CER Monitoring Report

(Version 1)

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

(First periodic verification)

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SECTION A. General Project Activity Information

A.1. Project Category

The project activity falls into sectoral scope 1 – Energy Industries (renewable/non-renewable sources).

A.2. Short description of the project activity:

As descried in 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 electricity generated can displace electricity generated by coal-fired thermal power plants which would have been built otherwise. The estimated annual GHG emission reductions are 858,165 tCO_2e.

A.3. Methodology applied to the project activity for the current period:

The project activity uses the approved baseline methodology AM0029 titled "**Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas"**, Version 03

A.4. Calculation Methodology (Including Secondary Effects/Leakage)

Project Emissions

According to section 6.1 of register 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 list in Section D of this monitoring period.

***$COEF_{NG,y}$*:** 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. The monitored data is list in Section D of this

monitoring period.

$EF_{CO2,NG,y}$ **:** the CO_2 emission factor per unit of heat value of NG in this monitoring period . It was determined by national data which is cited from updated edition of *IPCC* 2006, page24 according to register PDD. The ***$EF_{CO2,NG,y}$*** is 15.3tC/TJ

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

Baseline Emissions

According registered PDD, Baseline emissions are given as:

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

where:

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

$EF_{BL,CO2,y}$: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.

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

The detailed steps and formulas of calculating **baseline emission of CCPG** are as follows:

Step a: calculate the proportion λ_i of the CO_2 emission of solid, liquid and gas fuel type consumed for power generation to the total CO_2 emission 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 provin-cial 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*,

COAL, OIL and *GAS* is the footnote set of the solid fuel, liquid fuel and gas fuel, respectively.

In this monitoring period, the details 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 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 date as follow:

	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 $EF_{BL,BM,y}$ of the grid:

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

Where:

CAP_{Total} is the total newly capacity addition,

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

In this monitoring period,

$$EF_{Grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} = 70.64\% * 0.8213 = 0.5802\ tCO_2e/MWh.$$

Details as follow:

Parameter	**Date unit**	**Value**	**Reference**
$EF_{BL,BM,y}$	tCO_2e/MWh		**Calculated**
CAP_{Tercal} /CAP_{Total}	**--**	70.64% *	See details in Section E
EF_{Tercal}	tCO_2e/MWh	**0.8213**	**Calculated**

Leakage Emissions

As mentioned in PDD:

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

$$LE_{CH_4,y} = \left[FC_y \times NCV_y \times EF_{NG,upstreamCH4} - EGG_{PJ,y} \times EF_{BL,upstreamCH4}\right] \times 21$$

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.

***$NCV_{NG,y}$*:** 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 from production of gas in tCH_4/ Nm^3. Default value of 296 has been applied in PDD for area of China[1].

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

***$EF_{BL,upstream,CH4}$*:** The emission factor determined at $step_{CH4}$ c in PDD for upstream fugitive methane emissions occurring in the absence of the project activity in tCH_4/MWh. The value is 0.00407977tCO2/MWh.

Estimation of emission reduction:

The emission reduction 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).

SECTION B. Description of Monitoring Parameters

B.1. Parameters Monitored

Data / Parameter:	***$FC_{NG,y}$***
Data unit:	Nm^3
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	145,170,518
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	The total NG consumption was monitored both at supplier and project side

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

applied:	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
Description:	Net Calorific Value of NG
Source of data to be used:	Specific value on natural gas resource, published periodically by the Petro China Company Ltd. on its Website.
Value of data during this monitoring period	33.812
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 of the natural gas resource from "West to East natural gas transmission project" under NTP conditions and recorded fortnightly by project owner..
QA/QC procedures to be applied:	The calibration and testing for on-line gas chromatography was carried out by the qualified measurement technology verification institution authorized by 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, etc.
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 the fuel 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 which is cited from 2006 IPCC Guidelines
QA/QC procedures to be applied:	None
Any comment:	Unit Conversion: $EF_{CO2,NG,y}$ =15.30 tC/TJ=0.0561 tCO_2/GJ

Data / Parameter:	$COEF_{NG,y}$,
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 in detail.
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:	PE_y,
Data unit:	tCO_2e

Description:	CO_2 emissions from the power plant of the project due to combustion of natural gas fuel in y year.
Source of data used:	Calculated value
Value of data during this monitoring period	277,167
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:	

Data / Parameter:	$EG_{net\,pj,y}$ (Gateway meters No.1 and meter No.3)
Data unit:	MWh
Description:	The actual annual net electricity delivered by the project activity, measured by the meters No.1and No.3 at the monitoring point.
Source of data to be used:	Reading at project boundary by electricity energy meter with bidirectional reading function, and the electricity purchase receipt from the power grid company.
Value of data during this monitoring period	720,909.4
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 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 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. The electricity flow meters installed were subject to regular maintenance, calibration and testing to ensure accuracy and good operation condition (in accordance with national industrial standard).
Any comment:	The Project is a kind of power plant operating under peak load dispatch-ing, which would need certain amount electricity fed from the grid via 500KV and 110KV lines, in case in standby status during off peak load period (and then start up). This amount of electricity is fed from grid through two ways,

	measured by meter No.1and No.3 respectively. Therefore the annual net electricity delivered to the grid can be calculated by deducting that from-grid electricity measured at the monitoring point by the bi-directional meter No.1 and the from-grid electricity via start up transformer, measured by the meter No.3, from the actual to-grid electricity reading by the bidirectional meter No.1 of the project.

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 Table 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:	None
Any comment:	Data source from China's DNA and national official statistical data on electric power with lower uncertainty.

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 $\boldsymbol{\lambda_i}$ and $\boldsymbol{EF_{BM,y}}$
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:	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 on electric power with lower uncertainty.

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 $\boldsymbol{\lambda_i}$ and $\boldsymbol{EF_{BM,y}}$
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:	$\boldsymbol{\lambda_{Coal}, \lambda_{Oil}, \lambda_{Gas}}$
Data unit:	
Description:	The ratio $\boldsymbol{\lambda_i}$ of the CO_2 emission of solid (coal), liquid (oil) and gas fuel (gas) type consumed for power generation to the total CO_2 emission from the 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 Table 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	None

applied:	
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 Table Section E in Annex 3 in detail.
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 in Annex 3 in detail.
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 in detail.
Description of measurement methods and procedures to be applied:	Original ***CAP*** data for each province and each year are given in 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 in detail.
Description of measurement methods and procedures to be applied:	Original $CAP_{Thermal}$ data for each province and each year are given in China Electric Power Yearbook.
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 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 period of verification.
QA/QC procedures to be applied:	None
Any comment:	Data is from China DNA and an official national electric statistic data source with low uncertainty

B.2.Description of the monitoring report in first monitoring period

B.2.1. The user of the monitoring report

This monitoring report has been implemented by the project owner, Huaneng Zhongyuan Natural Power Plant Limit Company.

Activities and performance related to emission in the plant has been monitored inline with monitoring plan in PDD and methodology.

B.2.2. Metering system

The main content of metering:

- Electricity delivered to the grid
- Quantity of the natural gas consumed
- NCV of the natural gas
- the baseline CCPG grid emission factors EF_{BM}

2.2.1 Monitoring equipment and instrument for electricity supplied

Two bidirectional meters No.1 and No.2 with accuracy of 0.2S (gateway meters) are installed on the Plant side of the 500KV Chaya main substation for continuously and automatically measuring the export-grid supplied and the import-grid electricity by proposed project.

The meter No.3 with accuracy of 0.2S installed on high voltage side of the 110KV/6KV transformer at project site is used for measuring the import-grid electricity purchased in case the electricity is needed for starting up the power units. The meter No.4 with accuracy of 0.2S installed the Xiao Zhuyuan Substation as conservative. Therefore the total net electricity delivered to the grid is calculated by deducting the import-electricity from the export-electricity delivered to the grid.

2.2.2 Monitoring equipment and instrument for natural gas consumed

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 meter). Meanwhile, behind the natural gas delivery point, two cross-check gas flow meters (#3 and #4 meter,) are installed before the gas inlet for unit # 1 and # 2.

2.2.3 Natural gas NCV analysis devices

For the measurement of natural gas flowing at the point of measurement, the gas composition analysis is carried out by one set of on-line gas chromatography analyzer by acquiring the gas sample from the continuous operated sampling line which is linked with the gas flow.

B.2.3. Data collection

3.1 Data collection on electricity export and import.

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

2) The project owner also recorded the net amount of electricity delivered to the grid from gateway backup meter No.2.

In case the reading data difference between the primary and the backup gateway meters is beyond the allowance range or the meter is found to be malfunction, the amount of electricity supplied to the grid was determined by the following methods:

1) Firstly, the third-party arbitration agency designated by the grid company and the owners will read the data from the check meters which are installed at the output of both #1 and #2 generation units, and calculate the amount of electricity supplied to the grid based on the historical line losses rate, unless the agency identifies that the check meter is inaccurate;

2) In case the check meter's accuracy is not acceptable by standard or its operation does not meet the required standard, an appropriate and conservative method for estimation of the electricity supplied to

the grid was designed jointly by the project owner and the power plant, and justify the reasonableness and the conservativeness of the alternative method to verifying DOE by providing sufficient evidence.

3) If no agreement on the estimate method is reached between the project owners and the grid company, the arbitration procedures should be applied to determine the consistency of the estimate method.

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

3.2 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 standard condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure). The gas supplier and the project owner verify 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 was recorded daily, which is cross checked with purchase invoices. The project owner will preserve all relevant documents and records on the natural gas measurement.

3.3 The data collection for calculation of grid baseline emissions factor

The data for calculating grid baseline emissions factors are taken from the latest source available from the official website of the China's DNA, i.e. NDRC.

The principal of the CDM group of the project company is required to provide the latest data available to the verifying DOE to assist the verification and certification for the ex-post calculating the baseline emission factors.

It is the responsibility for the project owner to provide necessary information and data for validation and verification. All the monitoring data has been recorded and under safe keeping by the power plant site manager and the technology department.

Any change within the project boundary, such as change in spare or equipment would be recorded and any change in the emission reduction due to such alteration would also be studied and recorded.

Physical document was stored by the project owner and kept at least one copy in order to facilitate the verification of DOE.

B.2.4. Management operation

The CDM Leading Group that has been set up internally by the Henan Zhongyuan Gas Power Plant, 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 technically. The General Manager of the Company authorized CDM working team leader to manage and supervise over the CDM Leading Group.

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 has been calibrated by certified Parties once per year 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 meter(s) issued by a qualified third party.

The project owners will sign agreement with authorized and qualified institution for calibration and testing on the precision of the gas metering devices, in order to ensure the monitoring accuracy on the natural gas consumption. The calibration and testing for the natural gas metering devices was conducted periodically according to the national measurement standard and regulation.

The calibration and testing for on-line gas chromatography was carried out by the qualified measurement technology verification institution authorized by Chinese government in accordance with the China's national standards GB/T-13610.

C.3. Troubleshooting procedures:

In case there are errors found in calibration or during the regular checks, the malfunctioning meter or component shall be repaired or replaced immediately in accordance with the manufacturers' instructions, and all data recorded since the last recorded successful check or calibration shall be declared void. Back up meters and data have been identified as alternative sources.

The CDM responsible person and specialists was informed of the error and ensured that the necessary corrective actions are taken to resolve the problem causing the error and appropriate steps would be taken and to re-calibrate the malfunctioning meter. The error shall be recorded in an error log giving date and time of error discovery, nature of error and corrective action taken.

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

SECTION D. Calculation of GHG emission reductions

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

		Baseline Emission			**Project Emission**						**Leakage Emission**				
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/ Nm3		tCH4/ Nm3		
		C=A-B	**F**	**G=E×F**	**H**	**K**	**L**	**M**	**N= K×L×M×44/12/10^6**	**O=H×N**	**P**	**Q=H×P×K/1000**	**S**	**T=S*C**	**U=[T-Q]**
25/08/09-31/08/09	7061.89	35135.57	0.5802	20385.660	7084608	33.952	15.3	1	0.001905	13493.945	0.000296	70.30	0.0040798	143.345	0
01/09/09-30/09/09	31376.16	144136.44	0.5802	83627.962	28429954	34.083	15.3	1	0.001912	54360.013	0.000296	275.70	0.0040798	588.044	0
01/10/09-31/10/09	43279.28	203316.49	0.5802	117964.229	40032096	34.003	15.3	1	0.001908	76364.586	0.000296	394.06	0.0040798	829.485	0
01/11/09-30/11/09	18555.81	98937.63	0.5802	57403.614	20081304	34.002	15.3	1	0.001908	38305.468	0.000296	204.97	0.0040798	403.643	0
01/12/09-31/12/09	869.71	8103.77	0.5802	4701.810	2308640	34.023	15.3	1	0.001909	4406.4844	0.000296	20.22	0.0040798	33.062	0
01/01/10-31/01/10	4196.93	28920.38	0.5802	16779.607	6172256	34.056	15.3	1	0.001911	11792.28	0.000296	66.39	0.0040798	117.989	0
01/02/10-28/02/10	47999.29	202359.11	0.5802	117408.758	41061660	34.054	15.3	1	0.00191	78445.187	0.000296	366.22	0.0040798	825.579	0
Total	**143297.00**	**720909.409**		**418271**	**145170518**					**277167**		**1397.86**		**2941.145**	**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:

$$\lambda_{Coal} = 99.13\% \ , \ \lambda_{Oil} = 0.13\% \ , \ \lambda_{Gas} = 0.74\%$$

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 Suppy	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 register 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.