L=G \times J \times K / 10000$ (volume unit)
Raw Coal	10 <sup>4</sup> t				7623.9								
		665.16	1870.36	4	8024.02	12538.57	12654.05	<b>43376.1</b>	25.8	100	87,300	20,908	791,730,246
Cleaned Coal	10 <sup>4</sup> t						11.7	<b>11.7</b>	25.8	100	87,300	26,344	269,080
Other Washed Coal	10 <sup>4</sup> t												
		6.15			247.51	586.04	104.69	<b>1806.41</b>	25.8	100	87,300	8,363	13,188,417
Coal Briquettes	10 <sup>4</sup> t	3.73						<b>35.56</b>	26.6	100	87,300	20,908	649,065
Coke	10 <sup>4</sup> t							<b>10.43</b>	29.2	100	95,700	28,435	283,824
Coke Oven Gas	10 <sup>8</sup> m <sup>3</sup>	0.13	1.27	8.72	19.48	3.35	11.69	<b>44.64</b>	12.1	100	37,300	16,726	2,784,999
Other Coal Gas	10 <sup>8</sup> m <sup>3</sup>	10.23	13.43	228.32	35.89	48.35	37.21	<b>373.43</b>	12.1	100	37,300	5,227	7,280,656
Crude Oil	10 <sup>4</sup> t					0.13		<b>0.13</b>	20	100	71,100	41,816	3,865
Gasoline	10 <sup>4</sup> t						0.01	<b>0.01</b>	18.9	100	67,500	43,070	291
Diesel	10 <sup>4</sup> t	0.1		2.38		2.64	3.07	<b>8.19</b>	20.2	100	72,600	42,652	253,606
Fuel Oil	10 <sup>4</sup> t	0.82		0.19		0.02	2.63	<b>3.66</b>	21.1	100	75,500	41,816	115,550
LPG	10 <sup>4</sup> t							<b>0</b>	17.2	100	61,600	50,179	0
Refinery Gas	10 <sup>4</sup> t	0.83		3.95			3.44	<b>8.22</b>	15.7	100	48,200	46,055	182,472
Natural Gas	10 <sup>8</sup> m <sup>3</sup>	13.55	0.63		4.39	2.03	0.03	<b>20.63</b>	15.3	100	54,300	38,931	4,361,086
Other Petroleum Products	10 <sup>4</sup> t		1.52				23.18	<b>24.7</b>	20	100	72,200	41,816	745,721
Other Coking Products	10 <sup>4</sup> t	6.62		7.79			5.52	<b>19.93</b>	25.8	100	95,700	28,435	542,341
Other Energy	10 <sup>4</sup> tce		2.11	62.14	570.3	90.63	137.68	<b>862.86</b>	0	0	0	0	0
												Total	822,391,221

Data sources: China Energy Statistical Yearbook 2010



**Table 8. Thermal power generation of North China Power Grid (2007)**

Province	Generation (10 <sup>8</sup> kWh)	Generation (MWh)	Rate of electricity used by factory (%)	Power Supply (MWh)		
Beijing	223	22,300,000	7.51	20,625,270	Net electricity importation from NECPG (MWh)	1,789,750
Tianjin	399	39,900,000	6.53	37,294,530	Net electricity importation from CCPG (MWh)	803,000
Hebei	1633	163,300,000	6.67	152,407,890	Simple OM of NECPG	1.08186
Shanxi	1734	173,400,000	7.99	159,545,340	Simple OM of CCPG	1.10197
Inner Mongolia	1801	180,100,000	7.77	166,106,230	Total power supply (MWh)	778,939,080
Shandong	2591	259,100,000	7.23	240,367,070	Total emissions (tCO <sub>2</sub> )	757,552,268
Total		838,100,000		776,346,330	<b>Emission factor in 2007</b>	<b>0.97254</b>

*Data sources: China Electric Power Yearbook 2008***Table 9. Thermal power generation of North China Power Grid (2008)**

Province	Generation (10 <sup>8</sup> kWh)	Generation (MWh)	Rate of electricity used by factory (%)	Power Supply (MWh)		
Beijing	243	24,300,000	7.14	22,564,980	Net electricity importation from NECPG (MWh)	5,286,140
Tianjin	397	39,700,000	7.05	36,901,150	Simple OM of NECPG	1.10489
Hebei	1580	158,000,000	6.9	147,098,000		
Shanxi	1762	176,200,000	8.22	161,716,360		
Inner Mongolia	2008	200,800,000	7.96	184,816,320	Total power supply (MWh)	808,083,490
Shandong	2689	268,900,000	7.14	249,700,540	Total emissions (tCO <sub>2</sub> )	812,079,707
Total		867,900,000		802,797,350	<b>Emission factor in 2008</b>	<b>1.00495</b>

*Data sources: China Electric Power Yearbook 2009*



**Table 10. Thermal power generation of North China Power Grid (2009)**

Province	Generation (10 <sup>8</sup> kWh)	Generation (MWh)	Rate of electricity used by factory (%)	Power Supply (MWh)		
Beijing	241	24,100,000	6.55	22,521,450	Net electricity importation from NECPG (MWh)	6,982,610
Tianjin	413	41,300,000	6.8	38,491,600		
Hebei	1733	173,300,000	6.92	161,307,640	Simple OM of NECPG	1.06915
Shanxi	1850	185,000,000	8.1	170,015,000		
Inner Mongolia	2135	213,500,000	7.82	196,804,300	Total power supply (MWh)	860,687,660
Shandong	2858	285,800,000	7.43	264,565,060	Total emissions (tCO <sub>2</sub> )	829,856,644
Total		923,000,000		853,705,050	<b>Emission factor in 2009</b>	<b>0.96418</b>

*Data sources: China Energy Statistical Yearbook 2007, China Electric Power Yearbook 2010*

**Table 11. The simple OM emission factor for NCPG of the last three years**

Year	2007	2008	2009
Total CO <sub>2</sub> emissions	757,552,268	812,079,707	829,856,644
Total generation	778,939,080	808,083,490	860,687,660
OM emission factors weighted average	0.9803		





Table 12. NCV, Oxidation rate and the potential emission factors of every fuel

Fuel types	NCV (MJ/t,km <sup>3</sup> ) H	The lower limit of 95% confidential level of CO <sub>2</sub> EF of IPCC fuel (kgCO <sub>2</sub> /TJ) I	Oxidation rate (%) J	Carbon content (tC/TJ)
Raw coal	20908 kJ/kg	87,300	100	25.8
Cleaned coal	26344 kJ/kg	87,300	100	25.8
Other washed coal <sup>11</sup>	8363 kJ/kg	87,300	100	25.8
Coal Briquettes	20908 kJ/kg	87,300	100	26.6
Coke	28435 kJ/kg	95,700	100	29.2
Crude oil	41816 kJ/kg	71,100	100	20
Gasoline	43070 kJ/kg	67,500	100	18.9
Diesel	42652 kJ/kg	72,600	100	20.2
Fuel oil	41816 kJ/kg	75,500	100	21.1
Other oil products	38369 kJ/kg	72,200	100	20
Other Coke Products	28435 kJ/kg	95,700	100	25.8
Natural gas	38931 kJ/m <sup>3</sup>	54,300	100	15.3
Coke oven gas <sup>12</sup>	16726 kJ/m <sup>3</sup>	37,300	100	12.1
Other coal gas <sup>13</sup>	5227 kJ/m <sup>3</sup>	37,300	100	12.1
LPG	50179 kJ/kg	61,600	100	17.2
Refinery gas	46055 kJ/kg	48,200	100	15.7
Other energy	0	0	0	0

Data sources: NCV is from "China Energy Statistical Yearbook" 2010. The potential emission factors are from table 1.3 and 1.4 in Page 1.21-1.24, the first Chapter of Volume II in "2006 IPCC Guidelines for National Greenhouse Gas Inventories"

<sup>11</sup>Calculate with the NCV of washed coal in p283 of *China Energy Statistical Yearbook 2008*, the NCV of coal slurry is lower than washed coal, so this is conservative.

<sup>12</sup>Calculate with the lower value of NCV range 16,726-17,981 kJ/m<sup>3</sup> of coke oven gas in p283 of *China Energy Statistical Yearbook 2008*.

<sup>13</sup>Calculate with the lowest value of NCV of furnace gas, heavy oil catalytic pyrolysis gas, heavy oil hot pyrolysis gas, pressure gasification gas and water gas in p283 of *China Energy Statistical Yearbook 2008*.



Table13. CO<sub>2</sub> emissions proportion of solid, liquid and gas fuel in total emissions in electricity generation calculation

		Beijing	Tianjin	Hebei	Shanxi	Shandong	Inner Mongolia	Subtotal	NCV	Emission factor	Oxidation rate	Emissions
Fuel type	Unit	A	B	C	D	E	F	G=A+...+F	H	I	J	K=G×H×I×J/100,000
Raw coal	10 <sup>4</sup> t	665.16	1,870.36	7,623.94	8,024.02	12,654.05	12,538.57	43,376.10	20,908	87,300	1	791,730,246
Cleaned coal	10 <sup>4</sup> t	0	0	0	0	11.7	0	11.70	26,344	87,300	1	269,080
Other washed coal	10 <sup>4</sup> t	6.15	0	247.51	586.04	862.02	104.69	1,806.41	8,363	87,300	1	13,188,417
Coal Briquettes	10 <sup>4</sup> t	3.73	0	0	0	31.83	0	35.56	20,908	87,300	1	649,065
Coke	10 <sup>4</sup> t	0	0	0	0	10.43	0	10.43	28,435	95,700	1	283,824
Other Coke Products	10 <sup>4</sup> t	6.62	0	7.79	0	5.52	0	19.93	28,435	95,700	1	542,341
<b>Total</b>								0.00				806,662,974
Crude oil	10 <sup>4</sup> t	0	0	0	0	0	0.13	0.13	41,816	71,100	1	3,865
Gasoline	10 <sup>4</sup> t	0	0	0	0	0.01	0	0.01	43,070	67,500	1	291
Diesel	10 <sup>4</sup> t	0.1	0	2.38	0	3.07	2.64	8.19	42,652	72,600	1	253,606
Fuel oil	10 <sup>4</sup> t	0.82	0	0.19	0	2.63	0.02	3.66	41,816	75,500	1	115,550
Other oil products	10 <sup>4</sup> t	1.52	0	0	0	23.18	0	24.7	41,816	72,200	1	745,721
<b>Total</b>								0				1,119,034
Natural gas	10 <sup>4</sup> km <sup>3</sup>	135.5	6.3	0	43.9	0.3	20.3	206.3	38,931	54,300	1	4,361,086
Coke oven gas	10 <sup>4</sup> km <sup>3</sup>	1.3	12.7	87.2	194.8	116.9	33.5	446.4	16,726	37,300	1	2,784,999
Other coal gas	10 <sup>4</sup> km <sup>3</sup>	102.3	134.3	2283.2	358.9	372.1	483.5	3734.3	5,227	37,300	1	7,280,656
LPG	10 <sup>4</sup> t	0	0	0	0	0	0	0	50,179	61,600	1	0
Refinery gas	10 <sup>4</sup> t	0.83	0	3.95	0	3.44	0	8.22	46,055	48,200	1	182,472
<b>Total</b>												14,609,213
<b>Sum total</b>												822,391,221

Data sources: China Energy Statistical Yearbook 2010

According to the table and formula in the PDD,  $\lambda_{\text{Coal},y} = 98.08\%$ ,  $\lambda_{\text{Oil},y} = 0.14\%$ ,  $\lambda_{\text{Gas},y} = 1.78\%$ .



Table 14. CO<sub>2</sub> emission factor of Coal-fired, Oil-fired and Gas-fired power

	Variable	Efficiency of power supply (%)	Emission factor of fuel (kgCO <sub>2</sub> /TJ)	Oxidation rate	Emission factor (tCO <sub>2</sub> /MWh)
		A	B	C	D=3.6/A/1,000,000×B×C
Coal-fired power plant	EF <sub>Coal,Adv,y</sub>	39.45	87,300	1	0.7967
Oil-fired power plant	EF <sub>Oil,Adv,y</sub>	51.77	75,500	1	0.5250
Gas-fired power plant	EF <sub>Gas,Adv,y</sub>	51.77	54,300	1	0.37976

Calculate the emission factor of thermal power:

$$EF_{\text{Thermal},y} = \lambda_{\text{Coal},y} \times EF_{\text{Coal,Adv},y} + \lambda_{\text{Oil},y} \times EF_{\text{Oil,Adv},y} + \lambda_{\text{Gas},y} \times EF_{\text{Gas,Adv},y}$$

= 0.7889 tCO<sub>2</sub>/MWh



**Table 15. Installed capacity of the North China Power Grid in 2009**

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Fire power	MW	5,120	10,030	35,140	39,150	48,300	58,860	196,600
Hydro power	MW	1,050	10	1,790	1,610	830	1,060	6,350
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and other	MW	50	0	1,360	120	6,420	860	8,810
Total	MW	6,220	10,040	38,290	40,880	55,550	60,780	211,760

Data sources: China Electric Power Yearbook 2010

**Table 16. Installed capacity of the North China Power Grid in 2008**

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Fire power	MW	4,760	7,490	29,870	35,250	45,740	55,930	179,040
Hydro power	MW	1,050	0	1,540	790	830	1,050	5,260
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and other	MW	0	0	700	0	2,300	370	3,370
Total	MW	5,810	7,490	32,110	36,040	36,040	57,350	187,660

Data sources: China Electric Power Yearbook 2009

**Table 17. Installed capacity of the North China Power Grid in 2007**

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Fire power	MW	3,900	6,920	29,020	30,950	39,870	54,140	164,800
Hydro power	MW	1050	10	780	790	830	1,050	4,510
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and other	MW	2.7	0	410	0	1,096.5	210	1,719.2
Total	MW	4,952.7	6,930	30,210	31,740	41,796.5	55,400	171,029.2

Data sources: China Electric Power Yearbook 2008





Table 18. BM calculation of NCPG

	Installed capacity 2007	Installed capacity 2008	Installed capacity 2009	New added installed capacity 2007-2009	New added installed capacity 2008-2009	The fraction of newly added installed capacity
	B	C	C	D	E	F
Fire power	164,800	179,040	196,600	39,270	21,422	81.46%
Hydro power	4,510	5,260	6,350	1,849	1,090	3.84%
Nuclear power	0	0	0	0	0	0.00%
Wind power	1,719.2	3,370	8,810	7,091	5,440	14.71%
Total	<b>171,029.2</b>	<b>187,660</b>	<b>211,760</b>	<b>48,210</b>	<b>27,952</b>	<b>100.00%</b>
The fraction of installed capacity 2008				22.77%	13.20%	

$$EF_{\text{grid,BM},y} = 0.7889 \times 81.46\% = 0.6426 \text{ tCO}_2/\text{MWh}$$





**Annex 4**

**MONITORING INFORMATION**

Please refer to Section B.7.2

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