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: 01
Date: 01/12/2011

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 Town, Jining City, Shandong Province, China.

Scenario prior to the project:

- Shandong 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.
- The electricity consumed by the facilities in Jining Chemical Industry Economic & Technological Development Zone is supplied from the North China Power Grid (NCPG).
- The steam consumption by the consumers should 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 JikuangMorningsun Thermal Power Co., Ltd will recover the waste COG from Shandong Morningsun Coal Chem. Ltd about 158,604,000 Nm^3 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 24,000 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 242,242 tCO_2e 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 in indicated using the following tabular format.

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

Both of the project participants are private entities.

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 Ining 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:

The project is to install a combined–cycle power plant (CCPP), mainly consists of two coke oven gas compressors, two gas turbine generators, two complementary combustion heat recovery steam boilers (HRSB), and one set of steam turbine generators. 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, and then compressed by COG compressor in the gas turbine burning chamber before being delivered into gas turbine generator to generate electricity. The hot exhaust from the gas turbine would be captured by the HRSB to generate high pressure steam. Supplementary COG would be fired in the boilers to meet the requirement for the steam generation.

Then the high pressure steam would spin the steam turbine generator to produce electricity. The extraction steam from the steam turbine can meet the heat demand of the steam customers in Ining Chemical Industry Economic & Technological Development 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.4.1

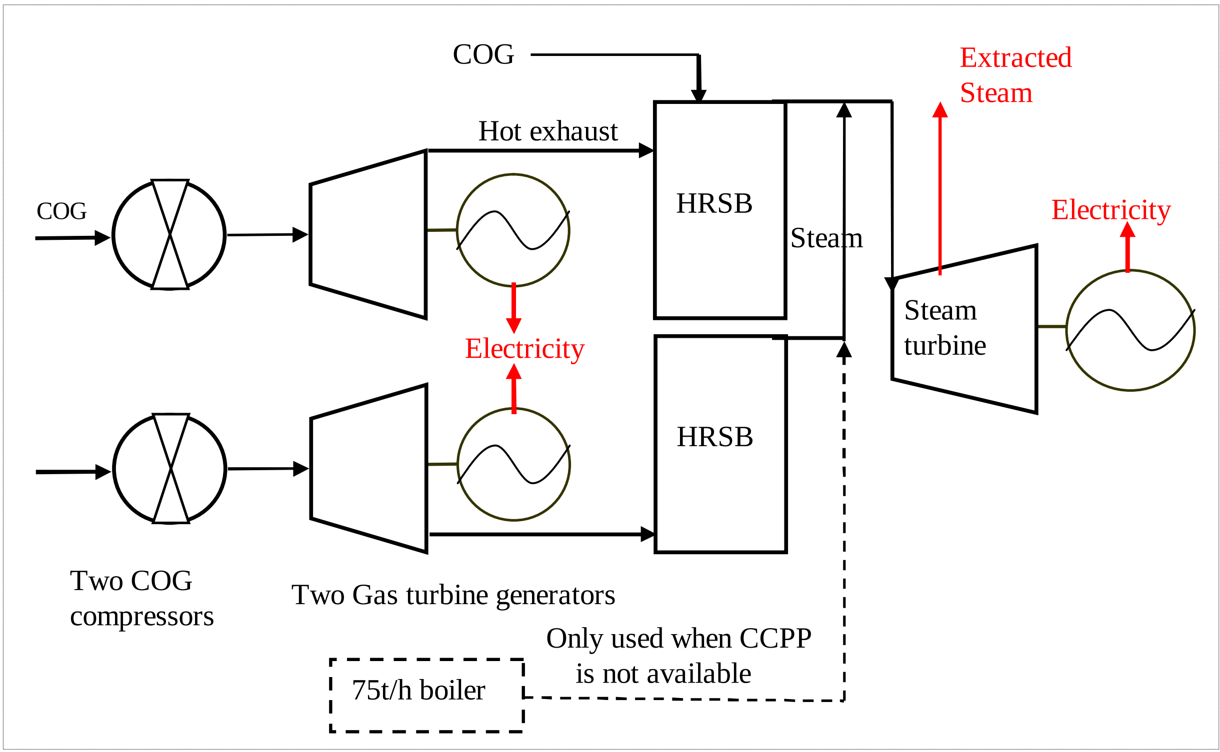

Figure A.4.2 Technology flow diagram of CCPP

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

Gas Turbine Generator		
Parameters	Value	Source

Type	TITAN 130-20501	FSR
Producer	SOLAR TURBINES INTERNATIONAL COMPANY	Purchase contract
Fuel type	Coke oven gas / Diesel	FSR
Units	2	FSR
Rated output	15,000kW	FSR
Frequency	50Hz	FSR
Voltage	10kV	FSR
Exhaust temperature	499℃	FSR
Lifetime	15 years	Purchase contract
Operational hours per year	6,000	FSR
COG Compressor		
Parameters	Value	Source
Type	4M32-189/0.025-2-63.8/2-27	FSR
Producer	SHENYANG YUANDA COMPRESSOR MANUFACTURING	Purchase contract
Units	2	FSR
Inlet pressure	3,000KPa（G）	FSR
Outlet pressure	2.4MPa	FSR
Outlet temperature	55-60℃	FSR
Rated capacity	1,650KW	FSR
Lifetime	15 years	Purchase contract
Operational hours per year	6,000	FSR
Complementary combustion heat recovery steam boilers (HRSB)		
Parameters	Value	Source
Type	BQ136.2/500	FSR
Units	2	FSR
Producer	Nanjing Nanguo Power	Purchase contract
Feed water temperature	150 ℃	FSR
Medium pressure steam Pressure	3.82 MPa（G）	FSR
Medium pressure steam Evaporation	45t/h	FSR
Medium pressure steam Temperature	450 ℃	FSR
Lifetime	15 years	Purchase contract
Operational hours per year	6,000	FSR
Steam Turbine Generator		
Parameters	Value	Source
Type	C12-3.43/1.27	FSR
Producer	QINGDAO JIENENG GROUP	Purchase contract
Units	1	FSR
Rated power	12MW	FSR

Rated input steam flow	93t/h	FSR
Rated input steam pressure	3.43 MPa（A）	FSR
Rated input steam temperature	435 ℃	FSR
Extraction steam pressure	1.27MPa（A）	FSR
Extraction steam Temperature	332℃	FSR
Steam extraction capacity	0～40t/h	FSR
Lifetime	15 years	Purchase contract
Operational hours per year	6,000	FSR
Circulating Fluidized Bed Boiler		
Type	UG-75/3.82-M41	Equipment specification
Producer	WUXI HUAGUANG BOILER CO.,LTD.	Purchase contract
Fuel type	COG or Coal	FSR
Units	1	FSR
Steam pressure	3.82MPa	FSR
Steam capacity	75t/h	FSR
Steam temperature	450℃	FSR
Lifetime	15 years	Purchase contract
Operational hours per year	Only be 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 coke production

Item	Unit	Value	Data source
Annual coke production	t/a	800,000	Energy balance
Waste COG	10^3m^3	177,552	Energy balance
Lifetime	Years	25	Manufacture's specification

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

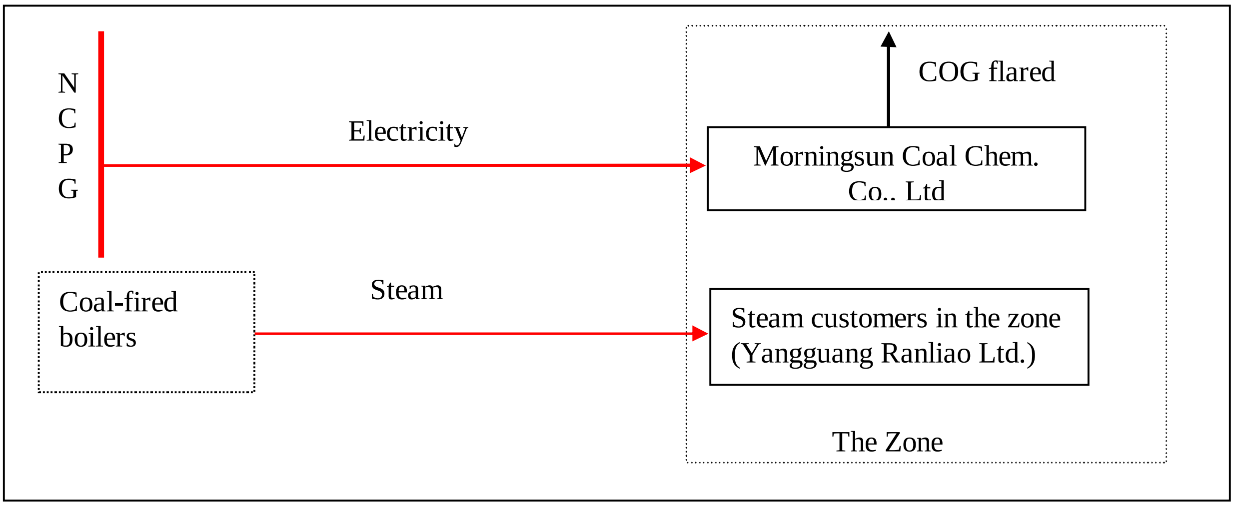

Figure A.4.3 General Process in the baseline

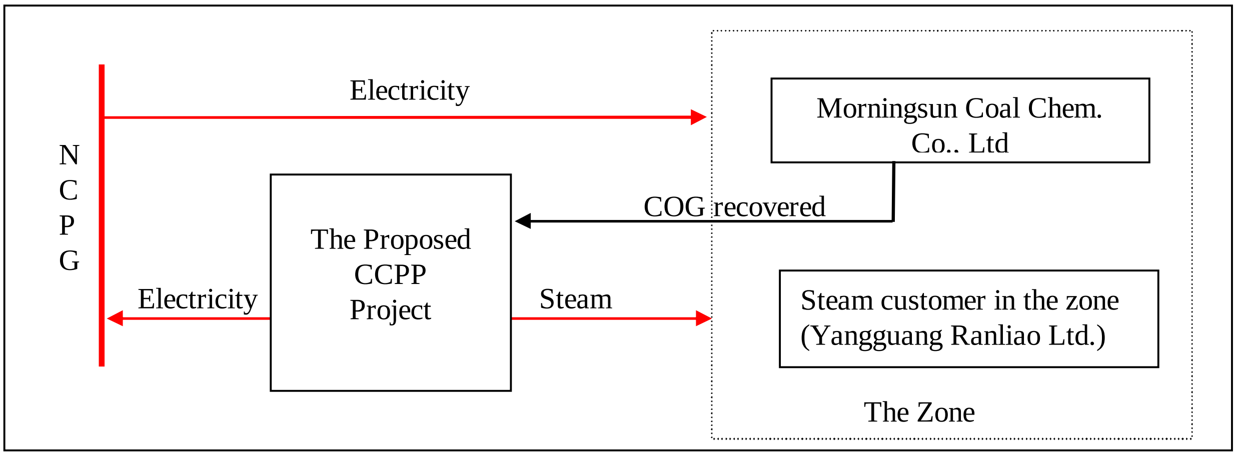

Figure A.4.4 General process after the implementation of the project

Technology transfer

The proposed project involves technology transfers and promotes the introduction and diffusion of efficient technology in China. The gas turbine and gas generator units are imported from SOLAR TURBINES INTERNATIONAL COMPANY.

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 Jun. 1, 2012 to May 31, 2022) is presented in Table A.4. 2. Estimated emission reductions during the crediting period are 2,422,420tCO2e.

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

year	**Annual estimation of emission reductions in tones of CO_2e**
01/06/2012-31/12/2012	121,121
2013	242,242
2014	242,242

2015	242,242
2016	242,242
2017	242,242
2018	242,242
2019	242,242
2020	242,242
2021	242,242
01/01/2022-31/05/2022	121,121
Total estimated reductions(tones of CO_2e)	2,422,420
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2e)	242,242

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 to calculate project or leakage CO2 emissions from fossil fuel combustion(version02), "Tool to calculate the emission factor for an electricity system (version 02.2.1)" , "Tool to determine the baseline efficiency of thermal or electric energy generation systems(version01)" , "Tool to determine the remaining lifetime of equipment (version01)", and "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion".

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:	The proposed project is implemented at an existing facility, and will use waste gas for cogeneration.	Applicable

n Generation of electricity; n Cogeneration; n Direct use as process heat source; n Generation of heat in element process; n Generation of mechanical energy; or n Supply of heat of reaction with or without process heating.		
In the absence of the project activity, the WECM stream: (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 (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.	In the absence of the project activity, the waste gas is not recovered and is flared into atmosphere.	Applicable
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".	The proposed project is not to improve the WECM recovery.	N/A
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;	The project is not to recover waste pressure,	N/ A
Regulations do not require the project facility to recover and/or utilize the waste energy prior to the implementation of the project activity	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	Applicable
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;	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.	Applicable
Waste energy that is released under abnormal operation (for example, emergencies, shut down) of the project facility shall not be included in the	Under abnormal operation, the waste COG will be flared and vented to the atmosphere just as the baseline	Applicable

emission reduction calculations.	scenario. And the time span will be recorded. These 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 **not** 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 **not** 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 proposed project applies Annex 2 guidelines to prove the extent of use of waste energy in the absence of the waste energy generation facilities	Applicable
The applicability conditions included in the tools	The applicability conditions included	Applicable

referred to above apply.	in the tools are applicable to the project	

Thus it is appropriate to use ACM0012 for this project.

B.3. Description of how the sources and gases included in the project boundary:

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, HRSBs, 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"[1] announced by Department of Climate Change, National Development and Reform Commission (NDRC) of China (DNA of China) on 20th 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:

[1] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239

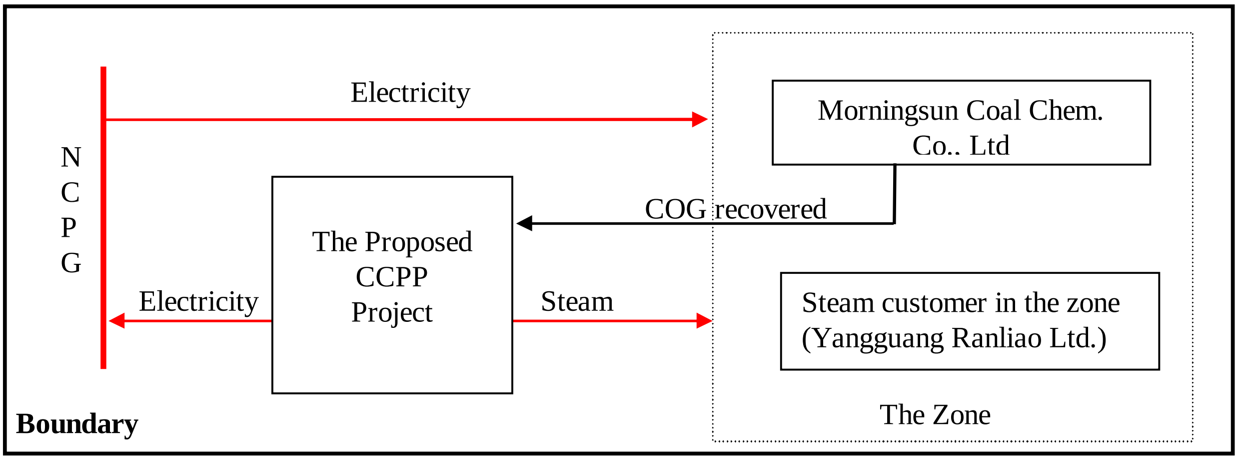

Figure B.3.1 Boundary of the project

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

	Source	Gas	Included?	Justification / Explanation
Baseline	NCPG electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Fossil fuel consumption in gas turbines for thermal energy	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Baseline emissions from generation of steam used in the flaring process, if any	CO_2	No	Waste COG is flared into atmosphere. There is no steam used in the flaring process.
		CH_4	No	Waste COG is combustible, there is no steam used in the flaring process. Excluded for simplification. This is conservative.
		N_2O	No	Waste COG is combustible, there is no steam used in the flaring process. Excluded for simplification. This is conservative.
Project Activity	Supplemental fossil fuel consumption at the project plant	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Supplemental electricity consumption	CO_2	No	Supplemental electricity consumption is excluded when to determine the baseline emission.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Project emission from cleaning of gas	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.

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 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 been 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[2]. So it is a part of possible baseline scenario.
W3	Waste COG is sold as an energy source	To sell the waste COG as an energy source is not a feasible option. The COG might be sold as energy source for the industrial and residential users. **For industrial user**: There are no industrial facilities which could use all the waste COG in the region;

[2] Survey of Coke Industry Association, http://hzs.ndrc.gov.cn/newhjyzyjb/t20060907_83477.htm

		For the residential user: It is also not possible to sell the waste COG as an energy source to local residents because it is not a viable option for the lack of demand market. The reasons include, firstly, the local farmers consume coal and waste straw as energy source for cooking and heating, so, there is no COG demand in the rural market. Secondly, the citizens of Jining city use nature gas supplied from West-to-East Natural Gas Transmission program, which is a cleaner and safe energy source than COG. So the waste COG is not needed by the city market. Thirdly, considering of the long distance from the project to the residential area of population concentration, and the relevant high investment and operation cost, it's not feasible to take huge investment for the gas sale. Hence it is not a possible baseline scenario.
W4	Waste energy is used for meeting energy demand at the recipient facility	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.
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	The proposed project activity is aimed to recover all the waste COG. To recover a portion of the waste gas is not comparable to the proposed project. It will face the same barrier with the project that recovers all the waste gas. So it can be excluded from the baseline scenarios.
W6	All the waste energy produced at the facility is captured and used for export electricity generation or steam	This option is interpreted as the Project activity not undertaken as a CDM project activity.The project will recover all the waste gas generated for electricity generation, which will be exported to NCPG. In addition, it is similar with W4. It is a possible baseline scenario.

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	The electricity generated by the project should be supplied to NCPG, and the electricity needed by the zone would be

		supplied by NCPG as well. So, this option is not a possible baseline scenario.
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 thermal power station with an installed capacity lower than 135MW[3]. The install capacity of proposed project is 42MW, so this alternative is not in accordance with national policy. Hence this option is not a part of baseline scenario.
P4	On-site or off-site existing renewable energy based cogeneration plant	The comment is similar with P2.
P5	On-site or off-site Greenfield renewable energy based cogeneration plant	There is not enough water or wind resource in Jining City, and the technology of biomass or solar energy plant are not mature in China, so the cost for power generation is very high. So, this option is not a possible baseline scenario.
P6	On-site or off-site existing fossil fuel based existing identified captive power plant	There is no existing fossil fuel fired identified captive power plant on-site or off-site. So this option is excluded from a baseline scenario.
P7	On-site or off-site existing renewable energy or other waste energy based captive power plant;	There is no renewable energy or other waste energy based captive power plant on-site or off-site. So this option is excluded from a baseline scenario.
P8	On-site or off-site Greenfield fossil fuel based captive plant	For the same reason as P3, this option is excluded from a baseline scenario.
P9	On-site or off-site Greenfield renewable energy or other waste energy based captive plant;	For the same reason as P5, on-site or off-site Greenfield renewable energy based captive plant should be excluded. 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. So this option is excluded from a baseline scenario.
P10	Sourced from Grid connected power plants	In the absence of the Project activity, the power would be sourced by the coal-dominated NCPG. So it is one possible baseline scenario.
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.)	The Project activity is cogeneration power plant and export power to NCPG rather than captive power plant. Therefore, this alternative can be excluded from the baseline scenarios.
P12	Existing Cogeneration using waste energy, but at a lower efficiency or lower recovery.	There is no existing power generating equipment on-site. Hence it is not a part of baseline scenario.

[3] http://www.gov.cn/gongbao/content/2002/content_61480.htm

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;	There is no existing on-site fossil fuel cogeneration plant. And also there is no off-site existing fossil fuel based cogeneration plant nearby that can supply steam to the zone. Therefore, this option is not a possible baseline scenario.
H3	On-site or off-site Greenfield fossil fuel based cogeneration plant;	According to regulations regarding power production in China, it is forbidden to build a cogeneration station with an installed capacity lower than 135MW[4]. The install capacity of proposed project is 42MW, so this alternative is not in accordance with national policy. Hence this option is not a part of baseline scenario.
H4	On-site or off-site existing renewable energy based cogeneration plant;	There is no existing on-site existing renewable energy based cogeneration plant. And also there is no off-site existing renewable energy based cogeneration plant nearby that can supply steam to the zone. Therefore, this option is not a possible baseline scenario.
H5	On-site or off-site Greenfield renewable energy based cogeneration plant;	There is not enough water or wind resource in Jining City, and the technology of solar energy plant are not mature in China, and the cost for power generation is very high. So, this option is 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;	In this project, the new fossil fuel based element process will be the coal-fired boilers to be installed in the new centralized steam plant in the zone. The heat demand will be met by the new fossil fuel based element process 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;	For the similar reason as H9, new renewable energy or other waste energy based element process to supply heat is not possible. 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);	The parameters of steam provided by project are 300℃ and 1.27MPa. The other heat generation technologies (e.g. heat

		pumps or solar energy) couldn't provide the steam with the same parameters. So it can be excluded from the baseline scenarios.
H12	Steam/process heat generation from waste energy, but with lower efficiency or lower recovery	The heat generation with lower efficiency could meet the energy demand, but with lower efficiency or lower recovery will also have the financial barriers and 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	For a lower efficiency cogeneration, it will also face financial barrier with less revenue and could not optimize the emission reduction. . So it can be excluded from the baseline scenarios.
H14	On-site fossil fuel consumption to supply heat	There is no existing on-site fossil fuel consumption to supply heat. If there is new/ Greenfield facility, that will be same as H7. So it is excluded.

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	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 boiler in the centralized steam plant supply steam.
2	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

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 (Uniufa)	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
14/08/2010	Submitted the notification of the commencement of the project activity and the notification of prior consideration of CDM to EB	Prior Consideration of the CDM Form
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 Shangdong Province	LuFaGaiNengJiao[2010]1258
19/04/2011	Approved by the NDRC (DNA of China)	FaGaiQiHou[2011]801
30/03/2012	Estimated commission date	Expected
01/06/2012	Starting Crediting Period(Expected)	Expected

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	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	W4/W6	P1	H1	The project will utilize waste COG for cogeneration, but not be undertaken as a CDM project activity.

Sub-step1b. 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 grid connected Power Generation 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)Annual diesel oil consumption (ton)	3,222,705	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	5%	FSR
	Education additional tax rate	3%	FSR
	Income tax	25%	FSR
Others	Residue value	5%	FSR
	CER price (EUR/tCO_2e)	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%

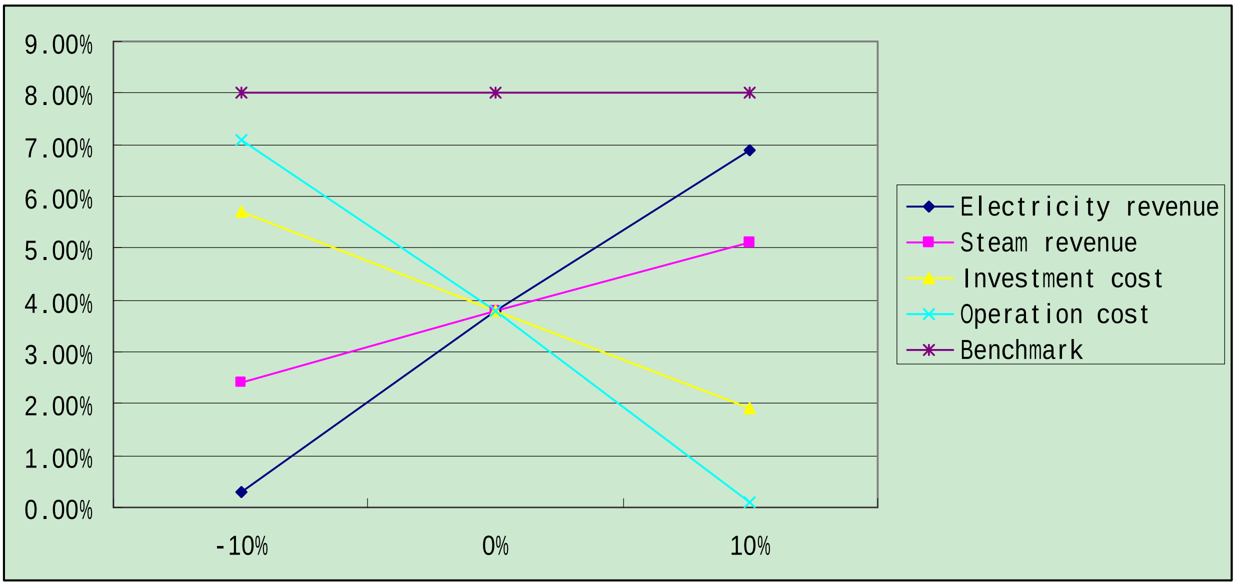

Fig. B.5.1 Sensitivity analysis of the Project activity

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 ±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. According to the FSR, the installed capacity had been chosen based on maximum hourly COG flow rate at normal operation of coking plant. 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

approved electricity tariff for similar project by Shandong Price Control Bureau, the electricity tariff of the Project was assumed at 0.4105 RMB/kWh in the FSR. According to Shandong Statistical Yearbook (1999-2009), over the past 10 years, the average annual growth rate of electricity tariff index is only 2.15%, the electricity tariff of the Project was unlikely to be increased 14%. It is impossible that the electricity tariff will increase 14% based on FSR assumption. Thus, it is unlikely that the electricity income of the Project activity will be increased 14%.

- **Steam revenue**: this parameter is influenced by steam output and steam price. 1) The steam output is extracted from the steam turbine and the current assumption is based on the rated extraction capacity of the steam turbine. So, steam output is impossible to be increased under the normal operation situation of steam turbines. 2) According to Shandong Statistical Yearbook (1999-2009), over the past 10 years, the average annual growth rate of Heat supply and production price index is 2.15%, the highest growth rate was 13.9%. Therefore, it is impossible that the steam output could increase 35%.
- **Investment cost:** According to Shandong Statistical Yearbook (1999-2009), over the past 10 years, the average annual growth rate of fixed asset investment is 17.67%, the lowest growth rate was -5.3%. therefore , it is impossible that the total investment could decrease 21%
- **Operation cost**: Annual O&M cost includes the cost of material, fuel, labour costs and other fees. According to Shandong Statistical Yearbook (1999-2009), over the past 10 years, the average annual growth rate of raw material purchase price index is 4.39%; over the past 8 years, the average annual growth rate of labour costs is 13.5%. therefore , it is impossible that the annual O&M cost could be decreased 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 guideline of common practice (version01.0),* the applicable geographical area covers the entire host country as a default. Project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions.

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.

Stepwise approach 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 CCPP 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 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	Included or exclude?	Apply for CDM?
1	Jinan Iron and Steel Work[5]	544MW	Before 2007.2.25	Excluded	Yes
2	Shandong Jinneng Coal Gasification Company, Ltd. [6]	<21MW	Before 2008	Excluded	Yes
3	Laiwu Iron & Steel Group Corp.[7]	61MW	Before 2009.1.1	Included	Yes

In the 3 projects listed above, only the last projects has the capacity within the scope of 21MW~63MW and started commercial operation before the start data of this project, i.e 12/04/2010.

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}.

The only project developed by Laiwu Iron & Steel Group Corp. is similar with the proposed project. Therefore, $N_{diff}=0$.

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.

$F= 1-N_{diff}/N_{all}=1-0/1=1$; $N_{all}- N_{diff}=1-0=1$

The proposed project activity is a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3.

As stated in step 4, F=1>0.2 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.

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[5] http://cdm.ccchina.gov.cn/website/CDM/pdf/Item_new/Item_new358.pdf

[6] http://www.qhccoo.cn/news/local/352094.html

[7] http://cdm.ccchina.gov.cn/website/CDM/pdf/Item_new/Item_new2367.pdf

B.6. Emission reductions:

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 refferred 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_2

$BE_{En,y}$ The baseline emissions from energy generated by the project activity during the year *y* in tCO_2

$BE_{flst,y}$ 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_2), 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_2

$BE_{Ther,y}$ Baseline emissions from thermal energy (due to heat generation by element process) during the year y in tons of CO_2

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

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

Where:

$BE_{Ther,y}$ Baseline emissions from thermal energy (as steam) during the year y in tCO2.

$HG_{n,j,y}$ 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_2 emission factor of the element process that would have supplied the heat to recipient facility j in absence of the project activity (tCO2/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.

In this 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. For Greenfield facilities fcap is 1. If the procedure in Annex 1 concludes that the waste energy would have been partially utilised in the ìreference waste energy generating facilitiesî this fact in the factor $f_{practice}$ (refer to equations in section .2.2 for the use of factor fpractice)

It is 1 for ex-ante estimation, which can be seen in equation (7). And the ex-post data will be calculated with monitoring data after the project implementation.

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

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

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

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)

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

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

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_{j} \sum_{i} (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \textbf{(6)}$$

Where:

$BE_{elec,y}$ Baseline emissions due to displacement of electricity during the year *y* (tCO_2)

$EG_{i,j,y}$ 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

$EF_{elec,i,j,y}$ The CO_2 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_2/MWh)

In this project, it means the CO_2 emission factor of NCPG If the displaced electricity for the recipient facility is supplied by a connected grid system, the CO_2 emission factor of the electricity $EF_{elec,gr,j,y}$ 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 ($EF_{grid,CM,y}$) 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. Depending upon the situation, this factor is estimated using the equations in section 3.1

Note: For a project activity using waste pressure to generate electricity, the electricity generated from waste pressure should be measurable and this fraction is 1

The electricity generated by the project 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 (7) 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.

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

$$f_{cap} = \frac{Q_{WCM,BL}}{Q_{WCM,y}}$$

(7)

$$Q_{WCM,BL} = Q_{BL,product} \times q_{wcm,product}$$ (8)

Where:

$Q_{WCM,BL}$	Quantity of waste energy generated prior to the start of the project activity (Nm^3)
$Q_{WCM,y}$	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 800,000t annually, equal to the manufacturer's designation for normal operating conditions.
$q_{wcm,product}$	Amount of waste COG per unit of coke generated by the coke oven (Nm^3/t) It's 222 Nm^3COG/t coke for ex-ant estimation in the PDD.

So,

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

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

And, the project will utilize COG 158,604,000 Nm^3/year, e.g.,
$Q_{WCM,BL}$=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:

$$PEy = PE_{AF,y} + PE_{EL,y}$$ **(9)**

Where:

PEy 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. 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.

Project emissions due to auxiliary fossil fuel combusted to supplement waste energy in the project activity

$$PE_{AF,y} = \Sigma(FF_{i,y} \times NCV_i \times EF_{CO2,i}) \quad \textbf{(10)}$$

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

$EF_{CO2,i}$ CO_2 emission factor per unit of energy or mass of the fuel type i in tons CO2 obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors

3. Leakage

No leakage is considered, according to ACM0012.

4. Emission Reductions

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

$$ER_y = BE_y - PE_y \quad \textbf{(11)}$$

Where:

ER_y the total emissions reductions during the year y in tons of CO_2

PE_y the emissions from the Project activity during the year y in tons of CO_2

BE_y the baseline emissions for the Project activity during the year y in tons of CO_2

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

Data / Parameter:	**Installed Capacity of the Project activity**
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:	/

Data / Parameter:	**$FC_{i,y}$**
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:	

Data / Parameter:	**GEN_y**
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:	

Data / Parameter:	**ECR_y**
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:	

Data / Parameter:	**$NCV_{i,y}$**

Data unit:	TJ/t, km^3
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:	

Data / Parameter:	**$CAP_{m,j,y}$**
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:	

Data / Parameter:	**$EF_{Coal,Adv,y}$**
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:	

Data / Parameter:	**$EF_{Gas,Adv,y}$**
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	Data that is collected from the official statistics.

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{Oil,Adv,y}$
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:	

Data / Parameter:	$EF_{coal,i,j}$
Data unit:	tCO_2/TJ
Description:	Carbon emission factor per unit of energy of the baseline fuel used in i boiler used by recipient j, in tCO2/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:	

Data / Parameter:	$Q_{BL,product}$
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 measurement methods and procedures actually applied :	Based on the specification of manufacture, the average annual coke production will be used for ex-ante calculation.
Any comment:	Used for determination of f_{cap} following method-2.

Data / Parameter:	$q_{wcm,product}$
Data unit:	Nm^3/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.

Data / Parameter:	$\mathbf{TE_p}$
Data unit:	KJ/kg
Description:	Enthalpy of the the reactor (feed water) for the WHRB
Source of data used:	From standard data books/ steam tables
Value applied:	634.6482 (150^{o}C)
Justification of the choice of data or description of measurement methods and procedures actually applied :	/
Any comment:	/

Data / Parameter:	TE_r
Data unit:	KJ/kg
Description:	Enthalpy of the production (extraction steam) from the steam turbine
Source of data used:	From standard data books/ steam tables
Value applied:	3,114,5784 (1,27MPa, 332^{o}C)
Justification of the choice of data or description of measurement methods and procedures actually applied :	/
Any comment:	/

Data / Parameter:	NCV_{diesel}
Data unit:	TJ/t
Description:	Net calorific value of the fossil fuel (diesel) combusted as supplementary fuel,
Source of data used:	China Energy Statistical Yearbook 2010
Value applied:	0.042652
Justification of the choice of data or description of measurement methods and	/

procedures actually applied :	
Any comment:	/

Data / Parameter:	$EF_{CO2,diesel}$
Data unit:	tCO_2/TJ
Description:	The CO_2 emission factor per unit of diesel oil
Source of data to be used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value of data applied	72.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	/
Any comment:	/

Data / Parameter:	$EF_{CO2,coal}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor per unit of energy of the fossil fuel (coal) used in the reference baseline generation source *(centralized steam plant)* providing steam to consumers
Source of data to be used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value of data applied	94.6
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

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

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

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) 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^{o}C, P_{steam} = 1.27MPa, Q_{steam}= 40t/h. the operation time is 6000h So, TE_P= 3,114.5784 KJ/kg $H_{p,n,j,y}$ = TE_P * Q_{steam}*1000* 6000 =3,114.5784 KJ/kg * 40t/h * 1000 * 6000 = 747 TJ	747TJ
$H_{r,n,j,y}$	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 HRSB(TJ) The parameters of feed water: $T_{feed\ water}$= 150 ^{o}C, $Q_{feed\ water}$= 40t/h. the operation time is 6,000h So, $NCV_{feed\ water}$= 634.6482 KJ/kg $H_{p,n,j,y}$ = $NCV_{feed\ water}$ * $Q_{feed\ water}$*1000* 6000 = 634.6482 KJ/kg * 40t/h * 1000 * 6000 =152 TJ	152TJ
$HG_{n,process,j,y}$	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 net quantity of steam supplied by the steam turbine for element process.	**595TJ**

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

Where :

$BE_{Ther,\,y}$	Baseline emissions from thermal energy (as steam) during the year y in tCO_2.	**56,304 tCO_2e**
$HG_{n,j,y}$	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 net quantity of steam supplied to the steam customers.	595
$EF_{Heat,j,y}$	The CO_2 emission factor of the element process that would have supplied the heat to recipient facility j in absence of the project activity (tCO_2/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_2/TJ
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

Step 1.2.2 $BE_{Elec,y}$ Calculation

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

Where:

$BE_{elec,y}$	Baseline emissions due to displacement of electricity during the year *y* (tCO_2e)	**186,000 tCO_2e**
$EG_{i,j,y}$	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	229,219MWh
$EF_{elec,i,j,y}$	The CO_2 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_2/MWh)	0.81145 tCO_2/MWh

	In this project, it means the CO_2 emission factor of NCPG	
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. 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 (7) below, it is 1.	1

Therefore,

$$\mathbf{BE_y=BE_{En,y}= BE_{Elec,y}+BE_{Ther,y}}$$
$$=186{,}000tCO_2e +56{,}304\ tCO2e$$
$$=242{,}304\ tCO_2e$$

Step 2. The calculation of project emission

$$PEy = PE_{AF,\ y} + PE_{EL,\ y}+PE_{EL,import,y} = PE_{AF,\ y}$$

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

$PE_{AF,y}$	Emissions from the project activity in year y due to combustion of auxiliary fuel in tonnes of CO2	**62tCO_2e**
$FF_{i,y}$	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 So, $FF_{i,y}= FF_{diesel,y}$	20t
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 In that case, the diesel fuel will be used in the project activity during the year y So, $NCV_i= NCV_{diesel}$	0.042652TJ/t
$EF_{CO2,i}$	CO2 emission factor per unit of energy or mass of the fuel type i in tons CO2 obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors In that case, the diesel fuel will be used in the project activity during the year y So, $EF_{CO2,i}=EF_{diesel,i}$	72.6 tCO_2/TJ

3. The leakage calculation

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

4. The calculation of emission reduction

$$ER_y = BE_y - PE_y - LE_y = BE_y - PE_y = 242,304 - 62 = 242,242 tCO_2e$$

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
01/06/2012-31/12/2012	31	121,152	0	121,121
2013	62	242,304	0	242,242
2014	62	242,304	0	242,242
2015	62	242,304	0	242,242
2016	62	242,304	0	242,242
2017	62	242,304	0	242,242
2018	62	242,304	0	242,242
2019	62	242,304	0	242,242
2020	62	242,304	0	242,242
2021	62	242,304	0	242,242
01/01/2022-30/11/2022	31	121,152	0	121,121
Total (tonnes of CO_2e)	620	2,423,040	0	2,422,420

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1. Data and parameters monitored:

Data / Parameter:	$ws_{i,j}$
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 insection B.5	100%
Description of measurement methods and procedures to be applied:	/

Monitoring frequency:	Yearly
QA/QC procedures to be applied:	/
Any comment:	/

Data / Parameter:	$EG_{i,j,y}$
Data unit:	MWh
Description:	Quantity of net 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 162,000MWh 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 insection B.5	229,219
Description of measurement methods and procedures to be applied:	The electricity generated and project consumed can be measured by the electricity meter, which can be cross checked with electricity sales records.
Monitoring frequency:	The electricity generated and project consumed can be measured continuously and recorded monthly.
QA/QC procedures to be applied:	The electricity meters will be calibrated to the industry standards.
Any comment:	/

Data / Parameter:	$\mathbf{Q_{WCM,y}}$
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 purpose of calculating expected emission reductions in section B.5	150,705,955
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:	/

Data / Parameter:	$\mathbf{FF_{diesel,y}}$
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	20

purpose of calculating expected emission reductions insection B.5	
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:	/

Data / Parameter:	T_{water}
Data unit:	^{o}C
Description:	Feed water temperature of the HRSB.
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.
Value of data applied for the purpose of calculating expected emission reductions insection B.5	150
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:	/

Data / Parameter:	Q_{water}
Data unit:	t/h
Description:	Feed water volume of the inlet of the HRSB.
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 insection B.5	40
Description of measurement methods and procedures to be applied: Monitoring frequency:	This parameter is monitored by the flow meter. Measured continuously, aggregated annually
QA/QC procedures to be	The flow meter will undergo regular maintenance/calibration according to

applied:	industry standards.
Any comment:	/

Data / Parameter:	$\mathbf{HG_{n,process,j,y}}$
Data unit:	TJ
Description:	Net quantity of heat supplied to the steam customers by the project activity during the year y in TJ.
Source of data to be used:	Calculation according to parameters in Feasibility Study Report Actual value will be obtained by calculation with monitored data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	595
Description of measurement methods and procedures to be applied:	Heat generation is determined by enthalpy of the steam. For the project activity, the respective enthalpy of steam is determined based on the volume flows, the temperatures and the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.
Monitoring frequency:	Measured continuously, aggregated annually
QA/QC procedures to be applied:	This data is calculated using other data. The related meters will undergo maintenance/calibration according to industry standards.
Any comment:	/

Data / Parameter:	T_{steam}
Data unit:	^{o}C
Description:	Extraction steam temperature generated 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.
Value of data applied for the purpose of calculating expected emission reductions insection B.5	332
Description of measurement methods and procedures to be applied: Monitoring frequency:	Thermometer is used to measure onsite steam temperature; It is recorded in both paper and electronic way. Measured daily, averaged yearly
QA/QC procedures to be applied:	The thermometer will undergo regular maintenance/calibration according to industry standards.
Any comment:	/

Data / Parameter:	P_{steam}
Data unit:	MPa
Description:	Extraction steam pressure provided 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.
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 / Parameter:	Q_{steam}
Data unit:	t/a
Description:	Extraction steam volume of the outlet of 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 flow meter.
Value of data applied for the purpose of calculating expected emission reductions insection 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 / Parameter:	Abnormal operation of the project facility including emergencies and shut down
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.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.

President
Selection and appointment of monitoring manager

↓

CDM Monitoring Manager
Responsible for CDM Monitoring

↓

CDM Monitoring Staff
Responsible for CDM monitoring such as;
- Data collection
- Maintenance of monitoring equipment
- Recording and archiving of collected data
- Reporting of monitoring results

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 ($FF_{diesel,yi,j}$, $FF_{coal,y,,PJ,y}$);
(2) Net calorific value of fossil fuel (NCV_{diesel}, NCV_{coal});
(3) CO_2 emission factor of the fossil fuel ($EF_{CO2,diesel}$, $EF_{CO2,coal}$);
(4) Quantity of electricity consumed by the project operations ($EC_{PJ,y}$);
(5) CO_2 emissions factor of electricity consumed by the project operations ($EF_{grid,CM,y}$);
(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_{steam}, Q_{water});
(2) Energy generation using WECM, in absence of project activity (N/A);
(3) Quantity and energy content of WECM ($Q_{wcm,y}$, and energy content is vacant in the PDD);
(4) CO_2 emission factor of electricity or heat that would have been consumed by the recipient facility(ies) in the absence of the project activity ($EF_{grid,CM,y}$, $EF_{CO2,coal}$);
(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_{steam}, P_{steam}, T_{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.

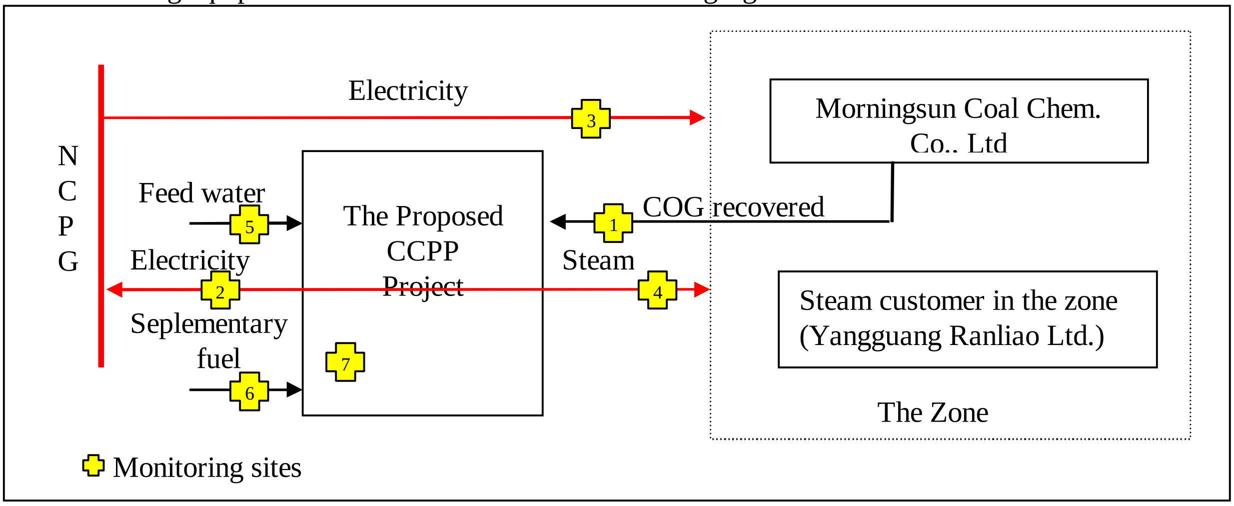

Figure B.7.1 Conceptual diagram of CDM monitoring system

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
101	$Q_{wcm,y}$	Quantity of the COG	Flow meter	Before the inlet of COG compressor	Continuously	Annually
201	EG_y	Total electricity generated during year *y*	Electric meter	Main outgoing line of CCPP generator	Continuously	Annually
301	$EC_{PJ,y}$	Internal electricity consumed by the Project activity during year *y*	Electric meter	Main incoming line of CCPP plant	Continuously	Annually
302	$EF_{grid,CM,y}$	The CO_2 emission factor of NCPG in year y	Fixed to be 0.81145 tCO2e/MWh in the fixed credit period. Sourced from data published by NDRC in 2011.			
401	T_{steam}	Steam temperature	Thermograph	Outlet of steam turbine	Continuously	Annually
402	P_{steam}	Steam pressure	Pressure meter	Outlet of steam turbine	Continuously	Annually
403	Q_{steam}	Steam flow of the extraction steam.	Flow meter	Outlet of steam turbine	Continuously	Annually
501	T_{water}	Water temperature of the inlet of the HRSB boiler.	Thermograph	Inlet of WHRB	Continuously	Annually
502	Q_{water}	Water volume of the inlet of the HRSB boiler	Flow meter	Inlet of WHRB	Continuously	Annually
601	$FF_{diesel,y}$	Diesel consumption	Flow meter	Diesel inlet for gas-turbine gerator	Monthly	Annually
602	NCV_{diesel}	NCV of diesel	Refer to China Energy Statistical Yearbook 2010			
603	$EF_{CO2,diesel}$	The CO_2 emission factor per unit of diesel	Refer to 2006 IPCC Guidelines for National Greenhouse Gas Inventories			

604	$FF_{coal,y,}$	Coal consumption	Balance	Coal inlet for boiler	Monthly	Annually
605	NCV_{coal}	NCV of coal	Refer to China Energy Statistical Yearbook 2010			
606	$EF_{CO2,coal}$	The CO_2 emission factor per unit of coal	Refer to 2006 IPCC Guidelines for National Greenhouse Gas Inventories			
701	AOH_y	Abnormal operation hours in year y	Manual record	CCPP plant	Daily	/

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 01/12/2011 by Uniufa Energy Technology Co., Ltd. (Not a project participant)

Address: Room A5000 Yan Dong Office Building, No 2 Wan Hong West Street, Chao Yang District, Beijing, China

Telephone: 86-10-84505948

E-mail: jss@uniufa.com; hlx@uniufa.com; thj@uniufa.com;

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:

01/06/2012

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_2, only few CO, NOx, 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 Jinxiang coal chemical industry 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 and so on. The aim 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 question are designed and allocated to them. The structure of the respondent is shown in table E.1.

Table E.1 Structure of the respondent

	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:

Except the staff of Morningsun, there are no any other residents living nearby in a radius of 5km around the project plant, and the effected people are main staff of Morningsun. So 40 questionnaires were distribute some works from Morningsun and the residents nearby Morningsun, who may be impacted by the project, were investigated, and 40 investigational questionnaires came back. 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%

Question	Item	Number	Percentage(%)
	No impact	0	0%
	Both positive and negative impact	0	0%
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
Street/P.O.Box:	Jining Chemical Industry Economic & Technological Development Zone
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The buyer

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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_2 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[8] 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 ($EF_{grid,OM,y}$):

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[8] 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_2 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:

$$EF_{grid,OMsimple,y} = \frac{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{y}}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/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)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/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

$EF_{grid,OMsimple,y}$ = **0.9803** tCO_2/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:

(a) 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 ($AEG_{SET\text{-}5\text{-}units}$,in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{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_{Total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calcualtion) ($SET_{\geqslant 20\%}$) and determine their annual electricity generation ($AEG_{\geqslant 20\%}$,in MWh);

(c) From $SET_{5\text{-}units}$ and $SET_{\geqslant 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

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

According to the "Tool to calculate the emission factor for an electricity system", $EF_{grid,BM,y}$ 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 $EF_{grid,BM,y}$ is calculated as follows:

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

Where:

$EG_{m,y}$	Net quantity of electricity, namely delivered to the grid by power unit m in year y (MWh)
$EG_{BL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/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 CO_2 emission factor of the generating plant m as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	CO_2 emission factor of fuel i in power unit m in year y (tCO_2/MWh)
$\eta_{m,y}$	Power supply efficiency of generating plant m in year y (%)

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

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

Where:

$EF_{i,Adv}$	=	The CO_2 emission factor of fuel i (tCO_2/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
λ_i	=	The weight of CO_2 emissions from fuel *i* fired power plants in the total CO_2 emissions from thermal power, using the most recent available data

And

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}$$

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^3 for gas fuel)
$EF_{CO2,i,j,y}$: CO_2 emission factor of fuel i in years y(tCO_2/GJ)
Coal, Oil and Gas: Subscripts of solid fuel, liquid fuel and gas fuel separately

$EF_{grid,BM,y} = 0.6426\ tCO_2/MWh$

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_2 emissions factor in year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/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*0.9803+0.5*0.6426=0.81145 tCO_2/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_2 emissions (tCO_2e)**
									(tC/TJ)	(%)	($kgCO_2$/TJ)	(MJ/t,km^3)	**L=G×J×K/100000 (mass unit)**
		A	B	C	D	E	F	**G=A+B+C +D+E+F**	H	I	J	K	**L=G×J×K/10000 (volume unit)**
Raw Coal	10^4t	816.17	1753.99	7716.13	7510.06	10434.25	11884.83	**40115.43**	25.8	100	87,300	20,908	732,214,267
Cleaned Coal	10^4t						18.43	**18.43**	25.8	100	87,300	26,344	423,859
Other Washed Coal	10^4t	5.76		156.89	478.81	48.57	756.84	**1446.87**	25.8	100	87,300	8,363	10,563,452
Coke	10^4t	7.93					42.86	**50.79**	26.6	100	87,300	20,908	927,054
Coke Oven Gas	10^8m^3			0.02			4.09	**4.11**	29.2	100	95,700	28,435	111,843
Other Coal Gas	10^8m^3	0.07	0.72	3.13	25.46	2.58	13.61	**45.57**	12.1	100	37,300	16,726	2,843,020
Crude Oil	10^4t	11.8	7.6	88.38	72.8	28.17	29.64	**238.39**	12.1	100	37,300	5,227	4,647,821
Gasoline	10^4t							**0**	20	100	71,100	41,816	0
Diesel	10^4t			0.01				**0.01**	18.9	100	67,500	43,070	291
Fuel Oil	10^4t	0.33		2.35		0.62	5.08	**8.38**	20.2	100	72,600	42,652	259,490
LPG	10^4t	4.74		0.18			2.35	**7.27**	21.1	100	75,500	41,816	229,522
Refinery Gas	10^4t							**0**	17.2	100	61,600	50,179	0
Natural Gas	10^8m^3	0.06		2.85			1.65	**4.56**	15.7	100	48,200	46,055	101,225
Other Petroleum Products	10^4t	5.03	0.73		0.54	4.22	0.01	**10.53**	15.3	100	54,300	38,931	2,225,993
Other Coking Products	10^4t	1.72						**1.72**	20	100	72,200	41,816	51,929
Other Energy	10^4tce	4.74						**4.74**	25.8	100	95,700	28,435	128,986
Raw Coal	10^4t	11.94		77.25	360.26	30.75	163.48	**643.68**	0	0	0	0	0
												Total	**754,728,750**

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_2 emissions (tCO_2e)**
									(tC/TJ)	(%)	($kgCO_2$/TJ)	(MJ/t,km^3)	**L=G×J×K/1000 (mass unit)**
		A	B	C	D	E	F	**G=A+B+C+D+E+F**	H	I	J	K	**L=G×J×K/1000 (volume unit)**
Raw Coal	10^4t	755.75	1800.12	7353.33	7854.39	12607.82	12360.75	**42732.16**	25.8	100	87,300	20,908	779,976,613
Cleaned Coal	10^4t						23.88	**23.88**	25.8	100	87,300	26,344	549,200
Other Washed Coal	10^4t	5.05		134.52	582.39	66.2	691.21	**1479.37**	25.8	100	87,300	8,363	10,800,731
Coal Briquettes	10^4t	5.66			32.49		45.38	**83.53**					1,524,647
Coke	10^4t			0.02			6.07	**6.09**	29.2	100	95,700	28,435	165,723
Coke Oven Gas	10^8m^3	0.11	0.86	8.37	24.55	3.55	16.2	**53.64**	12.1	100	37,300	16,726	3,346,491
Other Coal Gas	10^8m^3	10.4	9.08	187.54	36	34.32	29.76	**307.1**	12.1	100	37,300	5,227	5,987,440
Crude Oil	10^4t					0.02		**0.02**	20	100	71,100	41,816	595
Gasoline	10^4t							**0**	18.9	100	67,500	43,070	0
Diesel	10^4t	0.15		3.08		0.35		**3.58**	20.2	100	72,600	42,652	110,856
Fuel Oil	10^4t	2.56		0.25				**2.81**	21.1	100	75,500	41,816	88,715
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	0.44		2.93				**3.37**	15.7	100	48,200	46,055	74,809
Natural Gas	10^8m^3	11.09	0.7		0.97	2.12		**14.88**	15.3	100	54,300	38,931	3,145,563
Other Petroleum Products	10^4t	1.45						**1.45**	20	100	75,500	41,816	43,777
Other Coking Products	10^4t	7.97		7.61				**15.58**	25.8	100	95,700	28,435	423,968
Other Energy	10^4tce	4.9	2.34	61.02	466	63.72	141.71	**739.69**	0	0	0	0	0
												Total	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_2 emissions (tCO_2e)**
									(tC/TJ)	(%)	($kgCO_2$/TJ)	(MJ/t,km^3)	**L=G×J×K/100000 (mass unit)**
		A	B	C	D	E	F	**G=A+B+C+D+E+F**	H	I	J	K	**L=G×J×K/10000 (volume unit)**
Raw Coal	10^4t	665.16	1870.36	7623.94	8024.02	12538.57	12654.05	**43376.1**	25.8	100	87,300	20,908	791,730,246
Cleaned Coal	10^4t						11.7	**11.7**	25.8	100	87,300	26,344	269,080
Other Washed Coal	10^4t	6.15		247.51	586.04	104.69	862.02	**1806.41**	25.8	100	87,300	8,363	13,188,417
Coal Briquettes	10^4t	3.73					31.83	**35.56**	26.6	100	87,300	20,908	649,065
Coke	10^4t						10.43	**10.43**	29.2	100	95,700	28,435	283,824
Coke Oven Gas	10^8m^3	0.13	1.27	8.72	19.48	3.35	11.69	**44.64**	12.1	100	37,300	16,726	2,784,999
Other Coal Gas	10^8m^3	10.23	13.43	228.32	35.89	48.35	37.21	**373.43**	12.1	100	37,300	5,227	7,280,656
Crude Oil	10^4t					0.13		**0.13**	20	100	71,100	41,816	3,865
Gasoline	10^4t						0.01	**0.01**	18.9	100	67,500	43,070	291
Diesel	10^4t	0.1		2.38		2.64	3.07	**8.19**	20.2	100	72,600	42,652	253,606
Fuel Oil	10^4t	0.82		0.19		0.02	2.63	**3.66**	21.1	100	75,500	41,816	115,550
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	0.83		3.95			3.44	**8.22**	15.7	100	48,200	46,055	182,472
Natural Gas	10^8m^3	13.55	0.63		4.39	2.03	0.03	**20.63**	15.3	100	54,300	38,931	4,361,086
Other Petroleum Products	10^4t	1.52					23.18	**24.7**	20	100	72,200	41,816	745,721
Other Coking Products	10^4t	6.62		7.79			5.52	**19.93**	25.8	100	95,700	28,435	542,341
Other Energy	10^4tce		2.11	62.14	570.3	90.63	137.68	**862.86**	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	Generation	Rate of electricity used by factory	Power Supply		
	(10^8 kWh)	(MWh)	(%)	(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_2)	757,552,268
Total		838,100,000		776,346,330	**Emission factor in 2007**	**0.97254**

Data sources: China Electric Power Yearbook 2008

Table 9. Thermal power generation of North China Power Grid (2008)

Province	Generation	Generation	Rate of electricity used by factory	Power Supply		
	(10^8 kWh)	(MWh)	(%)	(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_2)	812,079,707
Total		867,900,000		802,797,350	**Emission factor in 2008**	1.00495

Data sources: China Electric Power Yearbook 2009

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

Province	Generation	Generation	Rate of electricity used by factory	Power Supply		
	(10^8 kWh)	(MWh)	(%)	(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_2)	829,856,644
Total		923,000,000		853,705,050	**Emission factor in 2009**	**0.96418**

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_2 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^3) H	The lower limit of 95% confidential level of CO_2 EF of IPCC fuel ($kgCO_2/TJ$) 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[9]	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/m3	54,300	100	15.3
Coke oven gas[10]	16726 kJ/m3	37,300	100	12.1
Other coal gas[11]	5227 kJ/m3	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"*

[9]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.
[10]Calculate with the lower value of NCV range 16,726-17,981 kJ/m^3 of coke oven gas in p283 of *China Energy Statistical Yearbook 2008.*
[11]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_2 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
Raw coal	10^4t	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	10^4t	0	0	0	0	11.7	0	11.70	26,344	87,300	1	269,080
Other washed coal	10^4t	6.15	0	247.51	586.04	862.02	104.69	1,806.41	8,363	87,300	1	13,188,417
Coal Briquettes	10^4t	3.73	0	0	0	31.83	0	35.56	20,908	87,300	1	649,065
Coke	10^4t	0	0	0	0	10.43	0	10.43	28,435	95,700	1	283,824
Other Coke Products	10^4t	6.62	0	7.79	0	5.52	0	19.93	28,435	95,700	1	542,341
Total								0.00				806,662,974
Crude oil	10^4t	0	0	0	0	0	0.13	0.13	41,816	71,100	1	3,865
Gasoline	10^4t	0	0	0	0	0.01	0	0.01	43,070	67,500	1	291
Diesel	10^4t	0.1	0	2.38	0	3.07	2.64	8.19	42,652	72,600	1	253,606
Fuel oil	10^4t	0.82	0	0.19	0	2.63	0.02	3.66	41,816	75,500	1	115,550
Other oil products	10^4t	1.52	0	0	0	23.18	0	24.7	41,816	72,200	1	745,721
Total								0				1,119,034
Natural gas	10^4km^3	135.5	6.3	0	43.9	0.3	20.3	206.3	38,931	54,300	1	4,361,086
Coke oven gas	10^4km^3	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	10^4km^3	102.3	134.3	2283.2	358.9	372.1	483.5	3734.3	5,227	37,300	1	7,280,656
LPG	10^4t	0	0	0	0	0	0	0	50,179	61,600	1	0
Refinery gas	10^4t	0.83	0	3.95	0	3.44	0	8.22	46,055	48,200	1	182,472
Total												14,609,213
Sum total												822,391,221

Data sources: China Energy Statistical Yearbook 2010

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

Table 14. CO_2 emission factor of Coal-fired, Oil-fired and Gas-fired power

	Variable	Efficiency of power supply (%)	Emission factor of fuel ($kgCO_2/TJ$)	Oxidation rate	Emission factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1,000,000×B×C
Coal-fired power plant	$EF_{Coal,Adv,y}$	39.45	87,300	1	0.7967
Oil-fired power plant	$EF_{Oil,Adv,y}$	51.77	75,500	1	0.5250
Gas-fired power plant	$EF_{Gas,Adv,y}$	51.77	54,300	1	0.37976

Calculate the emission factor of thermal power:

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.7889\ tCO_2/MWh$$

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	**171,029.2**	**187,660**	**211,760**	**48,210**	**27,952**	**100.00%**
The fraction of installed capacity 2008				22.77%	13.20%	

$EF_{grid,BM,y}$=0.7889×81.46%=0.6426 tCO_2/MWh

Annex 4

MONITORING INFORMATION

Please refer to Section B.7.2

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