

Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd.'s NG Power Generation Project

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd.'s NG Power Generation Project (hereafter called "the Project" or "the proposed project") is located in Zhenhai Power Plant, Hongqiao Village, Zhenhai District, Ningbo City, Zhejiang Province of China.

The proposed project installed two sets of gas-steam combined cycle for power generation units with the total rated output of 795.6MW. The selected technology for the Project is from the American manufacturer of GE PG9351FA system, and the generated electricity will be sold into the Zhejiang Grid, a sub-grid of an independent regional grid- East China Power Grid (ECPG).

The purpose of the Project is to build a grid-connected electricity generation plant using natural gas (NG) as fuel and without other auxiliary fuels. The Project using natural gas as a fuel to generate clean power, and will achieve greenhouse gas (GHG) emission reductions by avoiding CO₂ emission from the business-as-usual scenario electricity generation of those coal-fired power plants connected into the ECPG.

Relevant dates for the project are as follows:

The construction starting date for the project was 09/05/2005.

Commissioning start date for project (the first unit began to operate): 09/01/2007

The second unit began to operate: 28/07/2007

The project was registered as a VCS project (VCS 400). The first 10 year renewable crediting period started on 09/01/2007 and expired on 08/01/2017.

During the monitoring period (01/01/2012-31/12/2012), the emission reduction achieved by the project in this monitoring period is 441,637tCO₂e. The emission reductions in the monitoring period will be verified and issued under VCS rules.

1.2 Sectoral Scope and Project Type

This category would fall within sectoral scope 1: energy industries (Renewable sources).

Project type: Renewable energy projects.

1.3 Project Proponent

Organization name	Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd.
Contact person	Cao Lu

Title	Legal Representative
Address	No.235, Ningdong Road, Zhenhai District, Ningbo City, Zhejiang Province
Telephone	86-0574-86332378
Email	huqiaoen@126.com

1.4 Other Entities Involved in the Project

Organization name	Goldchina Consultancy International Co., Ltd.
Role in the project	The buyer
Contact person	Dr. Zheng Zhaoning
Title	Technical director
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1.5 Project Start Date

The operation starting date for the project was 09/01/2007.

1.6 Project Crediting Period

3×10 years renewable crediting period is adopted by the project activity. The project was registered as CDM project (CDM ref no.:1344), the third VCS project crediting period will be ended once the third CDM project crediting period expired.

The first 10 years renewable crediting period started on 09/01/2007 and expired on 08/01/2017.

1.7 Project Location

The proposed project is located in Zhenhai Power Plant, Zhenhai District, Ningbo City, Zhejiang Province, P. R. China. The geographical coordinates are east longitude 121°43' and north latitude 29°58'.

1.8 Title and Reference of Methodology

AM0029 (Version 01, 19 May 2006): "Baseline Methodology for Grid Connected Electricity Generation project using Natural Gas" and "Monitoring methodology for grid connected generation plants using nonrenewable and less GHG intensive fuel".

1.9 Other Programs

Emission Trading Programs and Other Binding Limits:

The project proponent confirmed that, emission reductions generated from 01/01/2012 to 31/12/2012 will be claimed as VCUs under VCS rules. And issued VCUs will be sold only once to one particular buyer.

Once the project proponent are included in an emissions trading program or any other mechanism that includes GHG allowance trading, the VCU issuance under VCS rules will be stop immediately since the date of included in an emissions trading program or any other mechanism that includes GHG allowance trading.

Other Forms of Environmental Credit:

The project is a renewable energy generation project, no GHG emission generated during operation period. Thus, the project doesn't fall into categories that creating GHG emissions primarily for the purpose of its subsequent removal or destruction.

The project has not created another form of environmental credit, which will be verified by DOE.

Participation under Other GHG Programs:

The project has been registered as a CDM project with registration number 1344.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The operation principle of the gas-steam combined cycle power generation is: the gas turbine drives the power generator to generate electricity. At the same time the exhaust gas from the gas turbine after combustion of nature gas enters the heat recovery steam generator and generates steam using demieralised water, and then, the steam generated enters into the steam turbine and drive the generator to generate electricity. The project involves two sets of gas-steam combined cycle power generation units with each unit including a gas turbine, heat recovery steam generator, steam turbine and generator

The selected technology for the Project is from American manufacturer of PG9351FA system, which includes following main equipments:

Table 1: Main Equipment

Equipment	Model	Manufacturer
Gas turbine	PG9351FA	GE
Heat recovery steam generator	HF-9FA-285.4-9.87-566.5-3P(R)	Ha'erbin Heat Recovery Boiler Plant
Steam turbine	D10	Ha'erbin Steam Turbine

		Plant
Electricity generator	390H (capacity 397.8MW)	

The starting date of operation of the project activity was described as follows:

For the 1st unit: 09/01/2007

For the 2nd unit: 28/07/2007

The project was implemented as described in the PD.

During this monitoring period from 01/01/2012 to 31/12/2012, there are no any emergencies or special events, which might impact the applicability of the chosen methodology.

2.2 Deviations

2.2.1 Methodology Deviations

There is no deviation applied to this monitoring period.

2.2.2 Project Description Deviations

There is no deviation applied to this monitoring period.

2.3 Grouped Project

The project is not a grouped project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	EF _{NG,upstream,CH4}
Data unit	tCH ₄ /GJ
Description	Emission factor for upstream fugitive methane emissions of natural gas.
Source of data	Use IPCC 2006 default
Value applied:	0.000296
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of the data	Calculation of baseline emissions
Comments	-

Other parameters available at validation in PD are not used, so they are not listed here.

3.2 Data and Parameters Monitored

The primary parameters to be monitored for the project emissions during the crediting period are listed below:

Data / Parameter	FC _{natural gas,y}																										
Data unit	Nm ³																										
Description	Net quantity of nature gas consumed in project activity in year y																										
Source of data	Fuel flow meters readings at the project boundary																										
Description of measurement methods and procedures to be applied	Measured																										
Frequency of monitoring/recording	The natural gas consumed by the project will be monitored continuously and recorded the readings daily, and a weekly record will be prepared by the project owner and the gas supplier.																										
Value monitored:	423,933.498																										
Monitoring equipment	<table><tr><td>Title</td><td>Serial No.</td><td>Accuracy</td><td>Calibrations Date</td><td>Validity</td></tr><tr><td>Gas Ultrasonic Flowmeter1</td><td>3315</td><td>1.0</td><td>13/12/2011 10/12/2012</td><td>Yes</td></tr><tr><td>Gas Ultrasonic Flowmeter2</td><td>3316</td><td>1.0</td><td>11/08/2011 08/08/2012</td><td>Yes</td></tr><tr><td rowspan="2">Gas Ultrasonic Flow meter at plant (Daniel)</td><td rowspan="2">05-520380</td><td rowspan="2">0.5</td><td>11/05/2011</td><td>Yes</td></tr><tr><td>10/05/2012</td><td>Yes</td></tr></table>					Title	Serial No.	Accuracy	Calibrations Date	Validity	Gas Ultrasonic Flowmeter1	3315	1.0	13/12/2011 10/12/2012	Yes	Gas Ultrasonic Flowmeter2	3316	1.0	11/08/2011 08/08/2012	Yes	Gas Ultrasonic Flow meter at plant (Daniel)	05-520380	0.5	11/05/2011	Yes	10/05/2012	Yes
	Title	Serial No.	Accuracy	Calibrations Date	Validity																						
	Gas Ultrasonic Flowmeter1	3315	1.0	13/12/2011 10/12/2012	Yes																						
	Gas Ultrasonic Flowmeter2	3316	1.0	11/08/2011 08/08/2012	Yes																						
	Gas Ultrasonic Flow meter at plant (Daniel)	05-520380	0.5	11/05/2011	Yes																						
10/05/2012				Yes																							
QA/QC procedures to be applied	Natural gas supply metering to the project will be subject to regular maintenance and testing in accordance with stipulation of meter supplier, applicable industry and national standards and relevant agreements to ensure accuracy. The readings will be double checked by the gas supply company.																										
Purpose of the data	Project emissions and leakage calculation																										
Calculation method	-																										
Comments	-																										

Data / Parameter	NCV _{natural gas}
Data unit	GJ/Nm ³
Description	Net calorific value of nature gas consumed in the project plant in year y.
Source of data	Natural gas supplier
Description of measurement methods and procedures to be applied	Measured
Frequency of monitoring/recording	The calorific value of the gas is provided daily by the supplier according to fuel purchase agreement, and recorded by the Project owner.
Value monitored:	0.03422 (weighted average)
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emissions and leakage calculation
Calculation method	-
Comments	-

Data / Parameter	EF _{CO₂, natural gas,}
Data unit	tCO ₂ /TJ
Description	The CO ₂ emission factor per unit of energy of nature gas in year y
Source of data	Local/ Regional / Global (IPCC)
Description of measurement methods and procedures to be applied	Use supplier-provided data, local data, country-specific values, that order of preference. The data will be recorded annually.
Frequency of monitoring/recording	Recording annually
Value monitored:	56.1
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emissions calculation
Calculation method	-

Comments	Data will be archived by electronic/ paper
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Data / Parameter	OXID _{natural gas} ,
Data unit	%
Description	Oxidation factor of natural gas used by the project plant
Source of data	IPCC
Description of measurement methods and procedures to be applied	Use IPCC current default
Frequency of monitoring/recording	Recording annually
Value monitored:	100
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emissions calculation
Calculation method	-
Comments	Data will be archived by electric/ paper

Data / Parameter	FC _y
Data unit	m ³
Description	Net quantity of fuel other than combusted by project activity in year y
Source of data	Fuel flow meter reading at project boundary
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	-
Value monitored:	0
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emissions calculation
Calculation method	According to the feasibility study report, the only type of fuel used in the project is natural gas. During the actual

	operation, no other auxiliary fuels were used in electricity generation. So, this parameter is 0.
Comments	Data will be archived by electronic paper

Data / Parameter	NCV _y
Data unit	GJ/m ³
Description	Net calorific value of fuel other than natural gas consumed in the project plant in year y.
Source of data	Fuel supplier, Local Authority, Country specific, IPCC
Description of measurement methods and procedures to be applied	Use supplier-provided data, local data, country-specific values, that order of preference. IPCC values can be used for startup fuel. According to the feasibility study report, the only type of fuel used in the project is natural gas. There is no other fuel used. This data is monitored in case that fuel other than natural gas is used.
Frequency of monitoring/recording	Recording annually
Value monitored:	0
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emissions calculation
Calculation method	-
Comments	-

Data / Parameter	EF _{CO₂, y}
Data unit	tCO ₂ /TJ
Description	The CO ₂ emission factor of the fuel other than natural gas in year y
Source of data	Local/ Regional / Global (IPCC)
Description of measurement methods and procedures to be applied	According to the feasibility study report, the only type of fuel used in the project is natural gas. During the actual operation, no other auxiliary fuels were used in electricity generation.
Frequency of monitoring/recording	-
Value monitored:	-

Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emissions calculation
Calculation method	-
Comments	-

Data / Parameter	OXID _y
Data unit	%
Description	Oxidation factor of the fuel other than natural gas used by the project plant
Source of data	IPCC
Description of measurement methods and procedures to be applied	According to the feasibility study report, the only type of fuel used in the project is natural gas. During the actual operation, no other auxiliary fuels were used in electricity generation.
Frequency of monitoring/recording	Recording annually
Value monitored:	-
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Project emissions calculation
Calculation method	-
Comments	-

Data / Parameter	GWP _{CH4}
Data unit	tCO ₂ /tCH ₄
Description	Global Warming Potential for CH4
Source of data	IPCC default value
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Annually
Value monitored:	21

Monitoring equipment	-
QA/QC procedures to be applied	The latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of the data	Leakage Emission calculation
Calculation method	-
Comments	-

The primary parameters to be monitored for baseline emissions as per ACM0002 during the crediting period are listed below:

Data / Parameter	EG _y
Data unit	MWh
Description	Net electricity delivered to the grid by the Project
Source of data	Reading of the meters installed in the plant
Description of measurement methods and procedures to be applied	Measured and calculated
Frequency of monitoring/recording	Power exported to the grid and imported from the grid is measured continuously and recorded the readings daily. A monthly record will be prepared by the project owner at beginning of the month, and sent to the grid company for cross-check.
Value monitored:	2,111,833.680MWh
Monitoring equipment	

	Title	Serial No.	Accuracy	Date	validity
	#01 Main Meter**	206654285	0.2s	30/12/2011	Yes
		211298525	0.2s	14/03/2012	Yes
	#01 back- up meter**	3060045528	0.2s	27/07/2011	Yes
		211298522	0.2s	14/03/2012	Yes
	#11 Main* Meter	206654297	0.2s	30/12/2011	Yes
		211298518	0.2s	05/03/2012	Yes
	#11 back- up meter*	3060045525	0.2s	27/07/2011	Yes
		211298519	0.2s	05/03/2012	Yes
	#12 main meter**	206654288	0.2s	30/12/2011	Yes
		211298528	0.2s	14/03/2012	Yes
	#12 back- up meter**	3060045521	0.2s	27/07/2011	Yes
		211298527	0.2s	14/03/2012	Yes
	* The old meter was replaced on 05/03/2012. ** The old meters were replaced on 14/03/2012. All the meters are calibrated at least annually.				
QA/QC procedures to be applied	Meters will be remained for regular maintenance and testing services for an ensured accuracy (0.2S). All the calibration tests records will be maintained for DOE's verification. Double check by receipt of sales.				
Purpose of the data	Calculation of baseline emissions				
Calculation method	$EG_y = EG_{out} - EG_{in}$ EG_{out} is electricity supplied to the grid (MWh) EG_{in} is electricity imported from the grid (MWh)				
Comments	-				

Data / Parameter	$EF_{BM,y}$
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Data unit	tCO ₂ /MWh
Description	Build margin emission factor
Source of data	China's DNA CDM official data
Description of measurement methods and procedures to be applied	Calculated based on the standard procedures approved by EB
Frequency of monitoring/recording	Annually
Value monitored:	0.5945
Monitoring equipment	-
QA/QC procedures to be applied	The latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of the data	Baseline Emission calculation
Calculation method	-
Comments	-

Data / Parameter	BTCA
Data unit	g/kWh
Description	Fuel consumption for best technology commercially available
Source of data	China's DNA CDM official data
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Annually
Value monitored:	292.3
Monitoring equipment	-
QA/QC procedures to be applied	The latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of the data	Baseline Emission calculation
Calculation method	-
Comments	-

Data / Parameter	CAP _{fire-y}
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Data unit	MW
Description	Installed capacity of fuel-fired power in year y within the ECPG.
Source of data	China Electric power Yearbook
Description of measurement methods and procedures to be applied	According to the requirements of methodology, applying the data in China Electric Power Yearbook
Frequency of monitoring/recording	Annually
Value monitored:	Refer to ER calculation spreadsheet
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Baseline Emission calculation
Calculation method	-
Comments	-

Data / Parameter	CAP _y
Data unit	MW
Description	Tool installed capacity of various power in year y within the ECPG.
Source of data	China Electric power Yearbook
Description of measurement methods and procedures to be applied	According to the requirements of methodology, applying the data in China Electric Power Yearbook
Frequency of monitoring/recording	Annually
Value monitored:	Refer to ER calculation spreadsheet
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Baseline Emission calculation
Calculation method	-
Comments	-

Data / Parameter	Fuel Energy Value
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Data unit	GJ/tSCE
Description	Fuel energy value of Standard Coal Equivalent
Source of data	China's DNA CDM official data
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Annually
Value monitored:	29.27
Monitoring equipment	-
QA/QC procedures to be applied	The latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of the data	Baseline Emission calculation
Calculation method	Refer to ER calculation spreadsheet
Comments	-

Data / Parameter	η_{BL}
Data unit	%
Description	Energy efficiency of the technology
Source of data	42.0%
Description of measurement methods and procedures to be applied	Default
Frequency of monitoring/recording	Annually
Value monitored:	Refer to ER calculation spreadsheet
Monitoring equipment	-
QA/QC procedures to be applied	The latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of the data	Baseline Emission calculation
Calculation method	-
Comments	-

Data / Parameter	$OXID_f$
Data unit	%

Description	Oxidation rate of the fuel y
Source of data	IPCC default Value
Description of measurement methods and procedures to be applied	Default
Frequency of monitoring/recording	Annually
Value monitored:	1
Monitoring equipment	-
QA/QC procedures to be applied	IPCC default value.
Purpose of the data	Baseline Emission calculation
Calculation method	-
Comments	-

3.3 Monitoring Plan

Monitoring plan for the project activity includes the details of the operation and management of the project activity during the crediting period and the measurement of the parameters in baseline and project emission scenarios that will be used to calculate actual emission reductions.

The monitoring plan of the project activity is organized as per the statement presented below.

Introduction

The approved monitoring methodology AM0029 (version 01, 19 May 2006) “Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel.” is adopted to determine the emission reductions from the net electricity generation from the project.

Organizational structure & procedures during project implementation

The host entity of this project is Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd.. An independent institution of operation and management for the project will be formed, and directed by the general manager of Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd..

CDM Project Director:

Part-time by the General Director or Deputy General Director of Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd. who will take charge of the management of the CDM project, take responsibility for Chinese DNA and stakeholders, meanwhile, take charge of the coordination with buyer countries and DOE;

CDM Manager:

He/she will take charge of the operation and management of CDM project, monitoring and statistics of material supply and utilization, project production, and cooperate with validation and verification, etc;

CDM Operation Team:

They will take charge of the regular monitor works, including monitoring of raw data, data aggregation and processing, statistic and storage of the processed data, calibration and maintenance of the measurement equipments, and cooperate with validation and certification, etc.

Training

All staff involved in any of the procedures related with the project activity will be trained before the start of the crediting period in order to perform the tasks specified in the monitoring plan.

Calibration, testing and maintenance for measurement equipments

The detailed calibration, testing and maintenance procedure for the measurement equipments used to monitor data of the project activity shall be prepared by the CDM Manager based on the agreements with the nature gas supplier, equipment manufacturer's recommendations and the industry and national standards as applicable.

Data monitoring

The main data monitoring of the project activity within the crediting period include:

Monitoring of net electricity generated by the project activity:

The net electricity generated by the project will be monitored through the electric meters within the project boundary. This data should be monitored and recorded daily by the computer system. There should be main and backup metering system in the control centre. The recorded readings should be readily accessible for DOE in verification. The records for calibration, testing and maintenance of the electric meters should be also readily accessible for DOE in verification.

Monitoring of quantity of nature gas combusted by the project activity:

Quantity of nature gas combusted will be monitored through the gas flow meters both at the project end and nature gas supplier for cross-verification. This data should be monitored and recorded daily by the computer system. The detailed monitoring procedure of this data should be established in accordance with the agreements with the nature gas supplier. The recorded readings should be readily accessible for DOE in verification. The records for calibration, testing and maintenance of the gas flow meters should be also readily accessible for DOE in verification.

Monitoring of NCV of natural gas combusted by the project activity:

The detailed monitoring procedure of NCV of nature gas combusted by the project activity should be established in accordance with the agreements with the nature gas supplier. This data should be monitored and recorded fortnightly by the computer system. The recorded readings should be readily accessible for DOE in verification. The records for calibration, testing and maintenance of the gas flow meters should be also readily accessible for DOE in verification.

Monitoring of relevant data used to calculate the baseline emission factor of BM:

According the approved monitoring methodology AM0029, the relevant baseline emission parameters will be monitored per ACM0002. In this PDD, the baseline emission factor has been selected to BM, so the relevant parameters used to calculate BM should be publicly available (e.g. raw data of *China Electric Power Yearbook*, IPCC, etc.) in china and monitored and recorded annually by the computer system. The recorded data and revised ex-post calculation should be readily accessible for DOE in verification.

Recording and archiving of data

The on-site control centre will be established from where all electronic data will be remotely monitored and recorded. Staff working at the control centre will prepare a daily report on the operations of the CDM project activity and this daily report will record data readings and equipment defects, outages, repairs and maintenance activities. All relevant information, notes of meetings, data files, maintenance records, defect reports, hard copy and computerised records of monitoring will be kept at the control centre or other designated location, and arranged in an orderly and transparent manner to facilitate audit as and when required. All monitored data required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later.

Meters failure

Should any reading of the main meters be inaccurate by more than the allowable error, or otherwise functioned improperly, the monitored parameters will be determined by:

- (a) First, by reading backup meter installed, unless a test by either party reveals it is inaccurate;
- (b) If the backup system is not within acceptable limits of accuracy or is otherwise performing improperly, the developer, the Grid Company and the natural gas supply company will jointly prepare an estimate of the correct reading;
- (c) If the developer, the Grid Company and the natural gas supply company fail to agree then the matter will be referred for arbitration according to agreed procedures.

Emergency preparedness

Disposal of Emergency will be implemented according to the stipulations in the Management Regulations of Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd..

Review of monitored data

Monitored data will be reviewed by responsible personnel. This audit will check compliance with operational procedures in this monitoring plan.

This internal audit will also identify potential improvements to procedures to improve monitoring and reporting in future years. If such improvements are proposed these will be reported to the DOE and only operated after approval from the DOE.

Verification of monitoring results

The verification of the monitoring results of the project activity is a mandatory process required for all CDM projects. The main objective of the verification is to independently verify that the project has achieved the emission reductions as reported and projected in the PDD. It is expected that the verification will be done annually.

The responsibilities for verification of the projects are as follows:

- CDM Manager will take charge of the arrangements for the verification and will prepare for the audit and verification process to the best of his/her abilities.
- CDM Manager will provide the DOE with all required necessary information, before, during and, in the event of queries, after the verification due to facilitate verification.

- CDM Manager will fully cooperate with the DOE, instruct other relevant staff, management to be available for interviews and respond honestly to all questions from the DOE.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are calculated by multiplying the electricity generated in the project plant (EG_y) with a baseline CO_2 emission factor ($EF_{BL,CO_2,y}$), the formulae can be described as follows:

$$BE_y = EG_y \times EF_{BL,CO_2,y}$$

Where, EG_y : Net electricity supplied to the grid in year y (MWh)

According to the methodology AM0029, the baseline emission factor is chosen as the minimum of the following three options:

Option 1: The build margin, calculated according to ACM0002; and

Option 2: The combined margin, calculated according to ACM0002, using a 50/50 OM/BM weight.

Option 3: The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario" above, and calculated as follows:

$$EF_{BL,CO_2,y} (tCO_2 / MWh) = \frac{COEF_{BL}}{\eta_{BL}} \times 3.6GJ / MWh \quad (2)$$

$COEF_{BL}$ = the fuel emission coefficient (tCO_2e/GJ), based on national average fuel data, if available, otherwise IPCC defaults can be used;

η_{BL} = the energy efficiency of the technology, as estimated in the baseline scenario analysis.

Based on the registered PDD, for the project, Option 1 was chosen as the baseline emission factor and should be updated by ex-post calculation during the crediting period.

EX ante calculation of baseline emission:

The build margin emission factor of the ECPG issued in the year 2015 is calculated as 0.5945 tCO_2/MWh .

The detailed calculation of EG_y is calculated below:

Period	Electricity Supplied to the Grid (MWh)	Electricity Imported from the Grid (MWh)	Net Electricity Supplied to the Grid (MWh)
01/01/2012~31/01/2012	37,496.800	875.600	36,621.200

01/02/2012~29/02/2012	140,659.200	951.280	139,707.920
01/03/2012~31/03/2012	138,424.000	1,151.920	137,272.080
01/04/2012~30/04/2012	302,535.200	934.560	301,600.640
01/05/2012~31/05/2012	137,086.400	1,262.800	135,823.600
01/06/2012~30/06/2012	148,860.800	825.440	148,035.360
01/07/2012~31/07/2012	307,568.800	824.560	306,744.240
01/08/2012~31/08/2012	223,229.600	1,263.680	221,965.920
01/09/2012~30/09/2012	169,769.600	1,312.960	168,456.640
01/10/2012~31/10/2012	195,800.000	1,023.440	194,776.560
01/11/2012~30/11/2012	167,376.000	957.440	166,418.560
01/12/2012~31/12/2012	155,601.600	1,190.640	154,410.960
Total	2,124,408.000	12,574.320	2,111,833.680

Item	$\text{COEF}_{BL}(\text{tCO}_2/\text{GJ})$	η_{BL}	$\text{EF}_{BL, \text{CO}_2, \text{option3}}(\text{tCO}_2/\text{MWh})$	$\text{EGy}(\text{MWh})$
	A	B	C	D
Data	0.0946	42.0%	0.81086	2,111,833.680
Data source	$25.8\text{tC/TJ} \times (44/12)/1000$	DNA of China	$C=(A/B) \times 3.6\text{GJ/MWh}$	

Item	$\text{EF}_{BM,y}(\text{tCO}_2/\text{MWh})$	$\text{EF}_{OM,y}(\text{tCO}_2/\text{MWh})$	$\text{EF}_{CM,y}(\text{tCO}_2/\text{MWh})$	$\text{EF}_{BM}(\text{tCO}_2/\text{MWh})$
	E	F	G	H

Data	0.5945	0.8112	0.648675	0.5945
Data source	China's DNA	China's DNA	$G=0.75 \cdot E + 0.25 \cdot F$	$H=\min(E, G, H)$

The detailed calculation of BE_y is calculated below:

Monitoring Period	EG_y (MWh)	$EF_{grid, BM, y}$ (tCO ₂ e/MWh)	BE_y (tCO ₂ e)
01/01/2012 – 31/12/2012	2,111,833.680	0.5945	1,255,480

4.2 Project Emissions

The Project activity is on-site combustion of natural gas to generate electricity and during the actual operation, no other auxiliary fuels were used in electricity generation. The CO₂ emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = FC_{natural_gas, y} \times COEF_{natural_gas, y} \quad (3)$$

Where:

$FC_{natural_gas, y}$: is the total volume of natural gas combusted in the Project plant in year(s) 'y'

$COEF_{natural_gas, y}$: is the CO₂ emission coefficient (tCO₂/m³ or similar) in year(s) for natural gas and is obtained as:

$$COEF_{natural_gas, y} = \sum NCV_{natural_gas, y} \times EF_{CO_2, natural_gas, y} \times OXID_{natural_gas} \quad (4)$$

Where:

$NCV_{natural_gas, y}$: is the net calorific value (energy content) per volume unit of natural gas in year 'y' (GJ/m³) as determined from the fuel supplier;

$EF_{CO_2, natural_gas, y}$: is the CO₂ emission factor per unit of energy of natural gas in year 'y' (tCO₂/GJ) as determined from the fuel supplier, wherever possible, otherwise from local or national data;

$OXID_{natural_gas}$: is the oxidation factor of natural gas.

Based on the above values, the project emission calculation was described as follows:

FC	NCV	EF_{CO_2}	OXID	PE
Nm ³	GJ/ Nm ³	tCO ₂ /GJ		tCO ₂

423,933,498	0.03422	0.0561	100%	813,843
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Note: Please see the ERs spreadsheet for more details.

4.3 Leakage

Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the Project boundary. This includes mainly fugitive CH₄ emissions and CO₂ emissions from associated fuel combustion and flaring. In the methodology AM0029, the leakage emission was calculated as follows:

$$LE_y = LE_{CH_4,y} + LE_{LNG,CO_2,y} \quad (5)$$

Where:

LE_y: Leakage emissions during the year y in tCO₂e

LE_{CH₄, y}: Leakage emissions due to fugitive upstream CH₄ emissions in the year y in t CO₂e

LE_{LNG, CO₂, y}: Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in t CO₂e

According to the registered PDD, no LNG was used in the project, only take fugitive upstream CH₄ emissions (LE_{CH₄, y}: Leakage) into account due to this project used NG as fuel, i.e.

$$LE_y = LE_{CH_4,y}.$$

According to AM0029, for the purpose of estimating fugitive CH₄ emissions, the Project participants should multiply the quantity of natural gas consumed by the Project in year y with an emission factor for fugitive CH₄ emissions (EF_{NG, upstream, CH₄}) from natural gas consumption and subtract the emissions occurring from fossil fuels used in the absence of the Project activity, as follows:

$$LE_{CH_4,y} = (FC_{natural_gas,y} \times NCV_{natural_gas,y} \times EF_{NG,upstream,CH_4} - EG_y \times EF_{BL,upstream,CH_4}) \times GWP_{CH_4} \quad (6)$$

FC_{natural_gas,y}: Quantity of natural gas combusted in the Project plant during the year y in m³;

NCV_{natural_gas,y}: Average net calorific value of the natural gas combusted during the year y in GJ/m³;

EF_{NG,upstream,y}: Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system, in t CH₄ per GJ fuel supplied to final consumers;

EG_y : Electricity generation in the Project plant during the year in MWh;

GWP_{CH_4} : Global warming potential of methane valid for the relevant commitment period, 21tCO₂/CH₄

$EF_{BL,upstream,CH_4}$: Emission factor for upstream fugitive methane emissions occurring in the absence of the Project activity in t CH₄ per MWh electricity generation in the Project plant, as defined below;

The emission factor for upstream fugitive CH₄ emissions occurring in the absence of the Project activity ($EF_{BL,upstream,CH_4}$) should be calculated consistent with the baseline emission factor (EF_{BL,CO_2}) used in step 2, so the $EF_{BL,upstream,CH_4}$ in this PDD was calculated as follows:

$$EF_{BL,upstream,CH_4} = \frac{\sum_j FF_{j,k} \times EF_{k,upstream,CH_4}}{\sum_j EG_j} \quad (7)$$

Where:

j: Plants included in the build margin;

$FF_{j,k}$: Quantity of fuel type k (a coal or oil type) combusted in power plant j included in the build margin;

$EF_{k,upstream,CH_4}$: Emission factor for upstream fugitive methane emissions from production of the fuel type k (a coal or oil type) in t CH₄ per MJ fuel produced;

EG_j : Electricity generation in the plant j included in the build margin in MWh/a.

Based on the calculation method of BM, the formula (7) could be converted to:

$$EF_{BL,upstream,CH_4} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{fossil,upstream,CH_4}$$

$$EF_{fossil,upstream,CH_4} = \lambda_{Coal} \times EF_{Coal,upstream,CH_4} + \lambda_{Oil} \times EF_{Oil,upstream} + \lambda_{Gas} \times EF_{Gas,upstream}$$

$$EF_{BL,upstream,CH_4} = \frac{CAP_{Thermal}}{CAP_{Total}} \times (\lambda_{Coal} \times EF_{Coal,upstream,CH_4} + \lambda_{Oil} \times EF_{Oil,upstream} + \lambda_{Gas} \times EF_{Gas,upstream})$$

Where:

CAP_{Total} is the total change in installed capacity of the Grid (MW);

$CAP_{Thermal}$ is the incremental capacity of fuel-fired power of the Grid (MW);

$EF_{coal,upstream,CH_4}$, $EF_{oil,upstream,CH_4}$, $EF_{gas,upstream,CH_4}$ is emission factor of coal, oil, gas-fired power with the most efficiency level of the best technology commercially available in China was selected;

λ_{Coal} , λ_{Oil} and λ_{Gas} are the proportions of the corresponding CH₄ emissions of the solid fuel, liquid fuel and gas fuel to the total emission.

For the project, the leakage calculation is described as follows:

FC Nm ³	NCV GJ/ Nm ³	$EF_{NG,upstream,CH_4}$ (tCH ₄ /GJ)
423,933,498	0.03422	0.000296

$EF_{BL,upstream,CH_4}$ (tCH ₄ /MWh)	GWP_{CH_4} (tCO ₂ /tCH ₄)	LE tCO ₂
0.004237	21	-187,821

According to the AM0029, when the total net leakage effects are negative, the Project should assume $LE_y = 0$.

4.4 Net GHG Emission Reductions and Removals

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	1,255,480	813,843	0	441,637

The calculated emission reductions achieved by the project activity within the covered monitoring period amount to 441,637tCO₂e in total.

For the value of estimated emission reduction in PD, the calculation is as follows:

The calculation of baseline emission (BE_y):

Item	COEF _{BL} (tCO ₂ /GJ)	η_{BL}	$EF_{BL,CO_2,option3}$ (tCO ₂ /MWh)	EG _y (MWh)
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	A	B	C	D
Data	0.0946	42.0%	0.81086	2,525,250
Data source	$25.8tC/TJ*(44/12)/1000$	DNA of China	$C=(A/B)*3.6GJ/MWh$	

Item	$EF_{BM,y}$ (tCO ₂ /MWh)	$EF_{OM,y}$ (tCO ₂ /MWh)	$EF_{CM,y}$ (tCO ₂ /MWh)	EF_{BM} (tCO ₂ /MWh)
	E	F	G	H
Data	0.5945	0.8112	0.648675	0.5945
Data source	China's DNA	China's DNA	$G=0.75*E+0.25*F$	$H=\min(E,G,H)$

The detailed calculation of BE_y is calculated below:

Monitoring Period	EG _y (MWh)	EF_{BM} (tCO ₂ /MWh)	BE _y (tCO ₂ e)
01/01/2012 – 31/12/2012	2,525,250	0.5945	1,501,261

The estimated project emission calculation was described as follows:

FC (Nm ³)	NCV (GJ/ Nm ³)	EF_{CO2} (tCO ₂ /GJ)	OXID	PE (tCO ₂)
533,540,000	0.03423	0.0561	100%	1,027,551

For the estimated leakage calculation is described as follows:

FC Nm ³	NCV GJ/ Nm ³	$EF_{NG,upstream,CH4}$ (tCH ₄ /GJ)
533,540,000	0.03423	0.000296

$EF_{BL,upstream,CH4}$	GWP_{CH4}	LE _y
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(tCH ₄ /MWh)	(tCO ₂ /tCH ₄)	tCO ₂
0.004237	21	-261,859

According to the AM0029, when the total net leakage effects are negative, $LE_y = 0$.

The estimated value of emission reduction is $1,501,261 - 1,027,551 = 473,710$ tCO₂.

So, the calculated emission reductions achieved by the project activity within the covered monitoring period amount to 441,637 tCO₂e in total, which is less than the estimated value, 473,710 tCO₂e, in the registered PD.