Monitoring report form
(Version 03.2)

Monitoring report

Title of the project activity	Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China
Reference number of the project activity	2344
Version number of the monitoring report	03
Completion date of the monitoring report	14/05/2014
Registration date of the project activity	25/08/2009
Monitoring period number and duration of this monitoring period	5th 01/04/2011-30/11/2011
Project participant(s)	Huaneng Henan Zhongyuan Gas Power Company Ltd. Carbon Asset Management Sweden AB Carbon Asset Management Sweden AB
Host Party(ies)	P.R.C. Sweden Switzerland
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope: 1 Energy industries (non-renewable sources) AM0029, Version 03: "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas"
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	1,286,072
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	102,619
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	102,619
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	0

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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As described in PDD, the Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China (hereinafter referred as the Project) is located at the southeast corner of the Zhumadian City, Henan Province, China. The designed installed capacity of the proposed project is 2×377.2MW, which is aimed to deliver 2,584.4235GWh electricity per year to the Central China Power Grid (CCPG). The Central China Power Grid is dominated by coal-fired power plants. By displace equal amount of electricity generated by coal-fired thermal power plants which would have been built otherwise, greenhouse gas (GHG) emission reductions could be achieved. The estimated annual GHG emission reductions are 858,165 tCO_2e.

The NGCC technology adopted in the project consists of two phases of combined dynamic cycles for electricity generation: Gas Cycle and Steam Cycle. Two phases of the cycles are combined to generate electricity with quite high efficiency.

The construction staring date of the project is 10/08/2005; the commenced electricity generation of the gas turbine #1 is in June 2007, and the commenced electricity generation of the gas turbine #2 is in December 2007. The commenced electricity generation of the steam turbine #1 is in August 2007 and the steam turbine #2 is in January 2008.

The current monitoring period is the 5th period that covers 01/04/2011-30/11/2011 including 577 days.

The total Emission Reductions achieved by the project in this period is 102,619 tCO_2e.

A.2. Location of project activity

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The proposed project is located at the planned industrial zone in the southeast corner of the Zhumadian City, Henan Province, China.

The geographic coordinate of the project site is situated as:

North-west corner: East longitude 114°03’39” North latitude 32°57’31”

South-west corner: East longitude 114°03’39” North latitude 32°57’22”

South-east corner: East longitude 114°03’52” North latitude 32°57’22”

North-east corner: East longitude 114°03’52” North latitude 32°57’31”

The geographic coordinate of the mark points within the project site are situated as

1＃Cooling tower: East longitude 114°03’41” North latitude 32°57’24”

2＃Cooling tower: East longitude 114°03’46” North latitude 32°57’24”

1＃Boiler stack: East longitude 114°03’48” North latitude 32°57’27”

2＃Boiler stack: East longitude 114°03’48” North latitude 32°57’29”

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (as applicable)**	**Indicate if the Party involved wishes to be considered as project participant (Yes/No)**
P.R.C.	**Huaneng Henan Zhongyuan Gas Power Company Ltd.**	**No**
Sweden	**Carbon Asset Management Sweden AB**	**No**

Switzerland	**Carbon Asset Management Sweden AB**	**No**

A.4. Reference of applied methodology

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The approved baseline methodology AM0029, Version 03: "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" and the approved monitoring methodology AM0029, Version 03: "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel" are applied to the project activity. The AM0029 also uses the "Tool to Calculate the Emission Factor for an Electricity System", Version 01 and "Tool for the Demonstration and Assessment of Additionality", Version 05 agreed by CDM EB.

More information about the methodology and the methodological tools can be found on the website: http://cdm.unfccc.int/methodologies/approved.

A.5. Crediting period of project activity

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The proposed project activity applies the renewable crediting period (7years×3). The starting date of the first crediting period is 25/08/2009 (i.e. the registration date of the proposed project). The first crediting period of the proposed project is 25/08/2009~24/08/2015 (7years).

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The NGCC technology adopted in the project consists of two phases of combined dynamic cycles: the first phase takes place in the gas turbine where the high temperature gas with about 1400°C generated by the natural gas combustion can power to rotate a coupled AC power generator to generate electricity - this is the Gas Cycle. In the second phase, the exhausted gas discharged from the gas turbine with about 600 °C can generate steam with 540°C temperature and 10.67MPa pressure in a heat recovery boiler, which then expands in the followed up steam turbine to generate electric power in the AC power generator again - this is the Steam Cycle. Two phases of the cycles is combined to generate electricity with quite high efficiency. The electricity generated by the project is delivered to the Central China Power Grid through 500 kV transmission line.

The technical performance indicators of the advanced technologies employed in the project are listed in the table below.

Table B.1 Technical Performance Indicators

Gas Turbine		
Manufacturer and Country of origin	Siemens Co. in Germany	
Type	V94.3A	
Rated speed	rpm	3000
Flow rate of flue gas at the gas turbine	t/h	2396.5
Temperature of flue gas at the gas turbine	°C	586.5
Gas turbine output	MW	243.4
Steam Turbine		
Manufacturer and Country of origin	Shanghai Steam Turbine Co., Ltd.	
Type	TCF-1	
Rated Speed	rpm	3000
Steam turbine output	MW	133.8

HRSG in Combined Cycle		
Manufacturer and Country of origin	Wuhan Boiler Manufacture Co.	
Feed water temperature of HRSG	°C	55
Output of generator	MVA	478
Generator		
Manufacturer and country of origin	Shanghai Elec. Group Co.	
Rated voltage	KV	21
Rated current	A	13142
Rated frequency	Hz	50
Rated speed	rpm	3000
Total output for one set	MW	377.2

The technology process was shown in the diagram below:

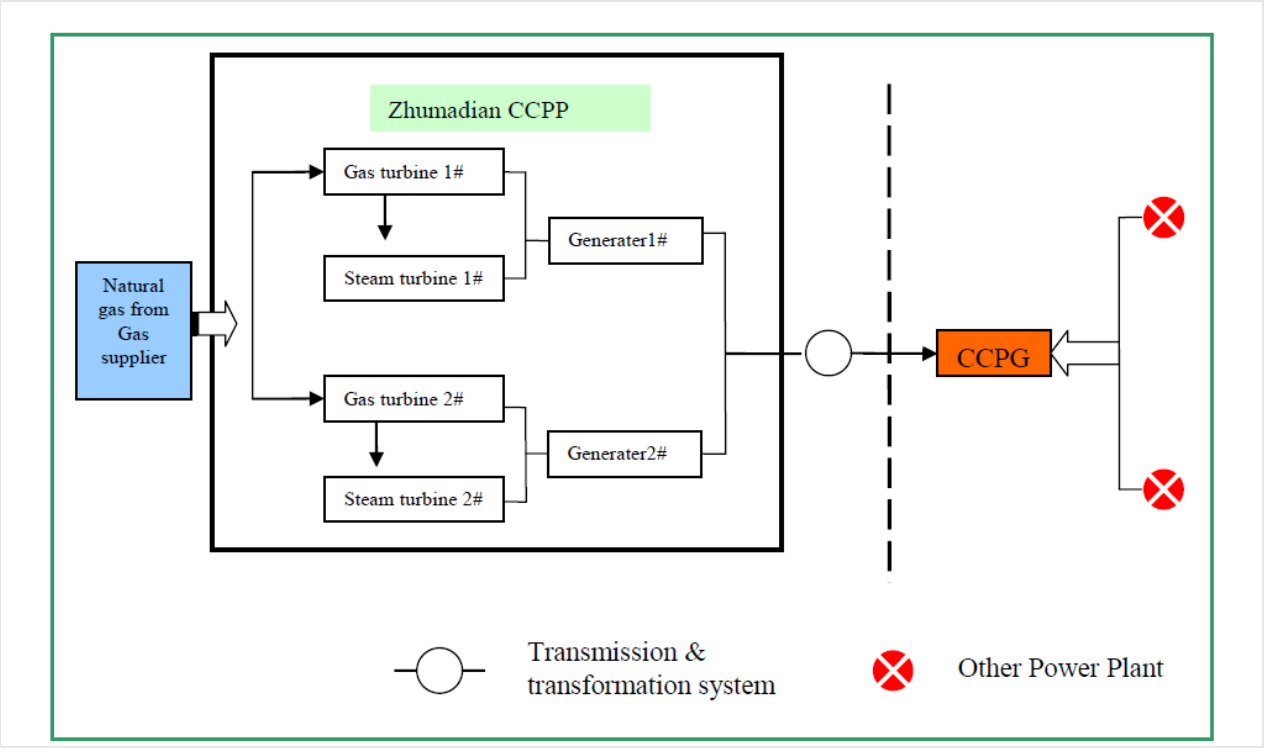

Diagram B.1 Technology Process

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

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There is no temporary deviation from registered monitoring plan or applied methodology.

B.2.2. Corrections

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There is no correction.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

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There is no permanent change from registered monitoring plan or applied methodology.

B.2.4. Changes to project design of registered project activity

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There is no change to project design of registered project activity.

B.2.5. Changes to start date of crediting period

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There is no change to start date of crediting period.

B.2.6. Types of changes specific to afforestation or reforestation project activity

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Not applicable.

SECTION C. Description of monitoring system

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C.1 Metering System

As described in PDD, two bidirectional meter No.1 and meter No.2 (Backup meter to meter No.1) were installed as gateway meters at 500kV Chaya substation for automatically measuring the exported and imported electricity by the proposed project. The meter No.3 was installed at the high voltage side of the 110KV/6KV transformer at the project site is used for measuring the import-grid electricity purchased. The total net electricity delivered to the grid is calculated based on readings from meter No.1 and meter No.3.

As described in PDD, the main gas metering point is set up in front of the natural gas delivery point, where two gas flow meters are installed (#1 and #2). Meanwhile, behind the natural gas delivery point, two cross-check ultrasonic flow meters (#3 and #5) are installed before the gas inlet for unit 1# and 2# at the project site. Ultrasonic Meter #4 and #6 has also been installed before #3 and #5 as their further backup meters.

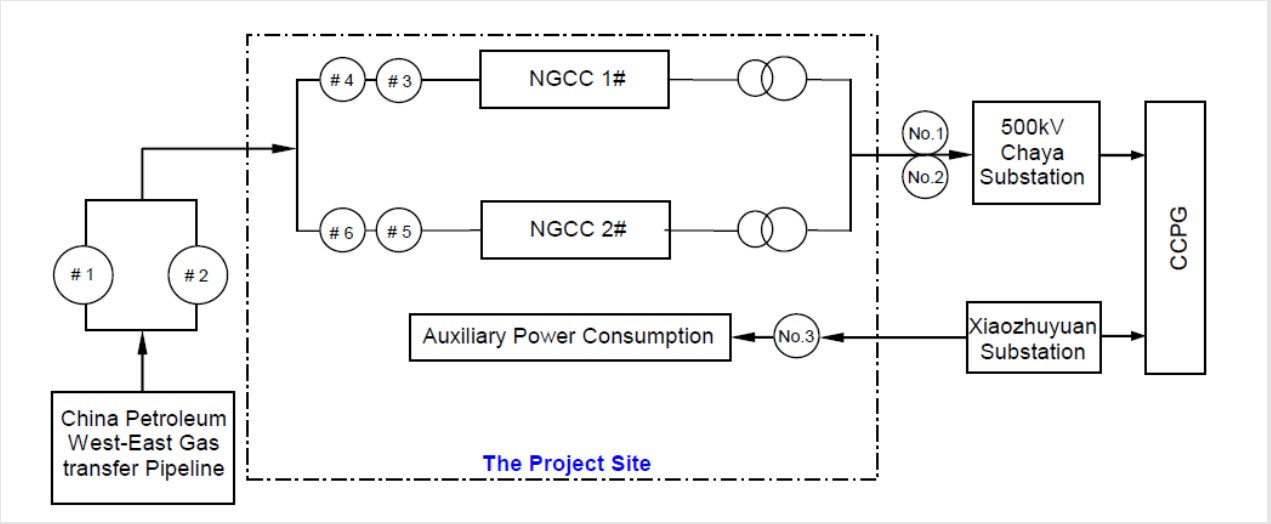

Diagram C.1 Electric and Nature Gas Monitoring System

The value of natural gas NCV is measured by an on-line gas chromatography analyzer.

C.2 Data Collection

The representatives from the project owner and the grid company have read the gateway meter meter No.1 and the meter No.3 on the last day of every month and the data has been recorded by the hard & soft means for monitoring, verifying, billing and cross checking. During this monitoring period, no abnormal difference has been found regarding calculation of emission reduction.

According to “GBT 18603-2001(Technical requirements of measuring systems for natural)”, natural gas is measured by volume under the normal condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure). The gas supplier and the project owner have verified the amount of natural gas supplied and consumed based on the reading from Gas meter #1 and #2 currently installed at the Zhumadian gas supply terminal, which are approved by both sides. The natural gas consumption has been recorded daily and cross-checked with receipt.

The measurement of NCV is conducted by an on-line gas chromatography analyzer by China Petroleum West-East Gas Transfer Pipeline Company Henan Province Xuedian Branch Station (GB/T-13610-2003), the value of NCV is recorded every ten days.

Everything worked fine during this monitoring period.

C.3 Monitoring Group & QA/QC

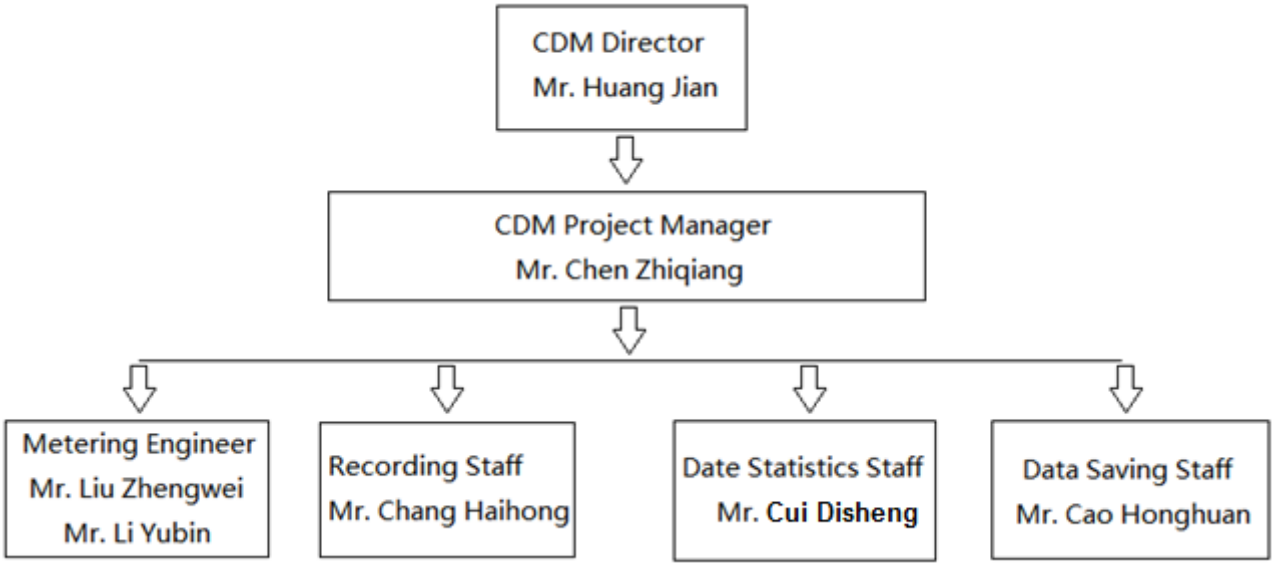

Figure C.2 Monitoring Group

Mr. Huang Jian, the Director of the proposed project exercised oversight on behalf of the Chairman.

The CDM Project Manager is Mr. Chen Zhiqiang who is responsible for monitoring plan implementation.

Mr. Liu Zhengwei and Mr. Li Yubin is responsible for Meters’ operation and calibration.

Mr. Chang Haihong is in charge of the data recording.

Mr. Cui Disheng is in charge of data statistics.

Mr. Cao Honghuan is responsible for data saving.

All electricity meters installed have been calibrated by certified Parties quarterly in accordance with manufacturer’s recommendations and National Regulations (SD109-83 & JJG569-1999) for ensuring reliability of the system. Calibrations have been evidenced with certificates of calibration for the relevant meters issued by the qualified third party.

The calibration and testing for the natural gas metering devices and the on-line gas chromatography was conducted periodically according to the national measurement standard and regulation (JJG1029-2007, JJG1037-2008, JG-700 1999) by the qualified measurement technology verification institution authorized by the Chinese government.

In summary, during this monitoring period, all meters and devices have been working normally and calibrated according to the registered monitoring plan and relevant national standards.

C.4 Emergency & Trouble Solving Procedure

Once error or emergency issue occurred during the operation and monitoring of the project, regulations on the Project Operation Manual and the CDM Monitoring Manual will be followed. All data of the monitoring of the project will be stored for more than two years after the end of the crediting period. Once an error occurred, these stored data will be the backup information for monitoring. No error occurred during this monitoring period.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	**$EF_{Coal,upstream,CH4}$**
Unit:	t CH_4/kt coal
Description:	Emission Factor for upstream fugitive methane emissions from coal production, transportation, distribution.
Source of data:	Revised 1996 IPCC Guideline Vol.3, default value, as required by AM0029, version 03.
Value(s) applied):	13.4
Purpose of data:	Data used for Leakage Emission Calculation
Additional comment:	

Data / Parameter:	**$EF_{oil,upstream,CH4}$**
Unit:	t CH_4/PJ
Description:	Emission Factor for upstream fugitive methane emissions from crude oil production, transportation, refining and storage processes.
Source of data:	Revised IPCC 1996 Guidance default value, Tables 1-60 to 1-64, p.1.129 - 1.131
Value(s) applied):	4.1
Purpose of data:	Data used for Leakage Emission Calculation
Additional comment:	

Data / Parameter:	**$EF_{NG,upstream,CH4}$**
Unit:	t CH_4/PJ
Description:	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.
Source of data:	Revised IPCC 1996 Guidance default value, Tables 1-63 to 1-64, p.1.130 - 1.131
Value(s) applied):	296
Purpose of data:	Data used for Leakage Emission Calculation
Additional comment:	

Data / Parameter:	GWP_{CH4}
Unit:	t CO_2e/tCH_4
Description:	Global Warming Potential for methane
Source of data:	IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
Value(s) applied):	21
Purpose of data:	Data used for Leakage Emission Calculation
Additional comment:	

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter:	$FC_{NG,y}$		
Unit:	Nm^3 (Volume unit Nm^3 measured under the normal condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure).		
Description:	Quantity of natural gas consumed in project activity		
Measured/ Calculated / Default:	Measured.		
Source of data:	NG flow meter reading at the power supplier terminal		
Value(s) of monitored parameter:	460,393,600		
Monitoring equipment:	Gas flow meter	1#	2#
	Type	TRZ-IFSG14000DN300ANSI600	
	Accuracy class	1.0	
	Serial number	83034891	83034059
	Calibration frequency	every 1yr	
	Calibration date	06/12/2010	17/11/2010
	Validity	05/12/2011	16/11/2011
	Calibration entity	Henan Institute of metrology and Testing	Henan Institute of metrology and Testing Nanjing Branch of National Station of Petroleum &Natural Gas Flow Meter
Measuring/ Reading/ Recording frequency:	The monitoring data of the NG consumption was aggregated and recorded daily.		
Calculation method (if applicable):	Meter Reading		

QA/QC procedures:	The total NG consumption was monitored both by Gas supplier and project owner. The monitoring readings were cross-checked with the receipts provided by the gas supply company. All the Gas Flow Meters have been calibrated once a year by a qualified third party. All the electronic and paper documents will be archived during the crediting period and two years after the end of the crediting period or the last issuance of CERs for this project activity.
Purpose of data:	Data used for Project Emission calculation.
Additional comment:	

Data / Parameter:	**$NCV_{NG,y}$**
Unit:	MJ/Nm^3
Description:	Net Calorific Value of NG
Measured/ Calculated / Default:	Weighted average value calculated was applied for emission reduction calculation.
Source of data:	Specific value on natural gas resource, provided by the Petro China Company Ltd.
Value(s) of monitored parameter:	34.11
Monitoring equipment:	On-line Gas Chromatograph of Petro China Company. Type：BTU-8000 Serial number: 100839 Calibration frequency: every 1yr Last calibration date: 28/05/2010 and 26/05/2011 Validity: 27/05/2011 and 25/05/2012 Calibration entity: National Institute of Metrology of P. R. China
Measuring/ Reading/ Recording frequen y:	The NCV value were measured continuously, read daily, and recorded every ten days.
Calculation method (if applicable):	Weighted average value of every ten days NCV values
QA/QC procedures:	The value of NCV was measured by the gas chromatography analyzer on-line, which has been record by the China National Petroleum Corporation (Gas supplier), and then provided to the project owner. The calibration and testing for on-line gas chromatography analyer was carried out once a year by the qualified measurement technology verification institution authorized by National Institute of Metrology of P.R. China. The calibration results showed that the Gas Chromatograph runs OK. All the electronic and paper documents will be archived during the crediting period and two years after the end of the crediting period or the last issuance of CERs for this project activity.
Purpose of data:	Data used for Project Emission calculation.

Additional comment:	

Data / Parameter:	**$OXID_{NG}$**
Unit:	None
Description:	Oxidation factor of the Natural gas
Measured/ Calculated / Default:	Default
Source of data:	"2006 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2 Energy, Chapter 1, Table 1.4, Page 1.24
Value(s) of monitored parameter:	1.00 for gas
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	
Purpose of data:	Data used for Project Emission calculation.
Additional comment:	

Data / Parameter:	**$EF_{CO2,NG,y}$**
Unit:	tCO_2/GJ
Description:	CO_2 emission factor per unit of energy of natural gas
Measured/ Calculated / Default:	Default
Source of data:	Determined by National data which is cited from 2006 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2 Energy, Chapter I, Table1.4 in Page 1.24.[1]

[1] The project owner had sent a letter to the Gas supplier (China National Petroleum Corporation) on 12/02/2010 requiring them to provide the $EF_{CO2,NG}$ value, and the Gas supplier had replied this letter. But according to the letter from supplier, the value is unavailable and cannot be provided by gas supplier. Therefore, according to PDD, the country value of 15.3tC/TJ (i.e. 0.0561tCO2/GJ)[6] which sourced from IPCC default value has been applied here.

Value(s) of monitored parameter:	0.0561
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Unit conversion: $EF_{CO2,NG,y}$ = 15.30tC/TJ×44/12/1000 = 0.0561 tCO_2/GJ
QA/QC procedures:	During implementing verification period for the project, the latest IPCC-value is applied.
Purpose of data:	Data used for $COEF_{NG,y}$, calculation
Additional comment:	

Data / Parameter:	**$COEF_{NG,y,}$**
Unit:	tCO_2/Nm^3
Description:	CO_2 emission coefficient in year y for natural gas
Measured/ Calculated / Default:	Calculated
Source of data:	
Value(s) of monitored parameter:	See ER Calculation Excel Table
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	$COEF_{NG,y} = NCV_{NG,y} * EF_{CO2,NG,y} * OXID_{NG}$
QA/QC procedures:	

Purpose of data:	Data used for Project Emission calculation.
Additional comment:	

Data / Parameter:	**PE_y**
Unit:	tCO_2e
Description:	CO_2 emissions from the power plant of the project due to combustion of natural gas fuel in y year.
Measured/ Calculated / Default:	Calculated
Source of data:	
Value(s) of monitored parameter:	881,166,601
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	$PE_y = FC_{NG,y} * COEF_{NG,y}$ $COEF_{NG,y} = NCV_{NG,y} * EF_{CO2,NG,y} * OXID_{NG}$
QA/QC procedures:	
Purpose of data:	Data used for Project Emission calculation.
Additional comment:	

Data / Parameter:	**$EG_{pj,y}$ (Gateway meter No.1 and meter No.3)**		
Unit:	MWh		
Description:	The net electricity delivered by the project activity, measured by the meter No.1 and meter No.3.		
Measured/ Calculated / Default:	Measured		
Source of data:	Reading at project boundary by electricity energy meter with bidirectional reading function, and the electricity purchase receipt from the power grid company		
Value(s) of monitored parameter:	2,347,518.06		
Monitoring			

equipment:		Electricity meter No.1	Electricity meter No.3
	Type	WU.TE432S	SL7000
	Accuracy class	0.2s	
	Serial number	18450580	33049113
	Calibration frequency	1 year	
	Calibration date	12/01/2011, 10/04/2011, 08/07/2011, and 06/10/2011	12/01/2011, 10/04/2011, 08/07/2011 and 06/10/2011
	Validity	11/04/2011, 09/07/2011 and 07/10/2011, 05/01/2012	11/04/2011, 09/07/2011, 07/10/2011 and 05/01/2012
	Calibration entity	Henan Province Research Institute	
Measuring/ Reading/ Recording frequency:	Measuring frequency: continuously Recording frequency: daily and monthly record.		
Calculation method (if applicable):	Net electricity supplied is calculated as exported electricity measured by meter No.1 minus imported electricity measured by meter No.1, then minus the imported electricity measured by meter No.3		
QA/QC procedures:	The electricity output was monitored and recorded at the on-site computer control centre. The record of electricity delivered and the receipt of the electricity purchase was cross-checked by both the project owner and the power grid company. All the electricity meters (meter No.1, meter No.2 and meter No.3) have been calibrated once a year by a qualified third party. All the electronic and paper documents will be archived during the crediting period and two years after the end of the crediting period or the last issuance of CERs for this project activity.		
Purpose of data:	Data used for Baseline Emission calculation.		
Additional comment:			

Data / Parameter:	**m**
Unit:	
Description:	A sample group m including recent capacity additions in the CCPG that comprise 20% of the total installed capacity in year 2011 and 2012.
Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table

Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**$F_{i,j,y}$**
Unit:	t or Nm^3
Description:	Fossil fuel i consumption in year y for electricity generation in province j which is covered under CCPG. Used for calculation of λ_i and $EF_{BM,y}$
Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table
Monitoring equipmen :	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	

QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**$COEF_{i,j}$**
Unit:	tCO_2/t or Nm_3
Description:	The CO_2 emission factor for fuel type i in Province j, taking into account the carbon content of the fuels used and the percent oxidation of the fuel. Used for calculation of λ_i and $EF_{BM,y}$
Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**λ_{Coal}, λ_{Oil}, λ_{Gas}**
Unit:	
Description:	The ratio λ_i of the CO_2 emissions from solid (coal), liquid (oil) and gas fuels consumed for power generation to the CO_2 emissions from total thermal power generation under CCPG.
Measured/ Calculated / Default:	Default

Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**$EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$**
Unit:	tCO_2/MWh
Description:	The emission factors in line with the efficiency level of the best technology commercially available in China's power grid for each fuel type as coal, oil and gas respectively.
Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table
Monitoring equipment:	

Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**$EF_{Thermal}$**
Unit:	tCO_2/MWh
Description:	The weighted averaged emission factor $EF_{Thermal}$ of the thermal power capacity under CCPG.
Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**CAP_{Total}**
Unit:	MW
Description:	The total capacity addition of CCPG in year 2007, 2008, 2009 and 2010.

Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**$CAP_{Thermal}$**
Unit:	MW
Description:	The capacity addition by thermal power of CCPG in year 2007, 2008, 2009 and 2010.
Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table

Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

Data / Parameter:	**$EF_{grid,BM,y}$**
Unit:	tCO_2e/MWh
Description:	Build marginal emission factor of the CCPG during the project operation period
Measured/ Calculated / Default:	Default
Source of data:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3545&TId=3 http://cdm.ccchina.gov.cn/Detail.aspx?newsId=3553&TId=3
Value(s) of monitored parameter:	See ER Calculation Table
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	

QA/QC procedures:	According to registered PDD, the latest value available at the DNA website of the crediting year has been used for the calculation.
Purpose of data:	Data used for Baseline Emission calculation.
Additional comment:	

D.3. Implementation of sampling plan

>>

Not applicable.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

Baseline Emissions

According to the registered PDD, Baseline emissions are given as:

$BE_y = EG_{pj,y} * EF_{BL,CO2,y}$

Where:

$EG_{PJ,y}$： Net amount of electricity generated by the project and sold into CCPG (MWh). The monitored data is listed in Section Annex 1 of this monitoring report.

$EF_{BL,CO2,y}$: As mentioned in PDD, $EF_{BL,CO2} = \min(EF_{grid,BM,y}, EF_{grid,CM,y}, EF_{BL,CO2,Option3\ EF})$

$EF_{grid,BM,y}$ is selected as the baseline emission factor of CCPG, which is ex-post calculated and updated.

Calculation of $EF_{BL,CO2,y}$ of CCPG in this monitoring period.

Step a: calculate the proportion λ_i of the CO_2 emissions of solid, liquid and gas fuel type consumed for power generation to the total CO_2 emissions from the total thermal power generation.

$$\lambda_{Coal} = \frac{\sum_{i \in coal,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

$$\lambda_{oil} = \frac{\sum_{i \in oil,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

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

Where:

$F_{i,j,y}$	= the amount of fuel i (in unit t or Nm^3) consumed by relevant power sources in provincial grid j in year y;
$COEF_{i,j,y}$	= the CO_2 emission coefficient of fuel i (tCO_2 /t or Nm^3), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y.

In this monitoring period, the details are as follow:

Parameter	Value
λ_{Coal}	97.66%
λ_{Oil}	0.13%
λ_{Gas}	2.21%

For the detailed information, please see the 2344 5th CER Calculation Sheet.xls.

Step b: calculate the emission factor $EF_{Thermal}$ of the corresponding thermal power:

According to the formula: $EF_{Thermal} = \lambda_{Coal} \times EF_{CH4,Coal,Adv} + \lambda_{Oil} \times EF_{CH4,Oil,Adv} + \lambda_{Gas} \times EF_{CH4,Gas,Adv}$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are the emission factors in line with the efficiency level of the best technology commercially available (tCO_2e/MWh) in China's power grid for each fuel type respectively.

The most advanced and commercially available coal power technology in China in 2009 is 600MW sub-critical unit with power supply coal consumption of 311.5gce/kWh, which is equivalent to a power supply efficiency of 39.45%.

And the best oil and gas fired power technology commercially available in China's power grid is defined as 200 MW combined cycle unit (the efficiency level technology is equivalent to the 9E type unit of GE Company) with power supply coal consumption of 237.4gce/kWh, which is equivalent to a power supply efficiency of 51.77%.

The detail data is listed in below table:

	Variable	Power Supply Efficiency	Emission Factor for Fuels ($kgCO_2/TJ$)	Emission Factor (tCO_2e/MWh) O=3.6/L/1,000,000×I
Coal-fired Power Plant	$EF_{Coal,Adv}$	39.45%	87,300	0.7967
Gas-fired Power Plant	$EF_{Gas,Adv}$	51.77%	75,500	0.5250
Oil-fired Power Plant	$EF_{Oil,Adv}$	51.77%	54,300	0.3776

In this monitoring period,

$EF_{Thermal} = 97.66\% \times 0.7967 + 0.13\% \times 0.5250 + 2.21\% \times 0.3776 = 0.7870\ tCO_2e/MWh$

Step c: calculate the $EF_{grid,BM,y}$ of the grid:

$$EF_{Grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$

Where:

CAP_{Total} is the total new capacity addition (MW),

$CAP_{Thermal}$ is the new capacity addition of thermal power plants (MW).

The share of thermal power of recent capacity addition is 53.25% (See 2344 5th CER Calculation Sheet.xls for details), thus, the

Build Margin emission factor ($EF_{grid,BM,y}$) of this monitoring period is calculated as:

$$EF_{Grid,BM,2011} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} = 53.25\% \times 0.7870 = 0.4191 tCO_2e / MWh$$

Thus, BE_y is calculated as:

$BE_{2011} = EG_{pj,2011} * EF_{BL,CO2,2011} = EG_{pj,2011} * EF_{grid,BM,2011} = = 2,347,518.06 \times 0.4191 = 983,786.339\ (tCO_2e)$

E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

Project Emissions

According to section 6.1 of the registered PDD, Project Emissions are given as:

$PE_y=FC_{NG,y} \times COEF_{NG,y}$

Where

$FC_{NG,y}$: the total volume of NG combusted (Nm^3) during this monitoring period. The monitored data is listed in Annex 1 of this monitoring report.

$COEF_{NG,y}$: the CO_2 emission coefficient (tCO_2/Nm^3) during this monitoring period for NG, which is calculated as follows:

$COEF_{NG,y} = NCV_{NG,y} \times EF_{CO2,NG,y} \times OXID_{NG}$

Where:

$NCV_{NG,y}$: the net calorific value (energy content) per volume unit of NG during this monitoring period (GJ/Nm^3) as provided by the fuel supplier.

$EF_{CO2,NG,y}$: the CO_2 emission factor per unit of energy value of NG in this monitoring period . It was determined by national data which is cited from the updated edition of IPCC 2006, page 24 according to the registered PDD. The $EF_{CO2,NG,y}$ is $0.0561tCO_2e/GJ$

$OXID_{NG}$: the IPCC default value 100% is used according to the registered PDD.

The every month's weighted averaged $NCV_{NG,y}$ value of this monitoring period are listed as follow:

Period	**01/04/2011-30/04/2011**	**01/05/2011-31/05/2011**	**01/06/2011-30/06/2011**	**01/07/2011-31/07/2011**
$NCV_{NG,y}$ (MJ/Nm^3)	34.15	34.20	34.02	34.14
Period	**01/08/2011-31/08/2011**	**01/09/2011-30/09/2011**	**01/10/2011-31/10/2011**	**01/11/2011-30/11/2011**
$NCV_{NG,y}$ (MJ/Nm^3)	33.99	34.38	33.92	34.10

For the every month's Project Emission and the total Project Emission during this monitoring period, please refer to the table below.

Period	**$NCV_{NG,y}$**	**$EF_{CO2,NG,Y}$**	**$OXID_{NG}$**	**$COEF_{NG,y}$**	**$PE_y = FC_{NG,y} \times COEF_{NG,y}$**
	MJ/Nm^3	**tCO_2e/GJ**	**-**	**tCO_2/Nm^3**	**tCO_2e**
01/04/2011-30/04/2011	34.148028	0.0561	1	0.00192	132,000.675
01/05/2011-31/05/2011	34.195365	0.0561	1	0.00192	175,477.820
01/06/2011-30/06/2011	34.020348	0.0561	1	0.00191	151,650.938
01/07/2011-31/07/2011	34.140372	0.0561	1	0.00192	183,791.738
01/08/2011-31/08/2011	33.993354	0.0561	1	0.00191	73,060.803
01/09/2011-30/09/2011	34.378005	0.0561	1	0.00193	40,713.769
01/10/2011-31/10/2011	33.924633	0.0561	1	0.00190	38,877.326
01/11/2011-30/11/2011	34.097080	0.0561	1	0.00191	85,593.532
Total					**881,166.601**

E.3. Calculation of leakage

>>

As mentioned in PDD, Leakage may result from upstream processes of fossil fuels outside of the project boundary. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring. In line with AM0029 version 03, as no LNG is used in the project plant, only leakage emissions from using natural gas ($LE_{CH4,y}$) are considered, which can be calculated based on following steps as mentioned in the PDD:

$Step_{CH4}$ a): calculate the weight proportion $\lambda_{k,CH4}$ which is defined as the ratio of the upstream CH_4 emissions associated with solid, liquid and gas fuel type consumed for power generation respectively to the total upstream CH_4 emissions for the total thermal power generation in the grid.

$$\lambda_{Coal,CH4} = \frac{\sum_{k \in coal,j} F_{k,j,y} \times COEF_{k,j,CH4}}{\sum_{k,j} F_{k,j,y} \times COEF_{k,j,CH4}}$$

$$\lambda_{Oil,CH4} = \frac{\sum_{k \in Oil,j} F_{k,j,y} \times COEF_{k,j,CH4}}{\sum_{k,j} F_{k,j,y} \times COEF_{k,j,CH4}}$$

$$\lambda_{GAS,CH4} = \frac{\sum_{k \in GAS,j} F_{k,j,y} \times COEF_{k,j,CH4}}{\sum_{k,j} F_{k,j,y} \times COEF_{k,j,CH4}}$$

where:

$F_{k,i,y}$: the amount of k type fuel (in unit t or Nm^3) consumed by relevant electric power sources in provincial grid j in year y,

$COEF_{k,i,CH4}$: the upstream fugitive CH_4 emission coefficient of k type fuel (tCH_4/TJ) used by relevant power sources in provincial grid j

In this monitoring period, $\lambda_{Coal,CH4}$ =97.37%, $\lambda_{Oil,CH4}$ =0.00%, $\lambda_{Gas,CH4}$ =2.62%.

$Step_{CH4}$ b: calculate the weighted averaged upstream fugitive CH_4 emission factor for the thermal electric power (tCH_4/MWh), $EF_{Thermal,Upstream,CH4}$:

$EF_{Thermal,Upstream,CH4} = \lambda_{Coal,CH4} \times EF_{Coal,Adv,CH4} + \lambda_{Oil,CH4} \times EF_{Oil,Adv,CH4} + \lambda_{Gas,CH4} \times EF_{Gas,Adv,CH4}$

Where:

$EF_{Coal,Adv,CH4}$, $EF_{Oil,Adv,CH4}$ and $EF_{Gas,Adv,CH4}$ are the upstream fugitive CH_4 emission factors in line with the efficiency level of the best power technology commercially available (tCO_2/MWh) in China's power grid for each fuel type respectively.

The $EF_{Coal,Adv,CH4}$, $EF_{Oil,Adv,CH4}$ and $EF_{Gas,Adv,CH4}$ value for this monitoring period are listed as follow:

Type of Power Plant	Variable	Oxidation	Efficiency of Power Supply	Fugitive Methane Emission Factor of the Fuel (tCH_4/TJ)	Fugitive Methane Emission Factor (tCO_2/MWh)
Coal-Fired Power Plant	$EF_{Coal,Adv,CH4}$	1	39.45%	0.6462	0.0059
Oil-Fired Power Plant	$EF_{Oil,Adv,CH4}$	1	51.77%	0.0041	0.0000
Gas-Fired Power Plant	$EF_{Gas,Adv,CH4}$	1	51.77%	0.2960	0.0021

So, $EF_{Thermal,Upstream,CH4}$=97.37%×0.0059+0.00%×0.0000 +2.62%×0.0021=0.00579576 tCH_4/MWh

$Step_{CH4}$ c: Calculate the $EF_{BL,upstream,CH4}$ in the context of CCPG grid BM (tCH_4/MWh):

$$EF_{BL,Upstream,CH4} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal,Upstream,CH4}$$

Here CAP_{Total} is the total recent capacity addition (MW); $CAP_{Thermal}$ is the recent capacity addition of thermal power plants within the CCPG grid BM sample group m (MW).

For this monitoring period,

$EF_{BL,upstream,CH4}$ = 53.25%×0.00579576 tCH_4/MWh =0.00308600 tCH_4/MWh

To estimate the fugitive methane emissions, one can multiply the NG quantity consumed by the project in year y with an emission factor for fugitive CH_4 emissions ($EF_{NG,upstream,CH4}$) due to NG consumption and subtract the fugitive CH_4 emissions occurring from fossil fuels used in the selected baseline power plant in the absence of the project activity, as follows:

$$LE_{CH4,y} = \left[FC_y \times NCV_{NG,y} \times EF_{NG,upstream,CH4} - EG_{PJ,y} \times EF_{BL,upstream,CH4} \right] \times GWP_{CH4}$$

Where:

$LE_{CH4,y}$: Leakage emissions due to fugitive upstream CH_4 emissions in the year y in tCO_2e.

FC_y: Total volume of NG combusted (Nm^3) during this monitoring period.

$NCV_{NG,y}$: Net calorific value of NG (GJ/ Nm^3), which is determined by the fuel supplier.

$EF_{NG,upstream,CH4}$: Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, in tCH^4/ GJ.

$EG_{PJ,y}$: Electricity generation in the project plant during this monitoring period in MWh.

$EF_{BL,upstream,CH4}$: The emission factor determined in $step_{CH4}$ c above for upstream fugitive methane emission occurring in the absence of the project activity in tCH_4/MWh.

GWP_{CH4}: Global warming potential of methane valid for the relevant commitment period, and the value is 21 tCO_2e/tCH_4.

The $EF_{NG,upstream,CH4}$, $EF_{BL,upstream,CH4}$, and GWP_{CH4} values for calculation the parameter $LE_{CH4,y}$ in this monitoring period are listed as follow:

$EF_{NG,upstream,CH4}$ = 0.000296 tCH_4/ GJ

$EF_{BL,upstream,CH4}$ = 0.00308600 tCH_4/MWh

GWP_{CH4} = 21 tCO_2e/tCH_4

For this monitoring period, LECH4,y= -58,497.89(tCO2e), which is a negative value. According to AM0029 version 3, the value of leakage is assumed as 0, i.e., LEy = 0.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

The emission reductions of the proposed project can be calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y: emission reduction during this monitoring period (tCO_2e).
BE_y: emission in the baseline scenario during this monitoring period (tCO_2e).
PE_y: emission in the project activity during this monitoring period (tCO_2e).
LE_y: leakage emission during this monitoring period (tCO_2e).

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)

Total	983,786.339	881,166.601	0	102,619

Therefore, the total amount of emission reductions for the project during this monitoring period is calculated as 102,619 (tCO_2e).

More calculation details are listed in Annex 1

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks ($t CO_2e$)	858,165	157,500

The annual emission reduction estimated in the registered CDM-PDD is 858,165tCO_2e/y. The comparison of the actual emission reduction during the whole year during 01/12/2010 to 30/11/2011, with that estimated in the CDM-PDD was shown in the table below. The result showed that the actual emission reduction achieved during this period is less than that estimated in the CDM-PDD by 81.65%[2]

The comparison of the actual emission reduction during this monitoring period (**Fehler! Verweisquelle konnte nicht gefunden werden.**, both days included) with that estimated in the CDM-PDD was shown in the table below. The result showed that the actual emission reduction achieved during this monitoring period is less than that estimated in the CDM-PDD by 82.11%[3].

The PLF during this period (**Fehler! Verweisquelle konnte nicht gefunden werden.**) is calculated as: 2,347,518.06/ (2×377.2)/(244×24)=53.14%, which is more than the value of 39.1% indicated in the registered PDD.

In the first half year of 2011, a power supply shortage took place in china due to the following reasons [4]

1) the water-flow of most rivers is less than the normal year, thus the operation condition of hydropower stations are poorer than normal year;
2) Supply of coal used for power generation was insufficient, thus the operation condition is poorer than before.

In order to meet the power demand and mitigate the shortage of power supply, the local power grid required the project owner to increase the power generation during this period. Meantime, there is an adequate supply of natural gas which can meet the demand of the power plant for generation. This is why the PLF during this monitoring period is much higher than the value in registered PDD.

E.6. Remarks on difference from estimated value in registered PDD

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The emission reduction during this monitoring period is lower than estimated in the PDD. No increase occurred. So no remarks are needed.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

[2] The whole year monitoring period (from 01/12/2010-30/11/2011, both days included) is 365 days. The actual CERs is 157,500tCO_2e, which is less than that estimated in the CDM-PDD (858,165tCO_2e) by 81.65%, calculated as :(858,165-157,500)/ 858,165×100%=81.65%.

[3] This monitoring period (from 01/04/2011-30/11/2011, both days included) is 244 days. The actual CERs is 102,619 tCO_2e, which is less than that estimated in the CDM-PDD (573,677 tCO_2 for 244 days) by 82.11% , calculated as :(573,677-102,619)/ 573,677×100%=82.11%.

[4] Please see the website: http://www.sdpc.gov.cn/jjxsfx/t20110729_426321.htm

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	102,619	0

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Document information

Version	*Date*	*Description*
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: issuance
Keywords: monitoring report, performance monitoring

Annex 1 Calculation of GHG emission reductions

Summary of the emissions reductions during the monitoring period (Cont):

		Baseline Emission			**Project Emission**						**LE**				
Period	Emission Reduction	$EG_{pj,y}$ MWh	$EF_{grid,BM,y}$ tCO_2e/MWh	$BE_y=EG_{pj,y} \times EF_{grid,BM,y}$ tCO_2e	$FC_{NG,y}$	$NCV_{NG,y}$	$EF_{CO2,NG,y}$	$OXID_{NG}$	$COEF_{NG,y}$	$PE_y = FC_{NG,y} \times COEF_{NG,y}$	$EF_{NG,upstream,CH4}$	$EF_{BL,upstream,CH4}$	GWP_{CH4}	LE_{CH4}	LE_y tCO_2e
					Nm^3	MJ/Nm^3	tCO_2/GJ		tCO_2e/Nm^3	tCO_2e	tCH_4/GJ	tCH_4/MWh	tCO_2e/tCH_4	tCO_2e	
		A	**B**	**C=A×B**	**D**	**E**	**F**	**G**	**H=E×F×G/10^3**	**I=H×D**	**J**	**K**	**L**	**M=[D×E×J/1000-A×K]×L**	**N**
01/04/11 - 30/04/11	16,331.917	353,952.30	0.4191	148,332.591	68,904,512	34.148028	0.0561	1	0.00192	132,000.675	0.000296	0.0030858	21	-8310.498	0.000
01/05/11 - 31/05/11	24,243.666	476,576.85	0.4191	199,721.486	91,472,832	34.195365	0.0561	1	0.00192	175,477.820	0.000296	0.0030858	21	-11439.327	0.000
01/06/11 - 30/06/11	19,143.428	407,550.75	0.4191	170,794.367	79,459,072	34.020348	0.0561	1	0.00191	151,650.938	0.000296	0.0030858	21	-9606.438	0.000
01/07/11 - 31/07/11	23,460.590	494,547.00	0.4191	207,252.328	95,961,024	34.140372	0.0561	1	0.00192	183,791.738	0.000296	0.0030858	21	-11682.611	0.000
01/08/11 - 31/08/11	8,182.589	193,863.57	0.4191	81,243.393	38,311,360	33.993354	0.0561	1	0.00191	73,060.803	0.000296	0.0030858	21	-4467.255	0.000
01/09/11 - 30/09/11	4,092.834	106,917.84	0.4191	44,806.603	21,110,464	34.378005	0.0561	1	0.00193	40,713.769	0.000296	0.0030858	21	-2417.208	0.000
01/10/11 - 31/10/11	510.976	93,988.65	0.4191	39,388.302	20,427,648	33.924633	0.0561	1	0.00190	38,877.326	0.000296	0.0030858	21	-1782.865	0.000
01/11/11 - 30/11/11	6,653.738	220,121.10	0.4191	92,247.269	44,746,688	34.097080	0.0561	1	0.00191	85,593.532	0.000296	0.0030858	21	-4780.116	0.000
Total	**102,619.00**	**2,347,518.06**		**983,786.339**	**460,393,600**					**881,166.601**				**-54,486.32**	**0.00**

Annex 2 The calculation of $EF_{grid,BM,y}$ of CCPG in the fourth monitoring period

Table 1 Percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Average Low Calorific Value	Emission Factor (tC/TJ)	Oxidation	CO_2 Emission (tCO_2e)
Fuel	**Unit**	**A**	**B**	**C**	**D**	**E**	**F**	**G=A+…+F**	**H**	**I**	**J**	**K=G×H×I×J/100000**
Raw Coal	10^4 t	2,184.31	9,339.64	2,888.29	2,810.69	1,413.64	2,817.31	**21,453.88**	20,908	87,300	1	391,590,892
Cleaned Coal	10^4 t	0.00	3.35	0.00	0.00	0.00	0.00	**3.35**	26,344	87,300	1	77,044
Other Washed Coal	10^4 t	0.00	59.93	0.00	0.00	136.75	97.94	**294.62**	8,363	87,300	1	2,150,991
Briquette	10^4 t	0.00	0.00	0.00	2.63	0.00	0.00	**2.63**	20,908	87,300	1	48,005
Coke	10^4 t	0.00	1.08	0.06	0.09	0.00	0.00	**1.23**	28,435	95,700	1	33,471
Other Coke product	10^4 t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	28,435	95,700	1	0
Subtotal												**393,900,403**
λ_{Coal}												**λ_{Coal} = 97.67%**
Crude Oil	10^4 t	0.00	0.10	0.00	0.00	0.00	0.00	**0.10**	41,816	71,100	1	2,973
Gasoline	10^4 t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	43,070	67,500	1	0
Diesel	10^4 t	0.69	4.28	1.23	1.55	1.19	0.00	**8.94**	42,652	72,600	1	276,830
Fuel Oil	10^4 t	0.02	1.44	0.48	1.27	0.06	4.00	**7.27**	41,816	75,500	1	229,522
Other Petroleum product	10^4 t	0.00	0.00	0.29	0.00	0.00	0.00	**0.29**	41,816	72,200	1	8,755
Subtotal												**518,081**
λ_{Oil}												**λ_{Oil} = 0.13%**
Natural Gas	10^7 Nm^3	0.00	76.90	2.70	0.00	1.40	218.40	**299.4**	38,931	54,300	1	6,329,176
Coke Oven Gas	10^7 Nm^3	0.90	60.40	12.00	0.00	10.30	0.00	**83.6**	16,726	37,300	1	521,564
Other Gas	10^7 Nm^3	307.60	566.40	0.00	42.30	75.70	0.00	**992**	5,227	37,300	1	1,934,074

LPG	10^4 t	0.00	0.00	0.00	0.00	0.00	0.00	**0**	50,179	61,600	1	0
Refinery Gas	10^4 t	0.25	2.18	0.82	1.91	0.00	0.00	**5.16**	46,055	48,200	1	114,544
Subtotal												**8,899,358**
λ_{Gas}												**λ_{Gas} = 2.21%**
Total												**403,317,841**

The percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions are calculated as:

λ_{Coal} = 97.67%，λ_{Oil} = 0.13%，λ_{Gas} =2.21%

Table 2 Installed Capacity of CCPG in 2009

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	11,500	43,100	15,670	15,900	6,800	12,270	105,240
Hydropower plant	MW	3,770	3,650	30,010	11,460	4,530	25,810	79,230
Nuclear plant	MW	0	0	0	0	0	0	0
Wind plant and other	MW	60	50	10	2	10	0	132
Total	MW	15,330	46,800	45,690	27,362	11,340	38,080	184,602

Data Source: China Electric Power Yearbook 2010

Table 3 Installed Capacity of CCPG in 2008

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	9,340	42,680	14,210	14,430	6,660	12,770	100,090
Hydropower plant	MW	3,710	3,020	29,050	10,650	4,060	22,240	72,730
Nuclear plant	MW	0	0	0	0	0	0	0
Wind plant and other	MW	30	30	10	0	0	0	70
Total	MW	13,080	45,730	43,270	25,080	10,720	35,010	172,890

Data Source: China Electric Power Yearbook 2009

Table 4 Installed Capacity of CCPG in 2007

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	9,270	38,540	13,040	13,360	6,370	12,000	92,580
Hydropower plant	MW	3,570	2,740	24,020	9,220	2,240	19,860	61,650
Nuclear plant	MW	0	0	0	0	0	0	0
Wind plant and other	MW	0	0	10	17	24	0	51
Total	MW	12,840	41,280	37,070	22,597	8,634	31,860	154,281

Data Source: China Electric Power Yearbook 2008

Table 5 Building Emission Calculation of CCPG

	2007	2008	2009	New Capacity Additions from Year 2007-2009	New Capacity Additions from Year 2008-2009	Percentage to the newly installed capacity
	A	B	C	D= C-A	E= C-B	F
Thermal plant (MW)	92,580	100,090	105,240	20,280	10,467.5	**53.25%**
Hydropower plant (MW)	61,650	72,730	79,230	17,727	6,500	46.54%
Nuclear plant (MW)	0	0	0	0	0	0.00%
Wind plant & Others (MW)	51	70	132	81	62	0.21%
Total（MW）	154,281	172,890	184,602	38,088.3	17,029.5	100.00%
Percentage of newly added installed Capacity to 2009				20.63%	9.22%	

Table 6 Calculation parameter of BM

	Parameter	Efficiency of Power Supply	Emission Factor of Fuel (tc/TJ)	Oxidation Factor	Emission Factor (tCO_2e/MWh)
Coal-fired Power Plant	$EF_{Coal,Adv}$	39.45	87,300	100%	0.7967
Oil-fired Power Plant	$EF_{Oil,Adv}$	51.77	75,500	100%	0.5250
Gas-fired Power Plant	$EF_{Gas,Adv}$	51.77	54,300	100%	0.3776

λ_{Coal} = 97.67%， λ_{Oil} = 0.13%， λ_{Gas} = 2.21%

According to registered PDD, $EF_{Thermal,adv} = \lambda_{Coal} \times EF_{Coal.\ Adv} + \lambda_{Oil} \times EF_{Oil.Adv} + \lambda_{Gas} \times EF_{Gas.\ Adv}$

Thus, $EF_{thermal,adv}$ = 97.67% × 0.7967 + 0.13% × 0.5250 +2.21% × 0.3776 = 0.7871 tCO_2e/MWh

Then, $EF_{grid,BM,y}$ = 56.97% × $EF_{Thermal,adv}$ =53.25% × 0.7871 = **0.4191** tCO_2e/MWh.