CER Monitoring Report

(Version 2)

Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China

(First periodic verification, Registration Reference No. 2344)

Monitoring period

25/08/2009 ~ 28/02/2010

Date of monitoring report: 25/05/2010

Contents

SECTION A. General Project Activity Information

A.1. Short description of the project activity:

As described in the PDD, the proposed 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. The proposed project was commissioned in June 2007 as described in the registered PDD.

Implementation status and comparison of the actual emission reduction claimed in the monitoring period with the estimate in the registered PDD, and explanation on any significant increase:

During this monitoring period (25/08/2009 to 28/02/2010 i.e. 188 days), the project has been operated properly without abnormal situations. The Plant Load Factor (PLF) of the proposed project during this monitoring period is 0.212[1], which is lower than the value 0.391[2] in the registered PDD. Also, the actual emission factor is lower than the one estimated in the PDD. Thus, there was no significant increase of the actual emission reductions in this monitoring period compared to the estimated figure in the registered PDD.

A.2. Methodology applied to the project activity for the current period:

As described in PDD, the project activity uses the approved methodology AM0029 titled "**Methodology for Grid Connected Electricity Generation Plants using Natural Gas"** (Version 03) and the "**Tool to Calculate the Emission Factor for an Electricity System**" (Version 01).

A.3. Calculation Methodology (Including Secondary Effects/Leakage)

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

[1] Calculate as: PLF [during p1]=(720,909/(2*377.2))/(188*24)

[2] Calculate as: PLF [pdd] =(2,584,423/(2*377.2))/(365*24)

***$FC_{NG,y}$*:** the total volume of NG combusted (Nm^3) during this monitoring period[3]. The monitored data is listed in Section D 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/m^3) as provided by the fuel supplier[4]. The monitored data is listed in Section D of this monitoring report.

$EF_{CO2,NG,y}$* :** 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 15.3tC/TJ

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

During this monitoring period, the diesel back-up generators have not been used as no emergency situation occurred. However, 78.5 liters have been used for no-load running tests during this monitoring period. The emissions are calculated as 0.0213 tCO_2 by using the China Energy Statistical Yearbook and IPCC2006 upper values of diesel:

- net calorific value of diesel in China Energy Statistical Yearbook is 42,652 kJ/kg,
- default carbon content of diesel in IPCC default values at the upper limit of the uncertainty at a 95% confidence interval is 20.4 tC/TJ,
- oxidation factor of diesel is 100%.

thus the emissions due to diesel consumption are calculated as 66.7*42652/1000000000*20.4*100%*44/12=0.213 tCO2.

This amount is equal to 0.000152% of baseline emission reductions and thus neglected.

Baseline Emissions

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

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

Where:

[3] N m^3 means volume unit (m^3) measured under the Normal condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure)

[4] Measured by volume under the normal condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure)

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

$EF_{BL,CO2,y}$: As mentioned in PDD, $EF_{BL,CO_2} = \min(EF_{grid,BM,y}, EF_{grid,CM,y}, EF_{BL,CO_2,Option3})$, so $EF_{grid,BM,y}$ 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	Reference
λ_{Coal}	99.13%	See section E
λ_{oil}	0.13%	See section E
λ_{gas}	0.74%	See section E

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

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

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 in China's power grid for each fuel type respectively.

The most advanced and commercially available coal power technology in China in 2007 is 600MW sub-critical unit with power supply coal consumption of 322.5 gce/kWh, which is equivalent to a power supply efficiency of 38.10%.

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 246 gce/kWh, which is equivalent to a power supply efficiency of 49.99%.

The detail data is listed in below table:

	Variable	**Power Supply Efficiency L**	**Emission Factor for Fuels ($kgCO_2/TJ$) I**	**Emission Factor (tCO_2e/MWh) O=3.6/L/1,000,000*I**
Coal-fired Power Plant	$EF_{Coal,Adv}$	38.10%	87,300	0.8249
Gas-fired Power Plant	$EF_{Gas,Adv}$	49.99%	75,500	0.5437
Oil-fired Power Plant	$EF_{Oil,Adv}$	49.99%	54,300	0.3910

In this monitoring period,

$EF_{Thermal}$ = 99.13% * 0.8249 + 0.13% * 0.5437+ 0.74% * 0.3910 = 0.8213 tCO_2e/MWh

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

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

Where:

$\boldsymbol{CAP_{Total}}$ is the total new capacity addition,

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

In this monitoring period,

$$EF_{Grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} = 70.64\% * 0.8213 = 0.5802 \text{ tCO}_2\text{e/MWh}.$$

Details as follow:

Parameter	Data unit	Value	Reference
$EF_{BL,BM,y}$	tCO_2e/MWh		**Calculated**
$CAP_{Thermal}$ /CAP_{Total}	--	70.64% *	See details in Section E
$EF_{Thermal}$	tCO_2e/MWh	0.8213	**Calculated according to latest updated data from China DNA (**http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf**)**

Leakage Emissions

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:

$F_{k,j,y}$: 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,

$Coef_{k,j,CH4}$: the upstream fugitive CH_4 emission coefficient of k type fuel (tCH_4/TJ) used by

relevant power sources in provincial grid *j*,

Step$_{CH4}$ b: calculate the weighted averaged upstream fugitive CH_4 emission factor for the thermal electric power, $EF_{Thermal,\ Upstream,CH4}$:

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

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 in China's power grid for each fuel type respectively.

Step$_{CH4}$ c: Calculate the $\boldsymbol{EF_{BL,upstream,CH4}}$ in the context of CCPG grid BM:

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

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

More calculation details can be found in Section D: Emission Reduction calculation

To estimated 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:

$$LE_{CH_4,y} = \left[FC_y \times NCV_y \times EF_{NG,upstream,CH4} - EGG_{PJ,y} \times EF_{BL,upstream,CH4}\right] \times 21$$

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. The value is 85,314,014 for this monitoring period.

$NCV_{NG,y}$: Net calorific value of NG (GJ/ Nm^3), which is determined by the fuel supplier. The value is 0.03403312, which is the weighted average value for this monitoring period.

$EF_{NG,upstream,CH4}$: Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, in tCH_4/ Nm^3. Default value of 296 has been applied for area of China[5] for this monitoring period as mentioned in the PDD.

$EGG_{PJ,y}$: Electricity generation in the project plant during this monitoring period in MWh. The value is 720,909.61 for this monitoring period.

$EF_{BL,upstream,CH4}$: As mention above, the emission factor has determined at step$_{CH4}$ c in PDD for upstream fugitive methane emissions occurring in the absence of the project activity in tCH_4/MWh.

[5] Volume 3 of the 1996 Revised IPCC Guidelines, Table 1-63 and 1-64, p. 1.130 and 1.131

No upstream emissions occur in Annex I countries due to the proposed project. The value is 0.00407977tCH_4/MWh.

More calculation details can be found in Section D: Emission Reduction calculations

Therefore, $LE_{CH4,y}$= -43,715.91 (tCO2e), which is a negative value. Thus according to AM0029 version 3, the value of leakage is assumed as zero.

Estimation of emission reductions:

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).

Therefore, the total amount of emission reductions for the project during the first monitoring period is calculated as 140,461 (tCO2e).

More calculation details can be found in Section D.

SECTION B. Description of Parameters applied

B.1. Parameters with fixed value:

Data / Parameter:	$EF_{NG,upstream,CH4}$
Data 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 used:	Revised IPCC 1996 Guidance default value, Table 1-63 and 1-64, p.1.130 and p.1.131
Value applied:	296
Justification of the choice of data or description of measurement methods and procedures actually applied :	Recommended by AM0029, version 03. The default value for the rest countries, including China is adopted.
Any comment:	

Data / Parameter:	GWP_{CH4}

Data unit:	t CO_2e/t CH_4
Description:	Global Warming Potential for methane
Source of data used:	"IPCC GWP default Value
Value applied:	21
Justification of the choice of data or description of measure-ment methods and procedures actually applied :	Adopted by the Decision 2/UNFCCC COP3 and by Article 5, Term 3 of Kyoto Protocol. Effective and applicable during the first commitment period of the Kyoto Protocol.
Any comment:	

B.2. Monitored Parameters

Data / Parameter:	$FC_{NG,y}$
Data unit:	Nm^3 (volume unit m^3 measured under the normal condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure))
Description:	Annual quantity of natural gas consumed in project activity
Source of data to be used:	NG flow meter reading at the project boundary
Value of data during this monitoring period	145,506,976
Description of measurement methods and procedures to be applied:	The NG flow rate was monitored continuously both by supplier and project owner. The monitoring data of the NG consumption was aggregated and recorded daily.
QA/QC procedures to be applied:	The total NG consumption was monitored both at supplier and project side for cross-checking. Natural gas flow meters installed were subject to regular maintenance, calibration and testing to ensure accuracy and good operation condition (in accordance with stipulation of the meter supplier). The monitoring readings was double checked with the receipt by the gas supply company
Any comment:	

Data / Parameter:	$NCV_{NG,y}$
Data unit:	MJ/Nm^3 (Measured by volume under the normal condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure))
Description:	Net Calorific Value of NG
Source of data to be used:	Published by the Petro China Company Ltd. on its Website and recorded once

	every 10 days by the project owner.
Value of data during this monitoring period	34.0331 (weighed average value)
Description of measurement methods and procedures to be applied:	This $NCV_{NG,y}$ value is measured by the Petro China Company Ltd., based on the content and the LHV (lower heat value) of the natural gas from "West to East natural gas transmission project" under normal conditions and recorded once every 10 days by the project owner.
QA/QC procedures to be applied:	The calibration and testing for on-line gas chromatography was carried out by a qualified measurement technology verification institution authorized by the Chinese government.
Any comment:	

Data / Parameter:	$OXID_{i,}$
Data unit:	None
Description:	Oxidation factor of the fuel I = Natural gas
Source of data used:	"2006 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2 Energy, Chapter 1, Table 1.3 and 1.4, Page 1.21-1.24 (Please refer to Annex 3)
Value of data during this monitoring period	1.00 for gas
Description of measurement methods and procedures to be applied:	IPCC 2006 Edition default value is used.
QA/QC procedures to be applied:	None
Any comment:	

Data / Parameter:	$EF_{CO2,NG,y,}$
Data unit:	tC/TJ
Description:	CO_2 emission factor per unit of energy of natural gas
Source of data used:	Determined by National data which is cited from 2006 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2 Energy, Chapter I, Table 1.3 and Table1.4 in Page 1.21-1.24.
Value of data during this monitoring period	15.30

Description of measurement methods and procedures to be applied:	Determined by National data[6] which is cited from 2006 IPCC Guidelines
QA/QC procedures to be applied:	None
Any comment:	Unit Conversion: $\boldsymbol{EF_{CO2,NG,y}}$=15.30 tC/TJ=0.0561 tCO_2/GJ

Data / Parameter:	$\boldsymbol{COEF_{NG,y,}}$
Data unit:	tCO_2/Nm^3
Description:	CO_2 emission coefficient in year y for natural gas.
Source of data used:	Calculated value
Value of data during this monitoring period	Please refer to Table Section D for further details.
Description of measurement methods and procedures to be applied:	$COEF_{NG,y} = NCV_{NG,y} \times EF_{CO2,NG,y} \times OXID_{NG}$
QA/QC procedures to be applied:	None
Any comment:	

Data / Parameter:	$\boldsymbol{PE_{y,}}$
Data unit:	tCO_2e
Description:	CO_2 emissions from the power plant of the project due to combustion of natural gas in y year.
Source of data used:	Calculated value
Value of data during this monitoring period	277,810
Description of measurement methods and procedures to be applied:	$PE_y = FC_{NG,y} \times COEF_{NG,y}$
QA/QC procedures to be applied:	None
Any comment:	

[6] DNA website of host country: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf

Data / Parameter:	$EG_{net\ pj,y}$ (Gateway meters No.1 and No.3)
Data unit:	MWh
Description:	The actual net electricity delivered by the project activity, measured by the meters No.1 and No.3.
Source of data to be used:	Meter reading, cross-checked by electricity purchase receipts from the power grid company.
Value of data during this monitoring period	720,910
Description of measurement methods and procedures to be applied:	The electricity was measured by the electricity meter continuously and recorded daily and monthly. Data was archived by the computer centre, and will be kept for 2 years following the end of the crediting period by means of electronic and paper backup.
QA/QC procedures to be applied:	The electricity meters installed were subject to regular maintenance, calibration and testing to ensure accuracy and good operation condition (in accordance with the relevant national industrial standard).
Any comment:	

Data / Parameter:	***m***
Data unit:	
Description:	A sample group m including recent capacity additions in the CCPG that comprise 20% of the total installed capacity in year 2008.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	Please refer to Section E for further details.
Description of measurement methods and procedures to be applied:	The latest value available at the DNA website is used for this period of verification.
QA/QC procedures to be applied:	None
Any comment:	Data source from China's DNA and national official statistical data.

Data / Parameter:	$F_{i,j,y}$

Data 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 $EF_{BM,y}$
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	Please refer to Section E in detail.
Description of measurement methods and procedures to be applied:	The latest value available at the DNA website is used for this period of verification.
QA/QC procedures to be applied:	
Any comment:	Data source from China's DNA and national official statistical data.

Data / Parameter:	$COEF_{i,j}$
Data 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 $EF_{BM,y}$
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	Please refer to Table Section E in detail.
Description of measurement methods and procedures to be applied:	$COEF_{i,j} = NCV_{i,j} \times EF_{CO2,i,j} \times OXID_{i,j}$
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$\lambda_{Coal}, \lambda_{Oil}, \lambda_{Gas}$
Data 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.

Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	λ_{Coal}=99.13%, λ_{Oil}=0.13%, λ_{Gas} =0.74%. Please refer to Section E in detail.
Description of measurement methods and procedures to be applied:	$\lambda_{Coal}=\frac{\sum_{i\in COAL,j}F_{i,j,y}\times COEF_{i,j}}{\sum_{i,j}F_{i,j,y}\times COEF_{i,j}}$, $\lambda_{Oil}=\frac{\sum_{i\in OIL,j}F_{i,j,y}\times COEF_{i,j}}{\sum_{i,j}F_{i,j,y}\times COEF_{i,j}}$, $\lambda_{Gas}=\frac{\sum_{i\in GAS,j}F_{i,j,y}\times COEF_{i,j}}{\sum_{i,j}F_{i,j,y}\times COEF_{i,j}}$
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$
Data 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.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	$\boldsymbol{EF_{Coal,Adv}}$ =0.8249, $\boldsymbol{EF_{Oil,Adv}}$=0.5437, $\boldsymbol{EF_{Gas,Adv}}$=0.3910 Please refer to Section E for further details.
Description of measurement methods and procedures to be applied:	$EF_{Coal,Adv}=\frac{3.6}{\eta_{Coal,Adv}}\times\frac{1}{1000}\times EF_{Coal}(tC/TJ)\times OXID_{Coal}\times\frac{44}{12}$ For $EF_{Oil,Adv}$ or $EF_{Gas,Adv}$, simply change foot index *Coal* to *Oil* or *Gas*
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$\boldsymbol{EF_{Thermal}}$
Data unit:	tCO_2/MWh
Description:	The weighted averaged emission factor $EF_{Thermal}$ of the thermal power capacity under CCPG.
Source of data to be used:	China's DNA CDM official Website:

	http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	0.8213 Please refer to Section E for further details.
Description of measurement methods and procedures to be applied:	$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	CAP_{Total}
Data unit:	MW
Description:	The total capacity addition of CCPG in year 2005, 2006 and 2007.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	Please refer to Section E for further details.
Description of measurement methods and procedures to be applied:	Original ***CAP*** data for each province and each year are given in the China Electric Power Yearbook.
QA/QC procedures to be applied:	None
Any comment:	See Above

Data / Parameter:	$CAP_{Thermal}$
Data unit:	MW
Description:	The capacity addition by thermal power of CCPG in year 2005, 2006 and 2007.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	Please refer to Section E for further details.
Description of measurement methods and procedures to be	Original $CAP_{Thermal}$ data for each province and each year are given in the China Electric Power Yearbook.

applied:	
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build marginal emission factor of the CCPG during the project operation period
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf
Value of data during this monitoring period	0.5802
Description of measurement methods and procedures to be applied:	$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$ According to the registered PDD, the latest value available at the DNA website (2009 baseline emission factors for regional power grids in China issued by China's DNA on 02/07/2009) has been used for this monitoring period.
QA/QC procedures to be applied:	None
Any comment:	Data is from China DNA and official national electric statistic data.

B.3. Description of the monitoring system

B.3.1. Metering system

The main parameters to be measured are the following:

- Electricity delivered to the grid
- Quantity of the natural gas consumed
- NCV of the natural gas

3.1.1 Monitoring equipment and instrument for electricity supplied

As described in PDD, two bidirectional meters No.1 and No.2 with accuracy of 0.2S (gateway meters)

are installed on the Plant side of the 500KV located at the Chaya main substation for continuously and automatically measuring the exported and imported electricity by the proposed project.

The meter No.3 with accuracy of 0.2S installed at the high voltage side of the 110KV/6KV transformer at the project site is used for measuring the import-grid electricity purchased in case the electricity is needed for starting up the power units. The total net electricity delivered to the grid is calculated based on readings from meters No.1 and No.3.

3.1.2 Monitoring equipment and instrument for natural gas consumed

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 gas flow meters (#3 and #5) are installed before the gas inlet for unit # 1 and # 2 at the project site. Meters #4 and #6 have also been installed before Meters #3 and #5 as their further backup meters.

3.1.3 Natural gas NCV analysis devices

The measurement of natural gas NCV is continuously carried out by an on-line gas chromatography analyzer.

B.3.2. Data collection

3.2.1 Data collection on electricity export and import.

1) The representatives from the project owner and the grid company have read the gateway primary meter No.1 regularly and the data has been recorded for monitoring, verifying, billing and cross checking;

During the first monitoring period, no abnormal difference has been found regarding calculation of emission reduction.

3.2.2 The data collection on amount of natural gas consumed and the NCV analysis results

According to “the Measurement Law of PRC”, 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 the measuring equipment 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 purchase invoices.

Everything worked fine during this monitoring period.

B.3.3. Management operation

The CDM Leading Group that has been set up internally by the Huaneng Zhongyuan Gas Power Company Ltd, is dedicated to be in charge of implementation and management of the whole monitoring plan. The CDM leading group director and all members were trained and supported by the CDM project advisor & consultant entity.

SECTION C. Quality assurance and quality control measures

C.1. Main Roles and responsibilities:

Mr. Huangjian, The Director of the proposed project exercised oversight on behalf of the Chairman. The nominated CDM responsible person is Mr. Chen Zhiqiang who is responsible for monitoring plan implementation.

C.2. Internal audits and control measures:

All electricity meters installed have been calibrated by certified Parties quarterly in accordance with manufacturer's recommendations and National Regulations (Verification Regulation of Electrical Energy Meters with Electronics JJG596-1999) for ensuring reliability of the system. Calibrations have been evidenced with certificates of calibration for the relevant meters issued by a qualified third party. During this monitoring period, all electricity meters have worked normally. In line with the local grid company's periodic replacement schedule to allow for a unified calibration management, M3 has been replaced on 26th Feb. The new meter is of the same type and accuracy and has been calibrated before utilization.

The calibration and testing for the natural gas metering devices was conducted periodically according to the national measurement standard and regulation by the qualified measurement technology verification institution authorized by the Chinese government in accordance with the China's national standards GB/T-13610.

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.3. Troubleshooting procedures:

During the first period of verification, no errors have been found regarding the calculation of emission reductions.

SECTION D. Calculation of GHG emission reductions

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

		Baseline Emission			**Project Emission**						**Leakage Emission =[K-M]*GWPch4**				
Period	Emission Reduction	Net Electricity output MWh	EF tCO2e/ MWh	Baseline Emission tCO2e	Gas Comsumption	$NCV_{NG,y}$	$EF_{CO2,NG,Y}$	$OXID_{NG}$	$COEF_{NG,y}$	$Pe_y = FC_{NG,y} \times COEF_{NG,y}$	EFNG,upstream,CH4		EFBL,upstream,CH4		
		Nm3	MJ/Nm^3	tC/TJ	%	tCO_2/Nm^3					tCH4/GJ		tCH4/ MWh		
		A	**B**	**C=A×B**	**D**	**E**	**F**	**G**	**H=E×F×G×44/12/10^6**	**I=H×D**	**J**	**K=D×E×J/1000**	**L**	**M=A*L**	**N=[K-M]**
25/08/09-31/08/09	6874.612	35135.574	0.5802	20385.660	7093504	33.952	15.3	1	0.00190	13511.048	0.000296	71.288	0.0040798	143.345	0
01/09/09-30/09/09	28899.519	144136.638	0.5802	83628.077	28622880	34.083	15.3	1	0.00191	54728.558	0.000296	288.764	0.0040798	588.045	0
01/10/09-31/10/09	41003.462	203316.492	0.5802	117964.229	40344960	34.003	15.3	1	0.00191	76960.767	0.000296	406.068	0.0040798	829.485	0
01/11/09-30/11/09	19691.761	98937.63	0.5802	57403.613	19770176	34.002	15.3	1	0.00191	37711.852	0.000296	198.979	0.0040798	403.643	0
01/12/09-31/12/09	290.078	8103.774	0.5802	4701.810	2311392	34.023	15.3	1	0.00191	4411.731	0.000296	23.278	0.0040798	33.062	0
01/01/10-31/01/10	4945.437	28920.384	0.5802	16779.607	6194144	34.056	15.3	1	0.00191	11834.170	0.000296	62.441	0.0040798	117.989	0
01/02/10-28/02/10	38756.532	202359.114	0.5802	117408.758	41169920	34.054	15.3	1	0.00191	78652.226	0.000296	414.992	0.0040798	825.579	0
Total	**140461.402**	**720909.606**		**418271.753**	**145506976**					**277810.352**		**1465.809**		**2941.147**	**0**

SECTION E. The calculation of $EF_{grid,BM,y}$ of CCPG in the first 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	2200.57	9357	3479.81	2683.81	1547.7	3239	22507.89	20908	87300	1	410829403.68
Cleaned Coal	10^4 t	0	3.07	0	0	3.8	0	6.87	26344	87300	1	157998.40
Other Washed Coal	10^4 t	0.04	87.16	0	2.06	96.42	0	185.68	8363	87300	1	1355630.93
Briquette	10^4 t	0	0	0	0	0	0.01	0.01	20908	87300	1	182.53
Coke	10^4 t	0	0	0	0	0	0	0	28435	95700	1	0.00
Other Coke product	10^4 t	0	0	0	0	0	0	0	28435	95700	1	0.00
Subtotal												**412343215.53**
λ_{Coal}												**99.13%**
Crude Oil	10^4 t	0	0.43	0	0	0	0	0.43	41816	71100	1	12784.41
Gasoline	10^4 t	0	0	0	0.04	0.01	0	0.05	43070	67500	1	1453.61
Diesel Oil	10^4 t	0.98	3.21	2.51	2.83	1.93	0	11.46	42652	72600	1	354862.93
Fuel Oil	10^4 t	0.42	1.25	1.33	0.63	0.64	1.74	6.01	41816	75500	1	189742.19
Other oil product	10^4 t	0	0	0	0	0	0	0	41816	75500	1	0.00

Subtotal												**558843.14**
λ_{Oil}												**λ_{Oil} = 0.13%**
Natural Gas	10^7 m^3	0	1.2	1.8	0	2	18.7	23.7	38931	54300	1	501006.93
Coke Oven Gas	10^7 m^3	0.8	26.1	2.5	3.1	9.1	0	41.6	16726	37300	1	259534.00
Other Gas	10^7 m^3	291.7	257.9	0	246.9	0	239.8	1036.3	5227	37300	1	2020444.06
LPG	10^4 t	0	0	0	0	0	0	0	50179	61600	1	0.00
Refinery Gas	10^4 t	1.43	10.01	0.97	0.7	0	0	13.11	46055	48200	1	291022.47
Subtotal												**3072007.45**
λ_{Gas}												0.74%
Total												**415974066.13**

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} = 99.13%，λ_{Oil} = 0.13%，λ_{Gas} = 0.74%

Table 2 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 3 Installed Capacity of CCPG in 2006

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	6,568	32,603	11,623	10,715	5,594	9,555	76,658
Hydropower plant	MW	3,288	2,553	18,320	8,648	1,979	17,730	52,518
Nuclear plant	MW	0	0	0	0	0	0	0
Wind plant and other	MW	0	0	0	17	24	0	41
Total	MW	9,856	35,156	29,943	19,380	7,597	27,285	129,217

Data Source: China Electric Power Yearbook 2007

Table 4 Installed Capacity of CCPG in 2005

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	5,906	26,268	9,526	7,212	3,760	7,496	60,167
Hydropower plant	MW	3,019	2,540	17,889	7,905	1,893	14,960	48,205
Nuclear plant	MW	0	0	0	0	0	0	0
Wind plant and other	MW	0	0	0	0	24	0	24
Total	MW	8,925	28,808	27,415	15,117	5,676	22,456	108,396

Data Source: China Electric Power Yearbook 2006

Table 5 Building Emission Calculation of CCPG

	2005	2006	2007	New Capacity Additions from Year 2005-2007	Percentage to the newly installed capacity
	A	B	C	D= C- A	
Thermal plant (MW)	60,167.20	76,658	92,580	32412.8	**70.64%**
Hydropower plant (MW)	48,205.20	52,518	61,650	13444.8	29.30%
Nuclear plant (MW)	0	0	0	0	0.00%
Wind plant & Others (MW)	24	41	51	27.0	0.06%
Total（MW）	108396.4	129217	154281	45884.6	100.00%
Percentage of newly added installed Capacity to 2005	70.26%	83.75%	100.00%		

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	$EF_{Coal,Adv}$	38.10	87,300	100%	0.8249
Oil-fired Power Plant	$EF_{Oil,Adv}$	49.99	75,500	100%	0.5437
Gas-fired Power Plant	$EF_{Gas,Adv}$	49.99	54,300	100%	0.3910

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

Thus, $EF_{thermal,adv}$ = 99.13% * 0.8249 + 0.13% * 0.5437 + 0.74% * 0.3910 = 0.8213 tCO_2e/MWh

Then, $EF_{grid,BM,y}$ = 70.64% * $EF_{Thermal,adv}$ =70.64% * 0.8213 = 0.5802 tCO_2e/MWh.