Monitoring Report

Start monitoring period: December 1st 2006
End monitoring period: September 30st 2008

Title: China Guangdong Shenzhen Qianwan LNG generation project

Project developer:

Shenzhen Guangqian Electric Power Co., Ltd.

This Monitoring Report is approved by: Mr Li-Fangji General Manager

Date: 12 October 2008 **Project advisor:Beijing MD Energy Technology Co.,Ltd**	**Management** **Verifier: Chen-Taifu**

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1 Introduction
The purpose of this Monitoring Report is to calculate the emission reductions achieved by the project activity in the period covered by this report, and to serve as the basis for the verification of these reductions and issuance of the VCUs.

1.1 Monitoring period
December 1st 2006 to September 30st 2008

1.2 Verification standard applied
This Monitoring Report is based on the Voluntary Carbon Standard Version2007.

1.3 Document details
Version: 2

Date: 12 October 2008

2 Project description
2.1 Title
China Guangdong Shenzhen Qianwan LNG generation project

2.2 Project summary
Qianwan LNG Generation Project (QLGP) is to construct a high efficient LNG (liquefied nature gas) CCGT (combined-cycle gas turbine) plant. The proposed project has a capacity of 1083.09 MW (3×361.03 MW) with annual electricity generation of 3700 GWh. The annual net electricity generation is 3611GWh.The proposed project will consume 505.6 thousand tons of LNG per annum.

Electricity to be generated by QLGP will subsequently displace power generation by coal-fired thermal plants and reduce CO_2 emission in China Southern Power Grid (CSPG), which is dominated by coal-fired generation technology. The estimated annual greenhouse gas (GHG) emission reductions will be 1, 035,685tCO_2e. The Project activity has generated the total amount of emission reductions 1,577,424 tCO_2e in the crediting period (from December 1st, 2006 to September 30st, 2008).

2.3 Category of project activity
The project type and category are defined as follows:

· Energy industries. (non-renewable sources)

3 Project timeline
Starting date of the project activity December 1st 2006

Start of monitoring period November 15st 2006

End of monitoring period September 30 st 2008

Table 1 lists the commissioning dates of turbines installed in the Project

Table 1 Commissioning dates of turbines

Turbine	Commissioning date
1#	November 15st 2006
2#	January 11st 2007
3#	May 16st 2007

4 Monitoring methodology and Procedure
4.1 Methodology
Version 01.1 of AM0029: "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" (referred as The Methodology). More information

about The Methodology can be found on the website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The version 06 of ACM0002: "Consolidated Methodology for Grid-connected Electricity Generation from Renewable Sources" and Version 05 of "Tool for the Demonstration and Assessment of Additionality".

4.2 Monitored data

The monitored data for the project activity includes electricity supplied to the grid ($EG_{y,}$ MWh) and NG consumption($FC_{,y}$ t).

ID	Variable	Source of data
1	$EG_{y,}$- net Electricity supplied to the grid (MWh)	Electricity meter
2	$FC_{LNG,y}$ -LNG onsumption by the project (t)	Fuel flow mete

4.3 Electricity supplied to the grid and imported from the grid

Electricity supplied to the grid has been monitored with the electricity meter as indicated in 4.2 above and in the PD. The monitoring data was shown in Table 2 below.

Table 2 Electricity supplied to the grid and imported from the grid

Period	Electricity supplied to the grid (, MWh)	Electricity imported from the grid (MWh)	$EG_{,y}$ (MWh)
Dec 1st 06- Dec 31st 06	124,149	0	124,149
Jan 1st 07- Dec 31st 07	2,963,057	29,807	2,933,250
Jan 1st 08- Sep 30st 08	2,419,449	26,504	2,392,946
Total (MWh)	5,506,655	56,310	5,450,345

4.4 Monitoring data NG consumed by the Project

LNG consumption in the project has been monitored with the fuel flow mete as indicated in 4.2 above and in the PD. The monitoring data was shown in Table 3 below.

Table 3 LNG consumed by the Project

Period	LNG consumption in the project(ton)
Dec 1st 06- Dec 31st 06	18,564
Jan 1st 07- Dec 31st 07	412,242
Jan 1st 08- Sep 30st 08	340,649
Total	771,455

5 Quality assurance and quality control measures

5.1 Roles and responsibilities

Overall responsibility for monitoring and carrying out the monitoring following this monitoring procedure lies with the Shenzhen Guangqian Electric Power Co., Ltd. Mr Li-Fangji, General Manager, is responsible for the operation and maintenance, which includes the monitoring, of the plant. Mr Ye shanpei is also responsible for the daily monitoring and reporting.

5.2 Training

The staff who is responsible for electricity and fuel flow meter reading and recording, and who is responsible for auditing these metered data have been trained according to the VER monitoring and management manual for Shenzhen Guangqian Electric Power Co., Ltd.

5.3 Calibrations

The Power Interchange Agreement between Shenzhen Guangqian Electric Power Co., Ltd.and Shenzhen Power Supply Bureau of Guangdong Power Grid Co.Ltd defines the metering arrangements and the required quality control procedures to ensure accuracy. The metering equipments have been calibrated and checked for accuracy based on the local industrial requirement with a permissible limit for the meter of 0.2% accuracy class. The metering equipment has sufficient accuracy so that any error resulting from such equipment shall not exceed local industrial standard. The Electricity supplied to the grid and imported from the grid registered by the meters alone will suffice for the purpose of billing and emission reduction verification as long as the error in the meters is within the agreed limits. Calibration is carried out by Testing Research Academy of Guandong Province Power Industry Bureau with the records being supplied to Shenzhen Guangqian Electric Power Co., Ltd.. These records have been maintained by Testing Research Academy of Guandong Province Power Industry Bureau and Shenzhen Guangqian Electric Power Co., Ltd.. Both meters has been jointly inspected and sealed on behalf of the parties concerned and not been interfered with by either party except in the presence of the other party or its accredited representatives. All the meters installed have been tested by Testing Research Academy of Guandong Province Power Industry Bureau within 10 days after:

· the detection of a difference larger than the allowable error in the readings of both meters;

· the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications; and/or If any errors has been detected the party owning the meter has repaired, recalibrated or replaced the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity. Should any previous months' reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, The Electricity supplied to the grid and imported from the grid has been determined by an estimate of the correct reading from Shenzhen Power Supply Bureau of Guangdong Power Grid Co.Ltd; and if Shenzhen Power Supply Bureau of Guangdong Power Grid Co.Ltd and Guangdong Shenzhen Guangqian Electric Power Co., Ltd. fail to agree then the matter has been referred for arbitration according to agreed procedures. No errors occurred during the operations of the Shenzhen Guangqian Electric Power Co., Ltd. Calibration took place as per schedule. The calibration results show that all meters operate in accordance with the industry standards and are qualified to measure the electricity supplied to the grid and consumed by Shenzhen Guangqian Electric Power Co., Ltd.

The Gas Interchange Agreement between Shenzhen Guangqian Electric Power Co., Ltd. and Guangdong Dapeng LNG Co.Ltd defines the metering arrangements and the required quality control procedures to ensure accuracy. The metering equipments have been calibrated and checked for accuracy based on the local industrial requirement. The metering equipment has sufficient accuracy so that any error resulting from such equipment shall not exceed local industrial standard. The gas supplied to Shenzhen Guangqian Electric Power Co., Ltd. registered by the meters alone will suffice for the purpose of billing and emission reduction verification as long as the error in the meters is within the agreed limits. Calibration is carried out by

National Station of Petroleum Flow Mearsurement with the records being supplied to Shenzhen Guangqian Electric Power Co., Ltd. These records have been maintained by Shenzhen Guangqian Electric Power Co., Ltd. Both meters has been jointly inspected and sealed on behalf of the parties concerned and not been interfered with by either party except in the presence of the other party or its accredited representatives. All the meters installed have been tested by National Station of Petroleum Flow Mearsurement r within 10 days after:

· the detection of a difference larger than the allowable error in the readings of both meters;

· the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications; and/or If any errors has been detected the party owning the meter has repaired, recalibrated or replaced the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity. Should any previous months' reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, The LNG consumption has been determined by an estimate of the correct reading from Guangdong Dapeng LNG Co.Ltd; and if Guangdong Dapeng LNG Co.Ltd and Shenzhen Guangqian Electric Power Co., Ltd. fail to agree then the matter has been referred for arbitration according to agreed procedures. No errors occurred during the operations of the Shenzhen Guangqian Electric Power Co., Ltd. Calibration took place as per schedule. The calibration results show that meter operate in accordance with the industry standards and are qualified to measure the LNG consumption

5.4 Quality control

The Electricity supplied to the grid and imported from the grid has been approved and signed off by staffs who are responsible for recording meter reading in power station side, and cross checked with receipts from Shenzhen Power Supply Bureau of Guangdong Power Grid Co.Ltd.

The NG consumption has been approved and signed off by staffs who are responsible for recording meter reading in power station side, and cross checked with receipts from Guangdong Dapeng LNG Co.Ltd.

6 Emission reduction calculations

6.1 Project emissions

According to the Methodology, the project activity is on-site combustion of natural gas to generate electricity, then the CO2 emissions from electricity generation are calculated as follows:

$$PE_y = FC_{LNG,y} \times COEF_{LNG,y} + FC_{Diesel,y} \times COEF_{Diesely} \quad (1)$$

Where

$FC_{LNG,y}$: is the total volume of LNG combusted in the project plant (tons) in year y.

$FC_{Diesel,y}$: is the total volume of diesel combusted in the project plant (tons) for start-up fuel in year y. In the proposed project activity, the diesel consumption for start up is zero.

$COEF_{LNG,y}$: is the CO_2 emission coefficient (tCO2/tons) in year y for LNG.

$COEF_{Diesel,y}$: is the CO_2 emission coefficient (tCO2/tons) in year y for diesel.

The emission coefficients of LNG and diesel are calculated as follows:

$$COEF_{LNG,y} = NCV_{LNG,y} \times EF_{CO_2,Gas,y} \times OXID_{Gas} \quad (2)$$

$$COEF_{Diesel,y} = NCV_{Diesl,y} \times EF_{CO_2,Diesel,y} \times OXID_{Diesel} \quad (3)$$

Where:
$NCV_{LNG,y}$: is the net calorific value of LNG (GJ/ton), which is determined from the fuel supplier.
$NCV_{Diesel,y}$: is the net calorific value of diesel (GJ/ton), which is determined from the most recent "Chinese Energy Statistics Yearbook" available when the verification begins.
$EF_{CO2,Gas,y}$: is the CO_2 emission factor per unit of energy of LNG in year y (tCO_2/GJ), which is determined from the fuel supplier.
$EF_{CO2,Diesel,y}$: is the CO_2 emission factor per unit of energy of diesel in year y (tCO_2/GJ), the IPCC default value will be used.
$OXID_{Gas}$: is the oxidation factor of LNG, the IPCC default value will be used.
$OXID_{Diesel}$: is the oxidation factor of diesel, the IPCC default value will be used.

For the project, no diesel combusted in the project plant (tons) for start-up, the values of the above parameters and project emission described as Table 4:

Table 4 Project emission

Period	$FC_{LNG,y}$ (ton)	$NCV_{LNG,y}$ (GJ/ton)	$EF_{CO2,Gas,y}$ (tCO_2/GJ)	$OXID_{Gas}$	PE_y (tCO_2e)
Dec 1st 06- Dec 31st 06	18,564	49.39	0.0561	1	51,437
Jan 1st 07- Dec 31st 07	412,242	49.39	0.0561	1	1,142,231
Jan 1st 08- Sep 30st 08	340,649	49.39	0.0561	1	943,863
Total	771,455				2,137,531

6.2 Baseline emissions

Calculate Baseline Emission (BE_y)

Once the baseline emission factor is determined, the baseline emissions can be calculated by multiplying the electricity generated in the project plant (EGy) with the baseline emission factor $EF_{BL,CO2}$:

$$BE_y = EG_y \times EF_{BL,CO_2} \quad (4)$$

Where,
BE_y is baseline emission(tCO_2)
EG_y is electricity supplied to the grid by the project(MWh)
$EF_{BL,CO2}$ is the baseline emission factor.
According to the version 01.1 of AM0029, the baseline emission factor $EF_{BL,CO2}$, is the lowest emission factor among the following three options:
Option 1. The build margin ($EF_{BL,BM}$), calculated according to ACM0002; and
Option 2. The combined margin ($EF_{BL,CM}$), calculated according to ACM0002, using a 50/50
OM/BM weight, then $EF_{BL,CM}=0.5EF_{BL,BM}+0.5EF_{BL,OM}$, where $EF_{BL,OM}$ is the operational margin calculated according to ACM0002.
Option 3. The emission factor of the technology (and fuel) identified as the most likely baseline scenario under Section 2.4, and calculated as follows:

$$EF_{BL,CO_2,Option3} = \frac{COEF_{BL}}{\eta_{BL}} \times 3.6GJ/MWh \quad (5)$$

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

η_{BL} is the energy efficiency of the technology, as estimated in the baseline scenario analysis above.
As described in Section 2.4, the 600 MW subcritical coal-fired plant has been identified as the most likely baseline, then emission coefficients of coal can be calculated as follows:

$$COEF_{Coal} = NCV_{Coal} \times EF_{CO_2,Coal,y} \times OXID_{Coal} \quad (6)$$

Where:
$COEF_{Coal}$: is the emission coefficient of coal in tCO_2/tce.
NCV_{Coal}: is the net calorific value of coal (GJ/tce), value from China Energy Statistics Yearbook 2004 has been adopted.
$EF_{CO2,Gas,y}$: is the CO_2 emission factor per unit of energy of coal in year y (tCO_2/GJ), which is determined by IPCC default value.
$OXID_{Coal}$: is the oxidation factor of coal, the IPCC default value will be used.
Then the formula (1) can be translated into the following one:

$$EF_{BL,CO_2,Option3} = COEF_{Coal} \times PGCC_{BL} / (1 - \gamma_{selfuse}) \, (7)$$

$COEF_{Coal}$: is the emission coefficient of coal in tCO2/tce.
$PGCC_{BL}$: is the power generation coal consumption of the most likely baseline technology identified in previous step, 600 MW subcritical coal-fired plant in the PD tce/MWh.
$\gamma_{selfuse}$: is the rate of power generation self-consumed by the power plant.

According to the Methodology and calculation steps described above, the baseline emission reductions can be ex-ante calculated as follows:
$EF_{BL,BM}$=0.6816 tCO_2/MWh
$EF_{BL,OM}$=1.0608 tCO_2/MWh
EFBL,CM=0.5×EFBL,BM +0.5×EFBL,OM=0.8712 tCO_2/MWh
$EF_{BL,CO_2,Option3} = \text{COEF}_{Coal} \times \text{PGCC}_{BL} / (1 - r_{selfuse})$ =2.769×0.312/(1-5.02%)=0.910 tCO_2/MWh.
Then $EF_{BL,CO2}$ =min($EF_{BL,BM}$, $EF_{BL,CM}$, $EF_{BL,CO2,Option3}$) =0.6816 tCO2/MWh. The build margin (Option 1) is selected as the baseline emission factor.

For the project, the values of the above parameters and baseline emission described as Table 5:

Table 5 Baseline emission

Period	EG_y (MWh)	Load factor (%)	$EF_{FF,BL}$ (tCO_2/MWh)	Baseline Emission (tCO_2e)
Dec 1st 06- Dec 31st 06	124,149	15.7%	0.6816	84,620
Jan 1st 07- Dec 31st 07	2,933,250	24.99%	0.6816	1,999,303
Jan 1st 08- Sep 31st 08	2,392,946	31.06%	0.6816	1,631,032
Total	5,450,345			3,714,955

6.3 Leakage emissions

Thus the leakage can be calculated as follows:

$$LE_y = LE_{CH4} + LE_{LNG,CO_2,y} \quad (8)$$

Where:
LE_y: leakage emission during the year y in tCO_2e.
$LE_{CH4,y}$: leakage emission due to fugitive upstream CH_4 emissions in year y in tCO2e.
$LE_{LNG,CO2,y}$: leakage emission due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in tCO_2e.

Calculate Fugitive Methane Emissions ($LE_{CH4,y}$)
To estimated the fugitive methane emissions, one can multiply the quantity of LNG consumed by the project in year y with an emission factor for fugitive CH_4 emissions ($EF_{Gas,upstream,CH4}$) for LNG consumption and subtract the emissions occurring from fossil fuels used in the absence of the project activity, as follows:

$$LE_{CH4,y} = \lfloor FC_{LNG,y} \times NCV_{LNG,y} \times EF_{Gas,upstream,CH_4} - EG \times EF_{BL,upstream,CH_4} \rfloor \times GWP_{CH4} \quad (9)$$

Where:
$LE_{CH4,y}$: Leakage emissions due to fugitive upstream CH4 emissions in the year y in tCO2e.
$FC_{LNG,y}$: Total volume of LNG combusted in the project plant (tons) in year y.
$NCV_{LNG,y}$: Net calorific value of LNG (GJ/ton), which is determined from the fuel supplier.
$EF_{Gas,upstream,CH4}$: Emission factor for upstream fugitive methane emissions from production of gas in tCH_4/GJ. The Methodology suggested several default fugitive CH4 associated with different regions. In this PD, the default value for other oil exporting countries/rest of world is adopted.
EG_y: Electricity generation in the project plant during year y in MWh.
$EF_{BL,upstream,CH4}$: is the emission factor determined in sub step 3a for upstream fugitive methane emissions 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.
Calculate CO_2 emissions from LNG ($LE_{LNG,CO2,y}$)
CO_2 emission from LNG combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system is estimated by multiplying the quantity of natural gas combusted in the project with an appropriate emission factor, as follows:

$$LE_{LNG,CO_2,y} = FC_{LNG,y} \times NCV_{LNG,y} \times EF_{Gas,upstream,CH_4} \quad (10)$$

Where,
$LE_{LNG,CO2,y}$: Leakage emissions due to LNG combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system in tCO_2e.
$FC_{LNG,y}$: Total volume of LNG combusted in the project plant (tons) in year y.
$NCV_{LNG,y}$: Net calorific value of LNG (GJ/ton), which is determined from the fuel supplier.
$EF_{CO2,upstream,LNG}$: Emission factor for upstream CO_2 emission due to LNG combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system in tCO_2/GJ. Because such data is unavailable in this project, the default value of 6 tCO_2/TJ suggested in the Methodology is adopted as a rough approximation.

According to the Methodology, the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the project activity should be consistent with the baseline emission factor ($EF_{BL,CO2}$). the BM will be selected as the baseline emission factor, then the corresponding upstream fugitive CH_4 emission factor can be calculated as follows:

$$EF_{BL,upsream,CH4} = \frac{FF_{Coal} \times EF_{Coal,upstream,y} + FF_{Gas} \times EF_{Gas,upstream,y} + FF_{Oil} \times EF_{Oil,upstream,y}}{GEN_y} \quad (11)$$

Where:

$EF_{BL,upstream,CH4}$: is the emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in tCH_4/MWh

FF_{Coal}: Total quantity of coal type fuel combusted (tons raw coal) in power plants included in the build margin.

FF_{Gas}: Total quantity of gas type fuel combusted (GJ) in power plants included in the build margin.

FF_{Diesel}: Total quantity of diesel type fuel combusted (GJ) in power plants included in the build margin.

$EF_{Coal,upstream,CH4}$: Emission factor for upstream fugitive methane emissions from production of coal in tCH_4/t coal. The Methodology suggested two default fugitive CH_4 associated with different source: underground mining and surface mining. Because 95% of the coal production in China are produced by underground mining, so the default value for underground mining 13.4 tCH_4/kt coal is used in this PD.

$EF_{Gas,upstream,CH4}$: Emission factor for upstream fugitive methane emissions from production of gas in tCH_4/GJ. The Methodology suggested several default fugitive CH_4 associated with different regions. In this PD, the default value for other oil exporting countries/rest of world is adopted, which is higher than the value for USA and Canada, resulting in an upward estimate of the leakage. Thus it is conservative.

The project might adopt the lower default value for USA and Canada because the new gas terminal and transmission and distribution network of this project is construed and operated by advance technology.

$EF_{Oil,upstream,CH4}$: Emission factor for upstream fugitive methane emissions from production of oil in tCH_4/GJ. The default value suggested in the Methodology is used in this PD.

GEN_y: Electricity generation in the plants included in the build margin in MWh/a.

For the BM is calculated based on a conservative way, we also use the following formula to estimate the upstream fugitive methane emissions as follows:

$$\begin{aligned}
EF_{BL,upsream,CH4} &= \frac{FF_{Coal} \times EF_{Coal,upstream,y} + FF_{Gas} \times EF_{Gas,upstream,y} + FF_{Oil} \times EF_{Oil,upstream,y}}{GEN_y} \\
&= \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{ThermalupstreaCHCH4} \\
&= \frac{CAP_{Thermal}}{CAP_{Total}} \times (\lambda_{Coal} \times EF_{Coal,adv,upstreamCH4} + \lambda_{Gas} \times EF_{Gas,adv,upstreamCH4} + \lambda_{Oil} \times EF_{Oil,adv,upstreamCH4_{Coal,BM}}) \\
&> \frac{CAP_{Thermal}}{CAP_{Total}} \times \lambda_{Coal} \times EF_{Coal,adv,upstreamCH4} \\
&= \lambda_{Coal} \times \frac{CAP_{Thermal}}{CAP_{Total}} \times PGCC_{Adv} \times EF_{Coal,upstream,CH4} \times \frac{NCV_{Coal}}{NCV_{Rawcoal}}
\end{aligned} \quad (12)$$

Where,

$\lambda_{Coal,BM}$: is the share of coal-fired generation in BM generation.

$PGCC_{Adv}$: is the power supply coal consumption of the most advance coal-fired generation technology within the grid boundary, which is estimated as 343.33 gce/kWh in this PD.

NCV_{Coal}: is the net caloric value of standard coal equivalent in GJ/tce.

$NCV_{Rawcoal}$: is the net caloric value of raw coal which is used for power generation in

GJ/tce.

For the project, the values of the above parameters and leakage emission described as Table 6-Table 8:

Table 6 Parameters for Leakage emission

Period	$FC_{LNG,y}$ (t)	$NCV_{LNG,y}$ (GJ/ t)	$EF_{Gas,upstream,CH4,}$ (tCH_4/TJ)	GWP_{CH4}	$EF_{CO2,upstream,LNG,}$ (tco_2/TJ)
Dec 1st 06- Dec 31st 06	18,564	49.39	296	21	6
Jan 1st 07- Dec 31st 07	412,242	49.39	296	21	6
Jan 1st 08- Sep 31st 08	340,649	49.39	296	21	6
Total	771,455				

Table 7 Parameters for Leakage emission

Period	$EG_{,y}$ (MWh)	$\lambda_{Coal,BM}$	$EF_{Coal,upstream,CH4}$ (t CH_4/kt coal)	$PGCC_{Adv}$ (tce/KWh)	NCV_{Coal} (GJ/tce)	$NCV_{Rawcoal}$ (GJ/tce)
Dec 1st 06- Dec 31st 06	124,149	0.7103	13.4	343.33	29.27	20.91
Jan 1st 07- Dec 31st 07	2,933,250	0.7103	13.4	343.33	29.27	20.91
Jan 1st 08- Sep 31st 08	2,392,946	0.7103	13.4	343.33	29.27	20.91
Total	5,450,345					

Table 6 Leakage emission

Period	$LE_{CH4,y}$ (tCO_2e)	$LE_{LNG,CO2,y}$ (tCO_2e)	LE_y (tCO_2e)
Dec 1st 06- Dec 31st 06	-7,096	5,501	-725 (0)
Jan 1st 07- Dec 31st 07	-175,757	122,164	-33,045 (0)
Jan 1st 08- Sep 31st 08	-160,870	82,782	-61,324(0)
Total			0

6.4 Summary of emission reductions during the monitoring period

Table 4 Emission reduction calculation (tCO_2e)

Period	Baseline Emission (tCO_2e)	Project Emission (tCO_2e)	Leakage (tCO_2e)	Emission Reduction (tCO_2e)
Dec 1st 06- Dec 31st 06	84,620	51,437	0	33,183
Jan 1st 07- Dec 31st 07	1,999,303	1,142,231	0	857,072

Jan 1st 08- Sep 31st 08	1,631,032	943,863	0	687,169
Total (tCO_2e)	3,714,955	2,137,531	0	1,577,424

Annex 1: Contact details

Project developer

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Annex 2: Baseline information

Data recommended in the *Notification on Determining Baseline Emission Factors of China power Grid*（issued by Chinese DNA）for CCPG are adopted for the Project. Table A1~A3 show the thermal power generation supplied to CCPG in 2004, 2005 and 2006.

Table A1. Thermal power generation data within CSPG in 2004

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Guangdong	169389000	5.42	160,208,116
Guangxi	20143000	8.33	18,465,088
Guizhou	49720000	7.06	46,209,768
Yunnan	24322000	7.56	22,483,257
Total			247,366,229

Data source: China Electric Power Yearbook 2005 Edition.

Table A2. Thermal power generation data within CSPG in 2005

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Guangdong	176453000	5.58	166606923
Guangxi	25023000	7.95	23033672
Guizhou	58430000	7.34	54141238
Yunnan	27281000	6.94	25387699
Total			269169531

Data source: China Electric Power Yearbook 2006 Edition.

Table A3. Thermal power generation data within CSPG in 2006

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Guangdong	188429000	5.27	178,498,792
Guangxi	27967000	4.45	26,722,469
Guizhou	76039000	6.06	71,431,037
Yunnan	39791000	4.12	38,151,611
Total			314,803,908

Data source: China Electric Power Yearbook 2007 Edition.

With reference to the *on Determining Baseline Emission Factors of China Power Grid* published by Chinese DNA on July. 18^{th} 2008, Table A4 shows the low calorific values, emission factors and oxidation rates of fuels consumed for electricity generation that are to be used in the following OM emission factor calculation and BM emission factor calculation.

Table A4. Data of fuels consumed for electricity generation

Fuel type	**Low calorific value**	**Emission factor (tC/TJ)**	**Oxidation rate**

Raw coal	20908 kJ/kg	25.80	1
Clean coal	26344 kJ/kg	25.80	1
Other washed coal	8363 kJ/kg	25.80	1
Shape coal	20908 kJ/kg	25.80	1
Coke	28435 kJ/kg	29.20	1
Crude oil	41816 kJ/kg	20.00	1
Gasoline	43070 kJ/kg	18.90	1
Kerosene	43070 kJ/kg	19.60	1
Diesel	42652 kJ/kg	20.20	1
Fuel oil	41816 kJ/kg	21.10	1
Other petroleum products	38369 kJ/kg	20.00	1
Other petroleum products	28435 kJ/kg	25.80	1
Natural gas	38931 kJ/m^3	15.30	1
Coke oven gas	16726 kJ/m^3	12.10	1
Other coal gas	5227 kJ/m^3	12.10	1
LPG	50179 kJ/m^3	17.20	1
Refinery gas	46055 kJ/m^3	15.70	1

Data sources: *China Energy Statistical Yearbook 2007 edition, P287*

Notification on Determining Baseline Emission Factors of China Power Grid issued by Chinese DNA published on July. 18th 2008

Table 1.3 and Table 1.4, Volume 2, "2006 IPCC Guidelines for National Greenhouse Gas Inventories"

Table A5. Emission and Power Supply Data of CSPG in 2004

Energy	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total Fuel E=A+B+C+D	Emission factor (tC/TJ) F	Oxidation rate (%) G	NCV (MJ/t or $1000m^3$) H	Emission (tCO_2e) I
Coal	10^4t	6017.7	1305	2643.9	1751.28	11717.88	25.8	100	20908	231767573.55
Cleaned coal	10^4t	0.21	0	0	0	0.21	25.8	100	26344	5233.50
Other washed coal	10^4t	0	0	0	0	0	25.8	100	8363	0.00
Coke	10^4t	0	0	0	0	0	29.2	100	28435	0.00
Coke oven gas	10^8m^3	0	0	0	0	0	12.1	100	16726	0.00
Other coal gas	10^8m^3	2.58	0	0	0	2.58	12.1	100	5227	59831.38
Crude oil	10^4t	16.89	0	0	0	16.89	20	100	41816	517932.98
Gasoline	10^4t	0	0	0	0	0	18.9	100	43070	0.00
Diesel	10^4t	48.88	0	0	1.83	50.71	20.2	100	42652	1601975.28
Fuel oil	10^4t	957.71	0	0	0	957.71	21.1	100	41816	30983494.25
LPG	10^4t	0	0	0	0	0	17.2	100	50179	0.00
Refinery gas	10^4t	2.86	0	0	0	2.86	15.7	100	46055	75825.26
Natural gas	10^8m^3	0.48	0	0	0	0.48	15.3	100	38931	104833.40
Other petroleum products	10^4t	1.66	0	0	0	1.66	20	100	38369	46707.86
Other energy	10^4tce	79.42	0	0	0	79.42	0	100	0	0.00
Net electricity import from the Central China Grid (MWh)						10951240				
Average emission factor of the Central China Grid (tCO_2e/MWh)						0.826448				
Total emission of CSPG (tCO_2e)						274214038				
Fossil power supply of CSPG (MWh)						258317469				

Data sources: China Energy Statistical Yearbook 2005 Edition

Table A6. Emission and Power Supply Data of CSPG in 2005

Energy	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total Fuel E=A+B+C+D	Emission factor (tC/TJ) F	Oxidation rate (%) G	NCV (MJ/t or $1000m^3$) H	Emission (tCO_2e) I
Raw Coal	10^4t	6696.47	1435	3212.31	1975.55	13319.33	25.8	100	20908	263442601.85
Clean Coal	10^4t				0.15	0.15	25.8	100	26344	3738.21
Other washed coal	10^4t			10.39	33.88	44.27	25.8	100	8363	350237.59
Coke	10^4t	4.79			8.05	12.84	29.2	100	28435	390906.18
Coke oven gas	10^8m^3				0.79	0.79	12.1	100	16726	58624.07
Other coal gas	10^8m^3	1.87			15.96	17.83	12.1	100	5227	413485.84
Crude oil	10^4t	10.91				10.91	20	100	41816	334555.88
Gasoline	10^4t	0.68				0.68	18.9	100	43070	20296.31
Diesel	10^4t	31.96	2.02		1.81	35.79	20.2	100	42652	1130638.84
Fuel oil	10^4t	887.21				887.21	21.1	100	41816	28702703.26
LPG	10^4t					0	17.2	100	50179	0.00
Refinery gas	10^4t	4.92				4.92	15.7	100	46055	130440.66
Natural gas	10^8m^3	0.93				0.93	15.3	100	38931	203114.71
Other petroleum products	10^4t	1.7				1.7	20	100	38369	47833.35
Other energy	10^4tce	104.66	133.15		59.72	297.53	0	100	0	0.00
Net electricity import from the Central China Grid (MWh)						20264000				
Average emission factor of the Central China Grid (tCO_2e/MWh)						0.77216				
Total emission of CSPG (tCO_2e)						310876215				
Fossil power supply of CSPG (MWh)						289433531				

Data sources: China Energy Statistical Yearbook 2006 Edition

Table A7. Emission and Power Supply Data of CSPG in 2006

Energy	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total Fuel E=A+B+C+D	Emission factor (tC/TJ) F	Oxidation rate (%) G	NCV (MJ/t or $1000m^3$) H	Emission[1] (tCO_2e) I
Coal	10^4t	7303.19	1490.01	4001.54	2735.88	15530.26	25.8	100	20908	307,179,636
Cleaned coal	10^4t	0	0	0	0	0	25.8	100	26344	0
Other washed coal	10^4t	0	0	19.53	45.8	65.33	25.8	100	8363	516,852
Shape coal	10^4t	133.75	0	0	0	133.75	26.6		20908	2,767,466
Coke	10^4t	0	0	0	1.31	1.31	29.2	100	28435	39,882
Coke oven gas	10^8m^3	0	0.84	0	2.06	2.9	12.1	100	16726	215,202
Other coal gas	10^8m^3	0.89	0	0	19.15	20.04	12.1	100	5227	464,737
Crude oil	10^4t	0.87	0	0	0	0.87	20	100	41816	26,679
Gasoline	10^4t	0	0	0	0	0	18.9	100	43070	0
Diesel	10^4t	29.92	1.26	0	3	34.18	20.2	100	42652	1,079,777
Fuel oil	10^4t	685.85	0.09	0	0	685.94	21.1	100	41816	22,191,288
LPG	10^4t	0	0	0	0	0	17.2	100	50179	0
Refinery gas	10^4t	0	0	0	0	0	15.7	100	46055	0
Natural gas	10^8m^3	7.92	0	0	0	7.92	15.3	100	38931	1,729,151
Other petroleum products	10^4t	0.67	0	0	0	0.67	20	100	38369	18,852
Other coke products	10^4tce	0	0	0	0	0	25.8	100	28435	0.00
Other energy	10^4tce	93.54	189.68	0	20.29	115.56	0	100	0	0.00
Net electricity import from the Central China Grid (MWh)						21,730,840				
Average emission factor of the Central China Grid (tCO_2e/MWh)						0.77134				
Total emission of CSPG (tCO_2e)						352951910				
Fossil power supply of CSPG (MWh)						336534768				

Data sources: China Energy Statistical Yearbook 2007 Edition

1 If the unit of the fuel is 10^4 t, then $I=E\times F\times G\times H\times 44/12/10^4$; if the unit of the fuel is 10^8 m^3, then $I=E\times F\times G\times H\times 44/12/10^3$. The same about the calculation of I in Table A6 and Table A7.

The simple OM emission factor is weighted average value of simple OM emission factors of CSPG in 2004,2005,2006 as fellows:

$$EF_{OM,y} = (274214038 + 310876215 + 352951910)/(258317469 + 289433531 + 336534768)$$
$$= 1.0608 \text{ tCO}_2\text{e/MWh}$$

Table A8. The data of efficiency level of the best electricity generation technologies commercially available in China and the corresponding emission factors

	Parameter	**Best efficiency of supplying electricity tce/MWh**	**Fuel emission factor (tc/TJ)**	**Oxidation rate**	**Emission factor (tCO_2e/MWh)**
		A	B	C	D=3.6/A/1000*B *C*44/12
Coal-fired power plant	$EF_{Coal,Adv}$	0.3728	25.8	1	0.9135
Gas-fired power plant	$EF_{Gas,Adv}$	0.4881	15.3	1	0.4138
Oil-fired power plant	$EF_{Oil,Adv}$	0.4881	21.1	1	0.5706

Data sources: Notification on Determining Baseline Emission Factors of China Power Grid issued by Chinese DNA
Table 1.3 and Table 1.4, Volume 2, "2006 IPCC Guidelines for National Greenhouse Gas Inventories"

Table A9. Data for calculating the thermal power emission factors

Energy	**Unit**	**Guangdong** **A**	**Guangxi** **B**	**Guizhou** **C**	**Yunnan** **D**	**Total** **E=A+B+C+D**	**NCV (MJ/t or 1000m^3)** **F**	**Emission factor (tC/TJ)** **G**	**Oxidation Rate** **H**	**Emission (tCO_2e)** **I =E*F*G*H *44/12/100**
Raw coal	10^4t	7303.19	1490.01	4001.54	2735.88	15330.66	20908	25.80	1	307,179,636
Cleaned coal	10^4t	0	0	0	0	0	26344	25.80	1	0
Other washed coal	10^4t	0	0	19.53	45.8	65.33	8363	25.8	1	516,852
Shape coal	10^4t	133.75	0	0	0	133.75	20908	25.80	1	2,767,466
Coke	10^4t	0	0	0	1.31	1.31	28435	29.2	1	39,882
Sub-total										310463836
Crude oil	10^4t	0.87	0	0	0	0.87	20	100	41816	26,679
Gasoline	10^4t	0	0	0	0	0	18.9	100	43070	0
Kerosene	10^4t	29.92	1.26	0	3	34.18	20.2	100	42652	1,079,777
Diesel	10^4t	0	0	0	0	685.94	21.1	100	41816	0
Fuel oil	10^4t	685.85	0.09	0	0	685.94	21.1	100	41816	22,191,288
Other oil products	10^4t	0.67	0	0	0	0.67	20	100	38369	18,852
Other coke products	10^4t	0	0	0	0	0	25.8	100	28435	0.00
Sub-total										23316596
Natural gas	10^7m^3	7.92	0	0	0	7.92	15.3	100	38931	1,729,151
Coke oven gas	10^7m^3	0	0.84	0	2.06	2.9	12.1	100	16726	215,202
Other coal gas	10^7m3	0.89	0	0	19.15	20.04	12.1	100	5227	464,737
LPG	10^4t	0	0	0	0	0	17.2	100	50179	0
Refinery gas	10^4t	0	0	0	0	0	15.7	100	46055	0
Sub-total										2409690
Total										**336190122**

Data sources: China Energy Statistical Yearbook 2007

Calculate with data provided in Table A8, A9 and formula (4)~(6), the value for

$$\lambda_{Coal} = 92.35\% ,$$

$$\lambda_{Oil} = 6.94\% ,$$

$$\lambda_{Gas} = 0.71\% ,$$

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

$$= 0.8862 \text{ tCO}_2\text{e/MWh}$$

Table A10. Installed capacity of the CSPG in 2004

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	30172.9	4378.1	4306.9	7801.8	46659.7
Hydro power (MW)	8584.6	5040.4	7058.6	6896.5	27580.1
Nuclear power (MW)	3780	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	83.4
Total (MW)	42621	9418.5	11365.5	14698.3	78103.3

Data source: China Electric Power Yearbook 2005.

Table A11. Installed capacity of the CSPG in 2005

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	35182.6	4931.2	4758.4	9634.8	54507
Hydro power (MW)	9035.7	6085.3	7993.1	7233	30347.1
Nuclear power (MW)	3780	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	83.4
Total (MW)	48081.7	11016.5	12751.5	16867.8	88717.5

Data source: China Electric Power Yearbook 2006.

Table A12. Installed capacity of the CSPG in 2006

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	40615	5434	8564	14350	68963
Hydro power (MW)	9320	7624	9698	7534	34176
Nuclear power (MW)	3780	0	0	0	3780
Wind power and Other (MW)	183	0	0	0	183
Total (MW)	53898	13058	18262	21884	107102

Data source: China Electric Power Yearbook 2007.

Table A13. Capacity increase data of CSPG from 2004 to 2006

	Installed	Installed	Installed	Capacity	Share in

	capacity in 2004 (MW) B	capacity in 2005 (MW) C	capacity in 2006 (MW) A	additions from 2003 to 2005 (MW) D=C-A	total capacity additions
Thermal power	46659.7	54507	68963	22303.3	76.91%
Hydro power	27580.1	30347.1	34176	6595.9	22.75%
Nuclear power	3780	3780	3780	0	0.00%
Wind power and Other	83.4	83.4	183	99.6	0.34%
Total	78103.3	88717.5	107102	28998.8	100.00%
Share in total installed capacity of 2005	88.04%	100%	100%		

Data source: China Electric Power Yearbook 2005 ,2006, 2007 Edition.

$$EF_{BM,y} = 0.8862 \times 0.7691 = 0.6816 \quad \text{tCO2e/MW}$$

$$\lambda_{Coal} = \lambda_{Coal} \times CAP_{Thermal} / CAP_{Total} = 0.9235 \times 0.7691 = 0.7103$$